COPY

U.S. FISH and WILDLIFE SERVICE'S
BIOLOGICAL and CONFERENCE OPINION
for the
PROPOSED ISSUANCE
of a
SECTION 10(a)(1)(B) INCIDENTAL TAKE PERMIT
(PRT- TE020907-0)
to the
CITY OF SEATTLE (SEATTLE PUBLIC UTILITY)
for the
CEDAR RIVER WATERSHED HABITAT CONSERVATION PLAN

April, 2000

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Biological and Conference Opinions for the Issuance of an Incidental Take Permit to the City of Seattle for the Seattle Public Utility's Cedar River Watershed Habitat Conservation Plan (FWS Ref: 1-3-00-FWF-0243)

INTRODUCTION

This document constitutes the U.S. Fish and Wildlife Service's (Service) Biological and Conference Opinions (Opinion) prepared pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act), on the effects of issuing an incidental take permit to the City of Seattle's Public Utility Department (City) for up to 70 species, pursuant to section 10(a)(1)(B) of the Act. These Opinions are based on the Service's review of the Cedar River Watershed Habitat Conservation Plan (HCP) located in southwestern King County, Washington, and it's effects on the northern spotted owl, marbled murrelet, bald eagle, grizzly bear, gray wolf, bull trout and Canada lynx (currently proposed in conterminous Unites States) in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). As per the new No Surprises Regulations (Fed. Reg. Vol. 63, No. 35, Pp. 8859-8873), the Service has also prepared conference opinions for the other 70 Covered Species (all currently unlisted species) addressed by this HCP. Note that National Marine Fisheries Service is preparing a companion Biological Opinion/Conference Opinion on the anadromous salmonids under it's purview, including Puget Sound chinook salmon, (currently listed as threatened in Puget Sound region), coho salmon, sockeye salmon, including kokanee, steelhead trout and anadromous cutthroat trout. The NMFS will be issuing a separate incidental take permit to the City (Permit number 1235)). The proposed incidental take of up to 83 listed and unlisted species would occur as the result of on-going water supply operations, hydro-electric generation and watershed management in the Watershed (Figure 1) consistent with the HCP, Implementation Agreement (IA), Instream Flow Agreement and Landsburg Mitigation Agreement. Table 1 contains a list of the 82 species for which the City of Seattle, via Seattle Public Utility, is seeking incidental take coverage.

Table 1. Species Included in Seattle's Multi-species Habitat Conservation Plan

14 Species of Greatest Concern- as described in the HCP, section 3.5 (includes all currently listed species, plus other species of high visibility). Currently listed species are highlighted. NMFS's species have *

Birds:
Bald Eagle, *Haliaeetus leucocephalus*
Common Loon, *Gavia immer*
Marbled Murrelet, *Brachyramphus marmoratus*
Northern Goshawk, *Accipiter gentilis*
Northern Spotted Owl, *Strix occidentalis caurina*
Peregrine Falcon, *Falco peregrinus*

Mammals:
Gray Wolf, *Canis lupus*
Grizzly Bear, *Ursus arctos*
Canada Lynx, *Lynx canadensis*

Fish:
Bull Trout, *Salvelinus confluentus*
*Chinook Salmon, *Oncorhynchus tshawytscha*
*Coho Salmon, *Oncorhynchus kisutch*
Pygmy Whitefish, *Prosopium coulteri*
*Sockeye Salmon incl. Kokanee, *Oncorhynchus nerka*
*Steelhead Trout, *Oncorhynchus mykiss*

Other Species of Concern- includes all other species.

Birds:
Band-tailed Pigeon, *Columba fasciata*
Black Swift, *Cypseloides niger*
Brown Creeper, *Certhia americana*
Golden Eagle, *Aquila chrysaetos*
Great Blue Heron, *Ardea herodias*
Harlequin Duck, *Histrionicus histrionicus*
Merlin, *Falco columbarius*
Olive-sided Flycatcher, *Contopus borealis*
Osprey, *Pandion haliaetus*
Pileated Woodpecker, *Dryocopus pileatus*
Rufous Hummingbird, *Selasphorus rufus*
Three-toed Woodpecker, *Picoides tridactylus*
Vaux's Swift, *Chaetura vauxi*
Western Bluebird, *Sialia mexicana*
Willow Flycatcher, *Empidonax traillii*

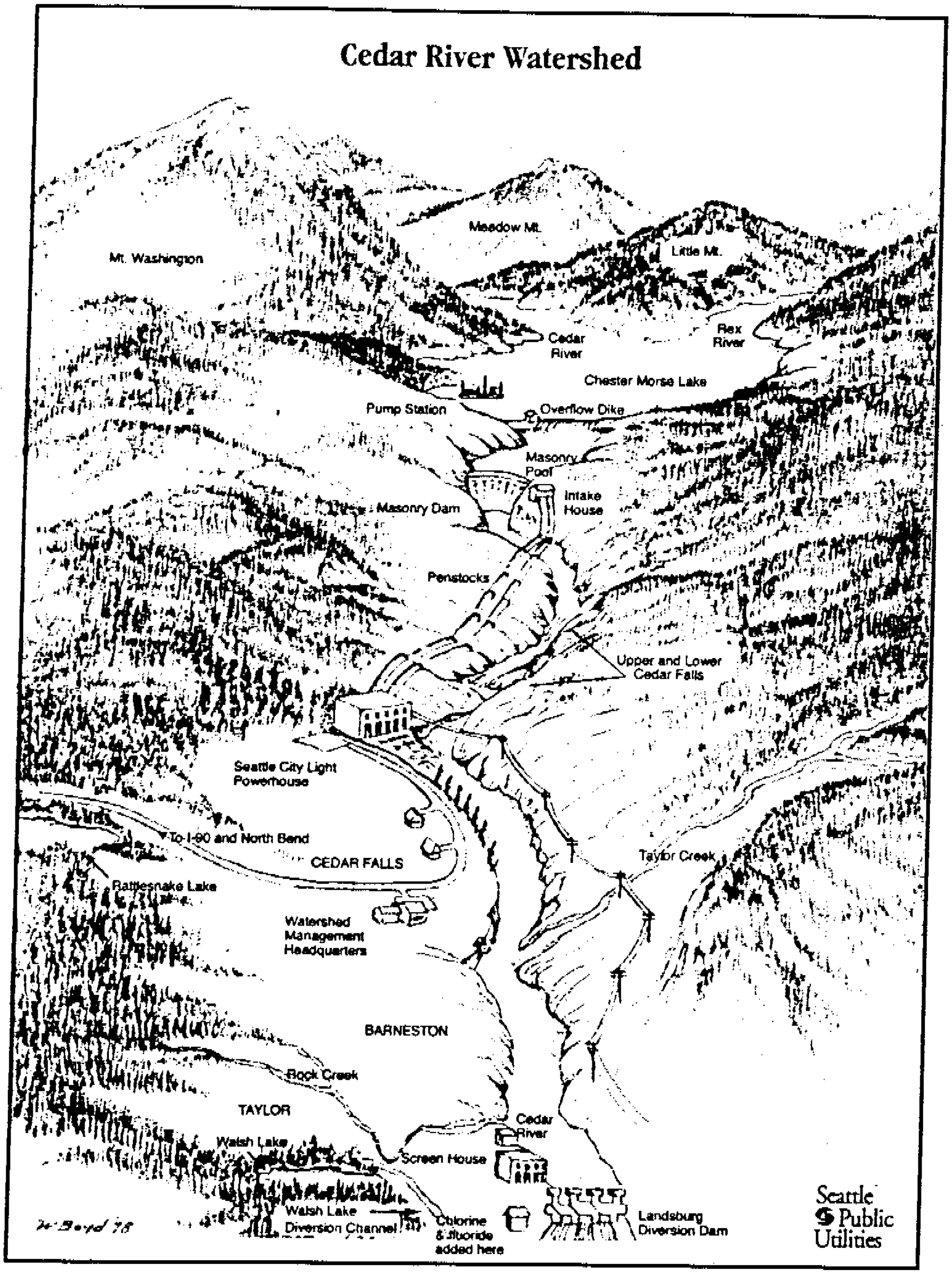
Fish:
*Cutthroat Trout, sea run, *Oncorhynchus clarki clarki*
Pacific Lamprey, *Entosphenus tridentatus*
River Lamprey, *Lampetra ayresi*

Amphibians and Reptiles:
Cascade Frog, *Rana cascadae*
Cascade Torrent Salamander, *Ryacotriton cascadae*
Larch Mountain Salamander, *Plethodon larselli*
Long-toed Salamander, *Ambystoma macrodactylum*
Northwestern Salamander, *Ambystoma gracile*
Pacific Giant Salamander, *Dicamptodon tenebrosus*
Red-legged Frog, *Rana aurora*
Roughskin newt, *Taricha granulosa*
Spotted Frog, *Rana pretiosa*
Tailed Frog, *Ascaphus truei*
VanDyke's Salamander, *Plethodon vandykei*
Northestern Pond Turtle, *Clemmys marmorata*
Western Redback Salamander, *Plethodon vehiculum*
Western Toad, *Bufo boreas*

Mammals:
Big Brown Bat, *Eptesicus fuscus*
California Myotis, *Myotis californicus*
Fisher, *Martes pennanti*
Fringed Myotis, *Myotis thysanodes*
Hoary Bat, *Lasiurus cinereus*
Keen's Myotis, *Myotis keenii*
Little Brown Myotis, *Myotis lucifugus*
Long-eared Myotis, *Myotis evotis*
Long-legged Myotis, *Myotis volans*
American Marten, *Martes americana*
Masked Shrew, *Sorex cinereus*
Northern Water Shrew, *Sorex palustris*
Silver-haired Bat, *Lasionycteris noctivagans*
Western (Townsend's) Big-eared Bat, *Plecotus townsendii townsendii*
Wolverine, *Gulo gulo*
Yuma Myotis, *Myotis yumanensis*

Invertebrates:
Aquatic Snail, *Valvata mergella*
Beller's Ground Beetle, *Agonum belleri*
Blue-gray Taildropper, *Prophysaon coeruleum*
Carabid Beetle, *Bembidion gordoni*
Carabid Beetle, *Bembidion stillaquamish*
Carabid Beetle, *Bembidion viator*
Carabid Beetle, *Bradycellus fenderi*
Carabid Beetle, *Nebria gebleri cascadensis*
Carabid Beetle, *Nebria kincaidi balli*
Carabid Beetle, *Nebria paradisi*
Carabid Beetle, *Omus dejeanii*
Carabid Beetle, *Pterostichus johnsoni fenderi*
Hatch's Click Beetle, *Eanus hatchii*
Fender's Soliperlan Stonefly, *Soliperla fenderi*
Johnson's (mistletoe) Hairstreak, *Mitoura johnsoni*
Long-horned Leaf Beetle, *Donacia idola*
Oregon Megomphix, *Megomphix hemphilla*
Papillose Taildropper, *Prophysaon dubium*
Puget Oregonian, *Cryptomastix devia*
Papillose Taildropper, *Prophysaon dubium*
Puget Oregonian, *Cryptomastix devia*

Figure 1. The Cedar River Municipal Watershed.



Consultation History

From 1994 to 1999 the US Fish and Wildlife Service and the National Marine Fisheries Service (collectively referred to as the Services) provided technical and policy assistance to the City in development of the Cedar River Watershed HCP. The Services prepared a number of Species Lists of threatened, endangered and proposed species known to occur in the Cedar River Watershed during the course of HCP development. The last of these was completed on October 14th, 1999, (1-3-00-SP-0155). That list was provided to Seattle Public Utility. On February 7, 1997, an Agreement in Principle was signed by the Services, the City, Army Corps of Engineers (ACOE), Washington Department of Fish and Wildlife (WDFW), and Washington Department of Ecology (Ecology). The Muckleshoot Indian Tribe (Muckleshoot) was a party to the Agreement in Principle but ultimately did not sign, citing outstanding differences with the City on hunting access to the Watershed and the level of future water withdrawals from the Cedar River by the City. At the time of this writing, the City and the Services are continuing to work toward resolving the Muckleshoot's concerns, but it is not yet clear whether those efforts will prove successful.

As originally drafted, the HCP was a habitat-based ecosystem management plan designed to address the needs of all fauna occurring in the Watershed (i.e. an "all-species" Plan). However, regulations promulgated by the Services regarding No Surprises Assurances (Fed. Reg. Vol. 63, No. 35, Pp. 8859-8873) in February of 1998, made the all-species plan no longer legally viable, and the HCP was reworked to address a finite list of Covered Species. The Services worked with the City to develop an Implementation Agreement and Environmental Assessment to accompany the HCP, and the City submitted a formal application for an incidental take permit on December 2nd, 1998. On December 11th, 1998, the Services initiated a 60-day public comment period under the National Environmental Policy Act of 1969, as amended (NEPA) (63 FR 68469). Based upon requests from the public, the Services extended the comment period an additional 22 days (64 FR 480), ending March 1, 1999.

The Services and the City prepared a Final NEPA Environmental Assessment (EA)/ Final State Environmental Policy Act Environmental Impact Statement (EIS) on the HCP (Seattle Public Utility 1999a) and a 767 page Response to Public Comments on the Public Review Draft of the EA/EIS (Seattle Public Utility 1999b). These two documents were made available to the public on May 27, 1999. The Services have addressed public, tribal and agency concerns raised about the HCP and discussed alternative approaches with the City. The City worked with the Mayor, who in turn recommended HCP changes to the Seattle City Council (Mayor of Seattle, 1999), which approved the changes on July 12, 1999 (City Council Resolution #29977; City of Seattle, 1999). On December 6th of 1999, as a result of a November, 1999, meeting with the City and the Muckleshoots, the City Council approved several additional changes to the HCP and related agreements, specifically regarding water conservation efforts and the role of the Muckleshoots during HCP implementation. These changes to the HCP are documented in City Council Resolution #30091, dated December 6th, 1999, and will be contained in the Final HCP and technical appendices. Note the final documents will be published after issuance of the incidental take permits.

On January 11, 2000, representatives of the Muckleshoot Tribe met with the FWS's Regional Director and others in a government-to-government meeting to discuss the Tribe's on-going concerns over the HCP. At that meeting, the Tribe asked to review the FWS's Biological and Conference Opinion. On January 20, 1999, the draft Biological and Conference Opinion was transmitted electronically and via hard copy to the Tribe. Comments were received by FWS on February 7, 2000. The FWS reviewed those comments and made appropriate changes to the Biological and Conference Opinion.

The Services wish to continue to consult with the Muckleshoot Indian Tribe regarding ongoing HCP implementation, including collaborative involvement in the implementation and oversight committees described in the HCP.

This Biological and Conference Opinion is based on the December 1998 HCP, as amended by City Council Resolutions 29977 and 30091 (HCP) and revised technical appendices, draft Implementation Agreement, draft Instream Flow Agreement and draft Landsburg Mitigation Agreement, the Final NEPA EA/SEPA EIS dated May 27, 1999, Response to Public Comments on the Public Review draft of the NEPA EA/ SEPA EIS dated May 27, 1999, several years of discussions and negotiations with Seattle Public Utility personnel and Washington Department of Fish and Wildlife personnel, site visits, technical reports published by researchers working in the Cedar River Watershed, and other published literature as cited in this document and listed in the Literature Cited section. A complete administrative record of this HCP is on file in the Service's Western Washington Office in Olympia, WA.

Initiation of consultation is considered to have begun on December 9th, 1999, upon receipt by the Olympia Office of Portland Regional Office's intra-Service section 7 evaluation form, where-in the Regional Office requested the Olympia Office to initiate formal consultation on the HCP.

BIOLOGICAL AND CONFERENCE OPINIONS

DESCRIPTION OF THE PROPOSED ACTION

The City of Seattle has prepared a multi-species HCP to comply with the federal Endangered Species Act (16 U.S.C. 1531 et seq.) and to address a variety of related natural resource issues. The 50-year plan will cover the City's 90,545-acre Cedar River Municipal Watershed and the City's water supply and hydroelectric operations on the Cedar River, which discharges into Lake Washington. In general, the City's HCP is not an HCP for planned development, but rather it is a set of mitigation and conservation commitments related to ongoing reservoir management and water supply operations, hydroelectric power generation, and watershed management activities.

The HCP is based on a decade of studies and the results of over three years of analysis and negotiations with Seattle Public Utility, two state agencies (WDFW and Ecology), and three federal agencies (Service, National Marine Fisheries Service and ACOE) as documented in an Agreement in Principle, dated March 14, 1997. The HCP addresses not only issues under the Endangered Species Act (ESA) but also related issues under state law and tribal treaties, and issues with the ACOE. The ACOE manages lake levels in Lake Washington, and navigational traffic between Lake Washington and Puget Sound, through operation of the Hiram Chittenden Locks (aka Ballard Locks) and Lake Washington Ship Canal.

The City's commitments regarding these related issues are included in and are part of the HCP, and the agreements with other agencies are represented in the related draft Instream Flow Agreement and draft Landsburg Mitigation Agreement, which are Appendices 27 and 28 of the HCP, respectively. The Instream Flow Agreement covers minimum and supplemental instream flows, operation of an instream flow commission, supplementation of minimum flows, and water conservation improvements at the Ballard Locks. The Landsburg Mitigation Agreement covers mitigation for the blockage to anadromous fish posed by the Landsburg Diversion Dam, where the City diverts water for municipal and industrial supply, as well as the effects of the intake structure. More detailed summaries of the proposed action can be found in the Executive Summary for the Cedar River Watershed Habitat Conservation Plan (December 1998, 40 pp, incl. color maps and photos), Chapter 1 of the HCP itself, and Chapter 1 of the Combined NEPA EA/SEPA EIS.

On February 23, 1998, the Services jointly published a final rule for the No Surprises Policy for HCPs (Fed. Reg. Vol. 63, No. 35, Pp. 8859-8873). Under the final rule, the Services will only provide assurances to applicants for the species that are adequately covered in the HCP and specifically identified on the permit. Therefore, all the Covered Species are addressed in this Opinion as if they are either listed or proposed. The City is seeking incidental take coverage for numerous unlisted species in this HCP, in the event these species become listed sometime during the 50 year permit term. At this time, the Services will do conference opinions on the currently unlisted species, treating them as though they are proposed for listing, and these species will be on the permit immediately, but only activated upon the effective date of the species being listed. Note, however, that all conservation measures will be implemented immediately by the City, regardless of the current listing status of the individual species. At the time of listing of a new species that is on the permit, the Service will review the effects analyses contained within this document, and update or revise the conclusions, as necessary. If the new analysis indicates that retaining a newly-listed species on the permit would result in a potential jeopardy situation for that species, the Services may delete that species from the permits, but only after exhausting other remedies.

Covered Activities

Covered activities are described in the HCP and IA, and in summary are all City operations on the Cedar River in conjunction with its water supply, hydroelectric power generation, and land management activities, including attendant facilities. Covered municipal watershed management activities include thinning, reforestation, and mechanical brush control; repair, re-engineering, decommissioning, and maintenance of forest roads, including use of gravel pits and other rock sources, as well as maintenance and replacement of culverts and bridges. Other covered watershed activities include actions to protect and restore watershed habitats, both aquatic and upland; cultural resource management and educational programs within the municipal watershed, including a public tour and field trip program and construction of educational and cultural facilities such as the planned educational resource center at Cedar Falls; scientific research, both by City staff and outside scientists; and other activities or facilities identified elsewhere in the HCP. The application of the term "Covered Activities" as it applies to the waters downstream of Landsburg is restricted specifically to the impacts of City operations and facilities on species using those waters and covered by this HCP, and does not apply to the impacts of activities by other public agencies or private parties. In general, covered activities downstream of Landsburg include mitigation, conservation, research, and monitoring activities carried out under the HCP and the related agreements (an Instream Flow Agreement and a Landsburg Mitigation Agreement, Appendices 27 and 28, respectively).

The Service has made clear to the City that the construction of permanent pumping facilities to access the dead storage available in Chester Morse Reservoir is not a Covered Activity under this HCP. As discussed in HCP section 4.5.6, Future Reservoir Management, the associated impacts to Covered Species of enhanced, permanent pumping capabilities cannot be postulated at this time, and therefore, the Service will not cover this activity under the HCP until we can clearly identify effects to Covered Species. We anticipate that additional take of Covered Species would have to be authorized for the City to implement this project, thus triggering amendment to the HCP, per section 12.2 of the Implementation Agreement (Appendix 1).

Action Area

The action area for this Biological and Conference Opinion, by regulation (50 C.F.R. § 402.02) includes "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." In this case, the proposed federal action is issuing the ITP. Since indirect effects include instream flows in the Cedar River, the action area includes the entire Cedar River to its junction with Lake Washington. Note that any potential downstream effects of the instream flows or other components of the HCP at Lake Washington, Lake Union, or the Ballard Locks would be addressed by separate formal consultations under the Act (Section 7 (a)(2)) with the ACOE that operate the Ballard Locks and regulate the lakes' levels. Similarly, the ACOE would be responsible to consult with the Services on mitigation projects in the Lake Washington basin, funded by the HCP, that may affect listed species as part of proposed actions that involve wetlands or waterways.

Changes and Unforseen Circumstances

Under the HCP, the City could be required to provide additional mitigation in response to the changed circumstances identified in the HCP (Section 4.5.7). These circumstances apply for six types of environmental events: forest fires, windstorms, insect infestations and disease outbreaks, floods, landslides, and droughts. The HCP states thresholds of each event that would trigger changes and unforseen circumstances.

In the event of changed circumstances related to environmental events, the City will consult with the Services regarding implementation of the contingency plans described in the HCP and in the example below, including whether alteration of mitigation, within the scope of the HCP, might be warranted. If the City and Services agree that alteration of mitigation is needed, then the City and Services will agree upon any changes to the mitigation described in the HCP. After such agreement, the City will implement the changes to mitigation on a schedule agreed upon by the parties. For example:

> **Changed circumstances for windstorms** are defined as events that result in (1) complete blowdown of 200 - 500 ft of riparian buffer along any fish-bearing stream; or (2) complete blowdown along any stream from which substantial amounts of sediment could be delivered downstream as a result of the blowdown that would result in significant adverse impacts to reaches equal to 200 - 500 ft of a fish-bearing stream.
>
> **Unforeseen circumstances for windstorms** are defined as events that result in (1) complete blowdown of more than 500 ft of riparian buffer along any fish-bearing stream; or (2) complete blowdown along any stream from which substantial amounts of sediment could be delivered downstream as a result of the blowdown that would result in significant adverse impacts to reaches equal to more than 500 ft of a fish-bearing stream.
>
> **The contingency plan for windstorms** under changed circumstances includes the following: Measures to reduce sedimentation, including measures to stabilize slopes, if feasible, by reprioritizing use of funds for riparian and/or stream restoration activities in the HCP; and, Measures to restore riparian forest, including such measures as replanting trees by reprioritizing HCP funds for riparian restoration or other restoration activities.

Adaptive Management for Studies or Monitoring under Changed Circumstances

The three issues listed below, and the contingent responses to potential outcomes, are discussed in the sections of the HCP that are cited for each. Each of these issues are defined as changed circumstances for the HCP. All three issues entail monitoring or other studies related to outcomes about which there is uncertainty. In each case, there is a commitment to adjusting measures in the HCP based on the results of the studies or monitoring.

1. <u>Accretion Flows</u>. The study of accretion flows downstream of Landsburg, with limited potential adjustment in instream flows based on results (sections 4.4.2 and 4.5.2), as provided for in the Instream Flow Agreement (Appendix 27).

2. <u>Landsburg Fish Passage</u>. Contingent mitigation if, based on monitoring results, the City must curtail passage of chinook and/or coho salmon over the Landsburg Dam for water quality reasons, including regulatory changes (sections 4.3.2 and 4.5.3), as provided for in the Landsburg Mitigation Agreement (Appendix 28).
3. <u>Sockeye Hatchery Operation and Effectiveness</u>. Monitoring and operation of the sockeye hatchery needed to control undesired impacts on wild fish and to determine effectiveness in helping to meet long-term goals for harvestable runs (sections 4.3 and 4.5.3), with provisions

for altering hatchery operations or developing alternative mitigation, as provided for in the Landsburg Mitigation Agreement (Appendix 28).

The sections cited for each of the three issues described above specify the type and extent of additional or alternative mitigation that would occur under changed circumstances, describe a process for determining that alternative or additional mitigation, or do both. For each of the three specific applications of adaptive management described above, the City will develop and present in a document, as provided for in the Implementation Agreement (Appendix 1), the following elements and criteria:

1. A general monitoring and/or research plan based on explicit hypotheses, the biological objectives described in this HCP, and the appropriate research and/or monitoring plans described in the foregoing parts of Section 4.5;

2. Threshold criteria for triggering additional or changed mitigation;

3. Limits to the type of and commitments to any long-term mitigation triggered by monitoring criteria;

4. A procedure for dispute resolution over interpretation of results consistent with dispute resolution procedures specific to the relevant agreement; and

5. A process for developing and implementing any additional mitigation for which the need is demonstrated and that clearly identifies the responsibilities of the parties involved.

6. The schedule for preparing the Adaptive Management Plans varies by issue: for Accretion Flows by the end of HCP year 3; for Landsburg Fish Passage, one year prior to initiation of adult fish passage above the dam; and for the sockeye hatchery, one year prior to initial operation of the replacement hatchery.

Conservation Measures

Species of Greatest Concern/Critical Habitat

There is Critical Habitat for northern spotted owls (owls) in the Plan Area. In 1992, the Service designated Critical Habitat for owls in specific Critical Habitat Units (CHUs), but only on federal lands. At the time, the Watershed contained federal lands, and CHU-33 incorporated all older forest on those federal lands, as well as federal lands outside the Watershed (see HCP Figure 3.5-2). As described in HCP section 2.3.11, the City acquired all federal lands in the Watershed via a Congressionally-directed land exchange that was completed in 1996. Deed restrictions were established as part of the exchange that prevent the city from harvesting or otherwise altering any of the native forest on the former federal lands. Therefore, the HCP has placed all of the Critical Habitat into the Ecological Reserve and there will be no adverse modification as a result of this HCP. Section 4.2.2 of the HCP describes administration of the Ecological Reserve, and HCP section 4.2.6 describes specific conservation measures to be implemented for the owl.

There is no other Critical Habitat for any other species in the Plan Area, nor is there any Critical Habitat proposed for any other species in the Plan Area. Therefore, Critical Habitat will not be discussed any further in this Biological and Conference Opinion.

Northern Spotted Owl

The reader is referred to HCP section 4.2.6, Species Conservation Strategies, which deals specifically with the 14 species of greatest concern, (specifically to pg 4.2-142 for Owl Conservation Objectives, and 4.2-144 for Additional Mitigation and Conservation Measures Benefitting the Owl. Also, the reader is referred to Table 4.6-3, entitled Summary of specific minimization and mitigation measures included in the individual species conservation strategies for the 14 species of greatest concern (Section 4.2.6) that are additional to those summarized in Table 4.6-2.

Marbled Murrelet

The reader is referred to the HCP section 4.2.6, Species Conservation Strategies, which deals specifically with the 14 species of greatest concern, (specifically to pg 4.2-143 for Murrelet Conservation Objectives, and 4.2-145 for Additional Mitigation and Conservation Measures Benefitting the Murrelet. Also, the reader is referred to Table 4.6-3, entitled Summary of specific minimization and mitigation measures included in the individual species conservation strategies for the 14 species of greatest concern (Section 4.2.6) that are additional to those summarized in Table 4.6-2.

Bald Eagle

The reader is referred to the HCP section 4.2.6, Species Conservation Strategies, which deals specifically with the 14 species of greatest concern, (specifically to pg 4.2-153 for Bald Eagle Conservation Objectives, and 4.2-159 for Additional Mitigation and Conservation Measures Benefitting the Bald Eagle. Also, the reader is referred to Table 4.6-3, entitled Summary of specific minimization and mitigation measures included in the individual species conservation strategies for the 14 species of greatest concern (Section 4.2.6) that are additional to those summarized in Table 4.6-2.

Gray Wolf

The reader is referred to the HCP section 4.2.6, Species Conservation Strategies, which deals specifically with the 14 species of greatest concern, (specifically to pg 4.2-163 for Gray Wolf

Conservation Objectives, and 4.2-164 for Additional Mitigation and Conservation Measures Benefitting the Gray Wolf. Also, the reader is referred to Table 4.6-3, entitled Summary of specific minimization and mitigation measures included in the individual species conservation strategies for the 14 species of greatest concern (Section 4.2.6) that are additional to those summarized in Table 4.6-2.

Grizzly Bear

The reader is referred to the HCP section 4.2.6, Species Conservation Strategies, which deals specifically with the 14 species of greatest concern, (specifically to pg 4.2-163 for Grizzly Bear Conservation Objectives, and 4.2-165 for Additional Mitigation and Conservation Measures Benefitting the Grizzly Bear. Also, the reader is referred to Table 4.6-3, entitled Summary of specific minimization and mitigation measures included in the individual species conservation strategies for the 14 species of greatest concern (Section 4.2.6) that are additional to those summarized in Table 4.6-2.

Bull Trout

The reader is referred to the HCP section 4.2.6, Species Conservation Strategies, which addresses in detail the 14 Species of Greatest Concern, (specifically to pg 4.2-152 for Bull Trout Conservation Objectives, and 4.2-155 for Additional Mitigation and Conservation Measures Benefitting the Bull Trout. Also, the reader is referred to Table 4.6-3, entitled Summary of specific minimization and mitigation measures included in the individual species conservation strategies for the 14 species of greatest concern (Section 4.2.6) that are additional to those summarized in Table 4.6-2.

<u>Other Covered Species – Listed as Threatened or Endangered</u>

Canada Lynx

Initially, the Canada lynx was not identified by the City as one of the 14 species of greatest concern, based on it's legal status, and the low probability that the species would occur in the habitat types in the watershed. At the time of the HCP's development (1994-middle of 1998), lynx were not proposed by the Service as Threatened under the Act, but was subsequently proposed and listed as threatened, effective April 24, 2000 (65 FR 16052). Therefore, there is not a lynx-specific protection strategy in the HCP, as there is for the 14 species of greatest concern (see Table 1). Rather, the lynx was deemed one of the *other species of concern* (see HCP Table 3.6-1 for complete listing of the other species of concern). For the seventy-one species that are considered *other species of concern*, which includes the lynx, the City and the Service opted to use habitat-based conservation strategies and habitat-based minimization and mitigation measures. Overall conservation objectives for the habitat-based strategies are described in section 4.2.6 of the HCP (pg. 4.2-166) and conservation objectives for each habitat type begin on pg. 4.2-167. There are not lynx-specific mitigation measures in the HCP. However, the City and the Services created a series of tables to specifically address the need in the Opinion to describe Conservation Measures for each Covered Species. These tables are contained in 4.6.3; Tables 4.6-1, 4..6-2 and 4.6-3, were developed to specifically cross-walk the habitat and community-based conservation measures to each of the 70 other species of concern. Rather, the habitat-based strategies that apply to the habitats lynx are known to use, and occur in the Watershed, are summarized below. These provisions were excerpted from section 3.6 Status of Covered Species and section 4.6 Effects of the Proposed Action upon Covered Species of the HCP.

1. Complete protection of all existing old growth and late successional forest above 3500', as well as all caves, talus and cliffs in the watershed (i.e. denning sites).

2. Reduction of road densities in upper watershed by about 1/3.

3. Entire watershed is closed to public access, including motorless access, thus minimizing chances of lynx mortality due to humans through trapping, hunting, harassment, etc.

Other Covered Species – Not Listed as Threatened or Endangered

Three currently unlisted, unproposed species covered by this HCP have species-specific conservation strategies (i.e. are considered Species of Greatest Concern in the HCP- see Table 1 of this Opinion). These are Northern Goshawk, Common Loon and Pygmy Whitefish:

Northern Goshawk

The reader is referred to the HCP section 4.2.6, Species Conservation Strategies, which deals specifically with the 14 species of greatest concern, (specifically to pg 4.2-142 for Goshawk Conservation Objectives, and 4.2-146 for Additional Mitigation and Conservation Measures Benefitting the Goshawk. Also, the reader is referred to Table 4.6-3, entitled Summary of specific minimization and mitigation measures included in the individual species conservation strategies for the 14 species of greatest concern (Section 4.2.6) that are additional to those summarized in Table 4.6-2.

Common Loon

The reader is referred to the HCP section 4.2.6, Species Conservation Strategies, which deals specifically with the 14 species of greatest concern, (specifically to pg. 4.2-153 for Loon Conservation Objectives, and 4.2-159 for Mitigation and Conservation Measures Benefitting the Loon. Also, the reader is referred to Table 4.6-3, entitled Summary of specific minimization and mitigation measures included in the individual species conservation strategies for the 14 species of greatest concern (Section 4.2.6) that are additional to those summarized in Table 4.6-2.

Pygmy Whitefish

The reader is referred to the HCP section 4.2.6, Species Conservation Strategies, which deals specifically with the 14 species of greatest concern, (specifically to pg 4.2-152 for Whitefish Conservation Objectives, and 4.2-155 for Additional Mitigation and Conservation Measures Benefitting the Whitefish. Also, the reader is referred to Table 4.6-3, entitled Summary of specific minimization and mitigation measures included in the individual species conservation strategies for the 14 species of greatest concern (Section 4.2.6) that are additional to those summarized in Table 4.6-2.

<u>Covered Species referred to as *Other Species of Concern*</u>

This Opinion addresses species referred to as *Other Species of Concern* in the HCP. The City and the Services did not develop species-specific conservation strategies for species considered *Other Species of Concern*. Note there are a total of 68 *Other Species of Concern* in the HCP, but 2 of these, sea-run cutthroat trout and kokanee, are addressed in NMFS's Opinion (NMFS 2000) and not here-in. In this section of the Opinion, the Service has addresses the 65 *Other Species of Concern* that are under our purview. A complete list of these species can be found in Table 1 of this document.

The City and Services used habitat-based conservation strategies, as well as habitat-based mitigation and minimization measures, to address the needs of the *Other Species of Concern*. Overall conservation objectives for the habitat-based strategies are described in section 4.2.6 of the HCP (pg. 4.2-166) and conservation objectives for each habitat type begin on pg. 4.2-167. Unlike the 14 Species of Greatest Concern, these 65 species do not have species-specific conservation strategies or mitigation measures. However, the City and the Services created a series of tables to specifically address the need in the Opinion to describe Conservation Measures for each Covered Species. Tables 4.6-2 and 4.6-4 were developed to cross-walk the habitat- and community-based conservation measures to each of the 68 *Other Species of Concern*. Therefore, rather than re-iterate the Conservation Measures contained in the HCP for the habitats used by each of the *Other Species of Concern*, the reader should examine tables 4.6-2 and 4.6-4 to determine which conservation measures apply to each species. The habitat-based approach to species conservation, as used in this HCP, entails placing each habitat type found in the watershed into 1 of 3 categories:

1) Riparian/Aquatic, which includes all lentic and lotic habitats and the riparian areas associated with them;

2) Late-successional/Old Growth, which includes all older upland forests and forest structures normally found in older forests (e.g. large trees, snags and down logs), or;

3) Special Habitats, which in the watershed includes all caves, cliffs, talus, rock outcrops, felsenmeer slopes, natural upland grass-forb meadows, persistent shrub communities, and the former town site of Taylor, which is now largely comprised of deciduous forest.

Detailed information on the management of the 3 general habitat types, as well as the sub-parts that comprise each of them, are described in HCP section 4.2.2, Ecological Reserve Conservation Strategy. The commitments by the City regarding levels of activities to be conducted under the HCP are listed in the following table.

Table 2. Summary of Covered Activities in the terrestrial portions of the Watershed, and projected levels of these activities over the term of the HCP.

FOREST RESTORATION

UPLANDS (acres)	Total	Units/year	Time period
Restoration planting	1,000	20 ac/yr	50 years
Restoration thinning (0-30 years old)	10,500	700 ac/yr	1st 15 years
Ecological thinning (30-60 years old)	2,000	40 ac/yr	50 years
RIPARIAN (acres)			
Conifer underplanting	700	14 ac/yr	50 years
Restoration thinning (0-30 years old) [1]	420	28 ac/yr	1st 15 years
Ecological thinning (30-60 years old) [1]	150	3 ac/yr	50 years

AQUATIC RESTORATION

ACTIVITY	Total	Units/year	Time period
Streambank Stabilization	7,500' of streambank	~200'/yr ~130'/yr	1st 16 years Remainder of term
Streambank Revegetation	10,600' of streambank	~330'/yr ~155'/yr	1st 16 years Remainder of term
LWD Placement	~50 LWD Projects	~5 projects ~2-3 projects/yr ~1 project/yr	1st 8 years Years 8-16 Remainder of term

ROADS

38% of existing roads will be removed over first 20 years

Construction of 5-10 miles of new roads over first 20 years (mostly relocation of existing roads)

ROADS (miles)	Total Mi.	Miles removed/yr	Time period
Removal (decommissioning)	239 miles	12 mi/yr	1st 20 years
Improvement/repair [2]		4-10/yr	50 years
Maintenance [3]		520/yr (yr 0)à 381/yr (yrs 21-50)	50 years

[1] Estimates using total funding for restoration and ecological thinning; may vary somewhat.

[2] Varies substantially by year; total miles of roads reduced by 38% during first 20 years; occasionally may be more than 10 mi/yr.

[3] HCP funding applies to 20% of roads that are near streams; miles of roads reducedby38%during first 20 years. Maintenance activity required on all active road search year, but activity will vary by year, and will include grading, cleaning ditches, cleaning culverts, brushing, and minor repairs.

The forest and riparian restoration activities and the roads removal, improvement and maintenance activities, referred to in the HCP as Watershed Management (Section 4.2) are the primary sources of potential impacts to the terrestrial Covered Species under Service purview. Most of these negative effects, if there are any, are of a short-term nature, such as the several-day disturbance associated with conducting a riparian restoration project. The long-term, net effect of the activities described in this section of the HCP are believed to be all positive at the time of this writing, and have been designed to create better habitat conditions for the affected species over the long-term.

The City's manipulations of instream flows, and drawing down and filling of the Chester Morse Reservoir, a consequence of water supply management, are the major sources of potential impacts to the aquatic Covered Species under Service purview (HCP section 4.4.4, Technical Appendix 27 (Instream Flow Agreement), and Technical Appendix 38 (Reservoir Management). Additionally, there are potential impacts associated with operation of the small hydroelectric generation facility that is located at Cedar Falls (HCP section 4.4.2, Additional Measures). The majority of these aquatic Covered Species are fish, which either occur in the Reservoir (bull trout and pygmy whitefish) or below the Reservoir (the 4 salmon species, steelhead, Pacific and river lampreys), or are piscivorous birds (bald eagle, common loon, osprey, great blue heron and harlequin duck). Most of these aquatic species have species-specific conservation strategies fully developed in the HCP (e.g. all the salmon, steelhead trout, bull trout, pygmy whitefish, bald eagle, common loon), and the reader has been previously directed where to find these strategies in the HCP (see above).

However, several aquatic species that do not have species-specific conservation strategies currently inhabit, or will inhabit after the fish passage facilities are built at Landsburg Diversion Dam (see Technical Appendix 28; Landsburg Fish Mitigation Agreement) the lower portion of the watershed, either below Masonry Dam (i.e. below the Reservoir) or below Lower Cedar Falls, a natural fish barrier. These species have the potential to be affected by the City's manipulations of instream flows and by the water supply and hydroelectric operations. These species include great blue heron, harlequin duck, osprey, Pacific and river lampreys, and sea-run cutthroat trout. At the time of this writing, the sea-run cutthroat trout is NMFS's responsibility under the Act, and hence will be addressed in their Biological Opinion and not here (NMFS 2000). The other 5 species (great blue heron, harlequin duck, osprey, Pacific lamprey and river lamprey) have been treated in this HCP using a habitat-based approach. Measures addressing Instream Flows below the Chester Morse Reservoir are contained in the HCP; see section 4.4.1 for Conservation Objectives, and 4.4.2 Conservation Measures. Measures relating to Reservoir Management are contained in HCP section 4.4.2. Conservation Objectives for Fish Passage Facilities at the Landsburg Dam are contained in HCP section 4.3.1, and Conservation Measures are contained in HCP section 4.3.2. Tables 4.6-2, <u>Summary of Minimization and Mitigation Measures</u> and Table 4.6-4, <u>Applicability of Minimization and Mitigation Measures to Species and Groups of Species</u>, relate the Conservation Measures for instream flows and hydroelectric facilities management to these 5 Covered Species.

STATUS OF THE SPECIES (rangewide)

Species of Greatest Concern/Critical Habitat

Spotted Owl

The northern spotted owl (owl) was listed as a threatened species on June 26, 1990, as a result of declining populations and the loss of suitable habitat from timber harvesting (55 FR 26114). For a more detailed discussion of the biology and status of the owl, refer to the following documents: the 1990 Status Review (USFWS 1990a); the final rule listing the owl as threatened (55 FR 26114); the biological opinions for the U.S. Forest Service's Region 6 pre-Section 318 (USFWS 1990b) and Section 318 (USFWS 1990c) timber sale programs; the final rule designating critical habitat (USFWS 1992; 57 FR 1796); the Interagency Scientific Committee report (Thomas et al. 1990); the Scientific Analysis Team report (Thomas et al. 1993); the FEMAT report (USDA et al. 1993); *Spotted Owl Habitat in Washington: A Report to the Washington Forest Practices Board by the Spotted Owl Scientific Advisory Group* (Hanson et al. 1993); the proposed 4(d) special rule (60 FR 9484); the supporting documents for the Northwest Forest Plan (USDA and USDI 1994, USFWS 1994); *The Contribution of Federal and Non-federal Habitat to Persistence of the Northern Spotted Owl on the Olympic Peninsula, Washington: Report of the Re-analysis Team* (Holthausen et al. 1995); and the *Demography of the Northern Spotted Owl* (Forsman et al. 1996).

Marbled Murrelet

The marbled murrelet was Federally listed as threatened on September 28, 1992 (57 FR 45328). Critical habitat was designated on May 24, 1996 (61 FR 26256). An account of the taxonomy, ecology, and reproductive characteristics of the marbled murrelet is found in: the 1988 Status Review (Marshall 1988); the final rule designating the species as threatened; the Service's biological opinion for Alternative 9 (USFWS 1994) of the FSEIS (USDA and USDI 1994); the *Ecology and Conservation of the Marbled Murrelet* (Ralph et al. 1995a); the final rule designating critical habitat for the species (61 FR 26256); the recovery plan for the species (USFWS 1997a); and, the biological opinion on the Quinault North Boundary Area Unit Management Plan for the Quinault Indian Nation (USFWS 1998c).

Bald Eagle

A detailed account of the taxonomy, ecology, and reproductive characteristics of the bald eagle is presented in the Pacific States Bald Eagle Recovery Plan (USFWS 1986) and the final rule to reclassify the bald eagle from endangered to threatened in all of the lower 48 States (60 FR 36010). Additional information on the listing of the species, and its status in Washington State was included in the biological opinion for the Quinault Indian Nation's Lancaster Timber Sale (USFWS 1998b). Section 3.5.12 of the HCP includes a narrative description of the bald eagle's legal status, a general description of the species range, and a detailed life history and habitat requirements discussion, both generally and specifically in the watershed. The reader is encouraged to refer to this narrative.

Grizzly Bear

The grizzly bear was listed as a threatened species in the conterminous United States in 1975. Livestock depredation control, habitat deterioration, commercial trapping, unregulated hunting, and protection of human life were leading causes of the decline of grizzly bears (USFWS 1993). Two of the six ecosystems identified in the grizzly bear recovery plan (USFWS 1993) include areas in Washington, the Northern Cascades and the Selkirks. Almack et al.(1994) estimated the 1991 grizzly bear population in the North Cascades recovery area at less than 50, and perhaps as low as 5 to 20. Wielgus et al. (1994) estimated a density of one bear per 27 mi^2 (71 km^2) for the U.S. portion of the Selkirks Ecosystem and one per 17 mi^2 (43 km^2) for the Canadian portion of the Selkirks Ecosystem.

Section 3.5.14 of the HCP includes a narrative description of the grizzly bear's legal status, a general description of the species range, and a detailed life history and habitat requirements discussion, both generally and specifically in the Watershed. The reader is encouraged to refer to this narrative.

Gray Wolf

The gray wolf was listed as endangered in 1978. In 1930, it was believed that breeding populations of wolves in Washington were extinct because of fur trading pressure in the 1800's followed by the establishment of bounties on all predators in 1871 in the Washington Territory (Young and Goldman 1944). The last reported wolf shot in the North Cascades was in 1975 (WDW 1975, as reported in Almack et al. 1994). Recent observations indicate that wolves exist in Washington, likely in small numbers, and mostly as individuals. However, several family units have been documented, indicating that some level of reproduction has occurred recently (Almack and Fitkin 1998).

Section 3.5.15 of the HCP includes a narrative description of the gray wolf's legal status, a general description of the species range, and a detailed life history and habitat requirements discussion, both generally and specifically in the Watershed. The reader is encouraged to refer to this narrative.

Bull Trout

Taxonomy
Bull trout or bull char are a member of the genus *Salvelinus*, within the Salmonidae family. This family also includes Pacific salmon of the genus Oncorhynchus. Bull trout are closely related to Dolly Varden (*Salvelinus malma*) and is sympatric with this species over part of their range, most notably in the Coastal/Puget Sound Region of Washington State. The taxonomic classification between these two char has been fraught with difficulty. Characteristics distinguishing the two

species as well as a taxonomic description of bull trout are presented by Haas and McPhail (1991). Char can be easily differentiated from other native pacific salmonids by their white spots on a dark background, whereas the latter have dark spots on a light background.

Status

All five bull trout DPS are currently listed under the Act as threatened, as of November 1st, 1999; (64 FR 58910). The State of Washington classifies bull trout as a State Priority Species. This Priority designation is given to those wildlife species that are of concern due to their population status and their sensitivity to habitat alteration (Mongillo 1993). The American Fisheries Society listed bull trout as a species of concern in all of its range (California, Idaho, Montana, Nevada, Oregon, Washington, Alberta and British Columbia) except Alaska, as a result of present or threatened destruction, modification, or curtailment of its habitat or range, and introduction of exotic species (Williams et al. 1989).

The Service listed the Columbia and Klamath River DPS of bull trout as threatened under the Act on June 13, 1998 (63 FR 31647) and the Jarbidge River DPS as threatened on April 8, 1999 (64 FR 17110), but no recovery plans or critical habitats have been designated. The Coastal/Puget Sound and St. Mary-Belly River DPS of bull trout was proposed as threatened by the Service, on June 10, 1998 (63 FR 31693), and listed as threatened on November 1st, 1999 (64 FR 58910).

Known range

Bull trout historically occurred in major river drainages in the Pacific Northwest from about 41 deg. N to 60 deg. N latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in Northwest Territories, Canada (Cavender 1978; Bond 1992). To the west, bull trout range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout are wide-spread throughout tributaries of the Columbia River basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978).

Life history

Unlike most Pacific salmon, members of the *Salvelinus* or char genus are entirely iteroparous; individuals are capable of reproducing several times (years) after maturing. Bull trout exhibit two distinct life history forms, migratory (fluvial, adfluvial and anadromous) and resident throughout their range. Bull trout are generally not anadromous (Meehan and Bjornn 1991), although anadromy may have been important in the past (Bond 1992) and is currently known to occur in Puget Sound (Kurt Kraemer 1994). Resident populations are generally found in small headwater streams where they spend their entire lives, whereas migratory populations rear in tributary streams for several years before migrating downstream into a larger river or lake to mature (Rieman and McIntyre 1993). Bull trout become sexually mature from 4 to 9 years old (Shepard et al. 1984a). They spawn in the fall (August through October) (Shepard et al. 1984a, Rieman and McIntyre 1996), typically in cold, low-gradient second- to fourth-order tributary streams, over loosely compacted gravel and cobble having groundwater inflow (Shepard et al. 1984b, Brown 1992, Rieman and McIntyre 1996). Spawning sites also seem to be near cover (Craig 1997; Brown 1992). Bull trout spawn in consecutive or alternate years (Shepard et al. 1984a, Pratt 1992). Post-spawning mortality, longevity, and repeat-spawning frequency are not well known (Rieman and McIntyre 1996).

Rieman and McIntyre (1993) stated that bull trout appear to have more specific habitat requirements than other salmonids. They list the habitat characteristics of channel stability, substrate composition, cover, temperature, and migratory corridors as important influences in bull trout distribution and abundance. In general, it is believed bull trout need habitat providing cold water, complex cover, stable substrate with a low percentage of fine sediments, high channel stability, and stream/population connectivity.

Water temperature is consistently recognized by researchers more than any other factor as influencing bull trout distribution (Bonneau, Scarnechia and Hall 1996; Craig 1997; Rieman and McIntyre 1993). Distribution is thought to be limited by temperatures above 61 ^{0}F (16 ^{0}C), while optimum incubation and juvenile rearing temperatures are thought to be much lower, 36 to 39^{0}F (2 to 4^{0}C) and 39 to 46^{0}F (4 to 8^{0}C) respectively (Goetz 1989, Pratt 1992). Spawning, incubation and juvenile rearing are the bull trout life history stages that require the coldest water temperatures and lowest fine sediment levels. Water incubation temperatures of 40 to 46^{0}F (4.5-8.0^{0}C), have produced inter-gravel hatching at 443-503 cumulative Celsius temperature units (CTU) which corresponds to 73-82 days (Gould 1987). Fraley and Shepard (1989) observed inter-gravel emergence at 223 days (635 CTU) when water temperatures were 34 to 42^{0}F (1.2-5.4^{0}C). Juvenile rearing and spawning typically occur in the smaller tributaries and headwater streams that may be upstream of anadromous salmonids, and therefore they are more directly influenced by conditions in non-fish bearing streams (Underwood et al. 1995; Rieman et al. 1997). Greatest riparian protection needs to be provided around bull trout spawning and rearing streams (often headwater streams and often the smaller fish-bearing streams), and the non-fish bearing streams above them that provide high quality water to downstream areas used by the fish.

Sedimentation is shown to cause negative effects on bull trout, although no thresholds can be set as clear tolerance limits for population maintenance (Rieman and McIntyre 1993). Emergence success of fry appears to be affected by the proportion of sediment in the substrate (Pratt 1992). Rearing densities of juvenile bull trout have been shown to be lower when there are higher percentages of fine sediment in the substrate (Shepard et al. 1984b). Bull trout require a long period of time (220+ days) from egg deposition until emergence, making them especially vulnerable to effects of sediment deposition, and bedload movement during this period (Gould 1987). Young bull trout are closely associated with the stream bed, this association appearing more important to bull trout than for other species (Pratt 1992; Rieman and McIntyre 1993). Due to this close connection to substrate, bed load movements and channel instability can also negatively influence the survival of young bull trout.

Bull trout distribution and abundance is also positively correlated with complex forms of cover and with pools (Rieman and McIntyre 1993). Cover that bull trout are usually associated with consists of large or complex woody debris and undercut banks, but may also include coarse substrates (cobble and boulder). Studies conducted with closely related Dolly Varden showed that population density declined with the loss of woody debris after clearcutting or the removal of logging debris from streams (Bryant 1983, Dolloff 1986, Elliott 1986, Murphy et al. 1986).

Population dynamics

The Service rated subpopulations (see status and distribution section below) within distinct population segments (DPS) as either "strong", "unknown" or "depressed", modified after Rieman et al. (1997). A "strong" subpopulation was defined as having all life history forms that once occurred, abundance that is stable or increasing, and at least 5,000 total fish or 500 adult fish present. A "depressed" subpopulation was defined as having either a major life history form eliminated, abundance that is declining or half of the historic abundance, or less than 5,000 total fish or 500 adults present. The Service rated a subpopulation's status as "unknown" if insufficient information currently exists to determine whether the status of the subpopulation is either strong or depressed. Based solely on stochastic demographic processes, Rieman and McIntyre (1995) assumed that bull trout would be at a high risk of extinction when lotic densities are below 24.2 fish/mile (1.5 fish/100m).

Population Status and distribution

Throughout the bull trout geographic range, declines have been attributed to the effects of land and water management activities, including forest management and road building, mining, agricultural practices, and livestock grazing (Furniss et al. 1991; Meehan and Bjornn 1991; Nehlsen et al. 1991; Craig and Wissmar 1993; Frissell 1993; McIntosh et al. 1994; Platts et al. 1995). Isolation and habitat fragmentation from dams and agricultural diversions (Rode 1990; Mongillo 1993); fisheries management practices, poaching and the introduction of non-native species also threaten bull trout populations (Rode 1990; Bond 1992; Howell and Buchanan 1992; Donald and Alger 1993; Leary et al 1993; Pratt and Huston 1993; Rieman and McIntyre 1993; MBTSG 1996; Palmisano, Ellis and Kaczynski 1993).

The Coastal-Puget Sound bull trout DPS encompasses all Pacific coast drainages within the coterminous United States north of the Columbia River in Washington. This population segment is discrete because it is geographically segregated from other subpopulations by the Pacific Ocean and the crest of the Cascade Mountain Range. The population segment is significant to the species as a whole because it is thought to contain the only anadromous forms of bull trout in the coterminous United States, thus, occurring in a unique (i.e., marine) ecological setting. In subpopulations of this DPS, it is not known whether the native char are bull trout, Dolly Varden or both. In the status assessment, the Service addressed them together as native char. This does not imply that both exist within a subpopulation when the words native char are used, but merely that the subpopulation of char has not been positively identified as either bull trout and/or Dolly Varden. The Service identified 35 subpopulations of native char within this DPS. Nine of the 35 (26%) delineated native char subpopulations are depressed, 25 (71%) are unknown, and one (3%) is listed as strong (63 FR 31693).

The Columbia River DPS occurs throughout the entire Columbia River basin within the United States and its tributaries, excluding bull trout found in the Jarbidge River, Nevada. Although Williams et al. (1995) identified two distinct subpopulations (clades) in the Columbia River basin (upper and lower Columbia River) based on genetic diversity patterns, a discrete geographical boundary between the two subpopulations was not documented. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997). This DPS is composed of 141 existing bull trout subpopulations of which 71 (50%) are at risk of extirpation (63 FR 31647).

The Klamath River DPS originates in south central Oregon near Crater Lake National Park, and flows southwest into northern California where it meets the Trinity River and empties into the Pacific Ocean. Bull trout in this drainage are discrete because of physical isolation from other bull trout by the Pacific Ocean and several small mountain ranges in central Oregon. The Service considers six of seven (86%) subpopulations at risk of extirpation in this DPS (63 FR 31647).

The Jarbidge River DPS is located in southwest Idaho and northern Nevada, is a tributary in the Snake River basin and contains the southernmost habitat occupied by bull trout. This population segment is discrete because it is segregated from other bull trout in the Snake River basin by a large gap (greater than 240 km (150 mi)) in suitable habitat and several impassable dams on the mainstem Snake River. The occurrence of a species at the extremities of its range is not necessarily sufficient evidence of significance to the species as a whole. However, because the Jarbidge River possesses bull trout habitat that is disjunct from other patches of suitable habitat, the population segment is considered significant because it occupies a unique or unusual ecological setting and its loss would result in a substantial modification of the species' range. The status of this DPS is currently listed as threatened (64 FR 17110).

The St. Mary-Belly River DPS is located in northwest Montana east of the Continental Divide. Both the St. Mary and Belly Rivers are tributaries in the Saskatchewan River basin in Alberta, Canada. The population segment is discrete because it is segregated from other bull trout by the Continental Divide and is the only bull trout population found east of the Continental Divide in the coterminous United States. Bull trout in this population segment are believed to migrate into Canada where a substantial amount of habitat still remains. This DPS consists of four subpopulations. Migratory fish occur in three of the subpopulations and the life-history form in the fourth subpopulation is unknown. The status of bull trout subpopulations in this DPS is unknown (63 FR 31693).

<u>Other Covered Species – Listed as Threatened or Endangered</u>

Canada Lynx

Status

The U.S. Fish and Wildlife Service, on July 8,1998, proposed to listed the contiguous United States Distinct Population Segment of the Canada lynx as a threatened species (63 FR 36994) under the Endangered Species Act. Due to similarity of appearance, the captive population of Canada lynx within the coterminous U. S., was also proposed to be listed as a threatened species. A special rule 4(d) was proposed for lynx in the same Federal Register notification. Federal listing of Canada Lynx as threatened occurred on March 24, 2000 (65 FR 16052). Within Washington State, the Canada lynx is classified as a threatened species (WDFW 1998). The lynx is 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 (Koehler and Aubry 1994).

Threats to Lynx

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 until winter from eight kittens present among three litters in July. When prey is scarce, kitten survival is low (Brand and Keith 1979, Bailey et al. 1986). Primary human-associated threats to lynx populations include the elimination of winter habitat for snowshoe hare and excessive trapping (WDW 1991). Because of the significant economic return for lynx pelts, trapping and hunting during the 1970's and 1980's increased the threat to lynx from over exploitation. The effects of overharvest of lynx during this time period persist today and continues to reduce the recovery of lynx. As early as 1942, Elton and Nicholson(1942) recognized that overharvest had the potential to reduce lynx populations to levels where the natural cycles of lynx populations could not occur. The effects of trapping have been shown to be additive to natural mortality, rather than compensatory (taking the place of natural mortality) (Brand and Keith 1979).

Loss of suitable habitat reduces the potential for lynx population growth or recolonization by lynx, further confining lynx to smaller, more isolated and less suitable habitat patches (Weaver 1993). Isolation increases the susceptibility of lynx to human-caused threats, random environmental events, and the effects of genetic bottlenecks (Weaver 1993). Likely the biggest modification to suitable habitat for lynx has been precipitated by fire suppression. Forest fires historically maintained a mosaic of early successional forest, un-burned down woody debris, and late-successional conifer forest that provided ideal habitat for snowshoe hares and lynx (Quinn and Parker 1987).

Roads are also a threat to lynx populations. Lynx use roads for hunting and travel, which may make them more vulnerable to human-caused mortality (Koehler and Aubry 1994). Roads increase human access into forests and increase the likelihood of lynx encountering people that may result in injuries or death by intentional or unintentional shooting, trapping and vehicle accidents (Koehler and Brittell 1990).

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, the Oregon Cascades and the southern Cascades of Washington (Thomas, T., Ecologist, U.S. Fish and Wildlife Service, Olympia, Washington, February 17, 1998, pers. comm.). In recent years, lynx have been found on the west side of the Cascade Crest only in the northern part of the North Cascades ((Koehler and Aubry 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

Little or no empirical data exist regarding the habitat requirements of Canada lynx in mid to low elevations on the west side of the Cascade Crest. Data on habitat use has largely been obtained by research conducted in the boreal forest zone, or further north in the sub-arctic. Most of the narrative discussion below is based on findings from these northerly vegetation types, and it is not clear how applicable it might be to how lynx use habitats found in the Cedar River Watershed.

Lynx are extremely wide-ranging, with home range size varying from between 7 and 115 mi^2, 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; Koehler and Aubry 1994). Lynx use a mosaic of forest types from early successional to mature coniferous and deciduous forest, as long as snowshoe hares are present (Koehler and Aubry 1994). Early successional forests where snowshoe hares are plentiful are the habitats that lynx favor for hunting (Koehler and Aubry 1994). Throughout the range of lynx, the key factor in whether stands are suitable as habitat appears to be the density of conifer stems, regardless of the species of conifer (Koehler and Aubry 1994). Den sites for lynx, however, tend to be located in 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; Koehler and Aubry 1994; WDW 1993c).

Forests composed of subalpine fir, Engelmann spruce, western and mountain hemlock, silver fir, and noble fir, particularly in association with lodgepole pine, may be used as habitat depending on the availability of their primary prey, snowshoe hare. Subalpine fir communities are not as common on the west side of the Cascades, where mountain hemlock replaces subalpine fir at upper elevations. Dense regeneration stands composed of the same species may serve as foraging habitat. These vegetation types generally occur in areas with heavy winter snow accumulations.

Landscape connectivity is likely a major factor in lynx distribution. Maintaining connectivity between northern habitat and southern habitat is critical to the long-term persistence of Canada lynx in the United States (Aubry et al. 1999).

Other Covered Species – Not Listed as Threatened or Endangered

The next 4 species, peregrine falcon, northern goshawk, common loon and pygmy whitefish, are considered Species of Greatest Concern in the HCP, and as such, the HCP has very detailed life history and habitat use narratives. The Service was involved in developing these narratives, and endorses their content. Therefore, this Opinion has incorporated the status sections in the HCP.

Peregrine Falcon

The peregrine falcon (*Falco peregrinus*) was listed as endangered in the United States in 1970, and subsequently, in North America was removed from the list of endangered and threatened wildlife on August 25, 1999 (64 FR 46542). The USFWS completed this action because available data indicates that the species has recovered following the banning of DDT in Canada and the United States, restrictions on the use of other organochlorine pesticides, and implementation of successful management activities (USFWS 1998).

The Pacific Coast states have exceeded the delisting goal of 185 pairs by 54 pairs. The number of occupied eyries in Washington has increased from three known in 1980 and 1981 (Pacific Coast American Peregrine Falcon Recovery Team 1982) to 44 in 1997 (64 FR 46542). Between 1993 and 1997, eyries in Washington obtained the average productivity goal of 1.5 young per pair. Threats to peregrine falcons include disturbance during the onset of their courtship activities (Fyfe and Olendorff 1975) and during nesting (Pagel 1991). Destruction of wetlands supporting waterfowl and other forage species, particularly near nesting areas and areas of winter concentrations is also of concern.

Section 3.5.13 of the HCP includes a narrative description of the peregrine falcon's range, and a detailed life history and habitat requirements discussion, both generally and specifically in the Watershed. The reader is encouraged to refer to this narrative.

Northern Goshawk

On September 29, 1997, the Service announced a 90-day finding (62 FR 50892) in response to a petition from the public to list northern goshawks (*Accipiter gentilis*) west of the 100th meridian. In June of 1998 the Service completed it's status review, (*Northern Goshawk Status Review*, USFWS 1998e), and a 12-month administrative finding in response to the petition to list northern goshawks (memo from Regional Director dated June 10, 1998) and *Northern Goshawk Finding*, (63 FR 35183). These documents summarize the status of northern goshawks west of the 100th meridian, and describe the threats facing the species; the reader is encouraged to consult these documents for further information if needed. On June 29, 1998, the Service published in the Federal Register the Notice of 12-month Petition Finding (63 FR 35183).

Section 3.5.4 of the HCP includes a narrative description of the goshawk's status, a general description of the species range, and a detailed life history and habitat requirements discussion, both range-wide and specifically in the Watershed. The reader is encouraged to refer to this narrative.

Common Loon

For most of the rest of these Covered Species there are no Federal Register Notices regarding listing proposals, since the Service has not embarked on any listing or pre-listing actions. An exception to this is the Oregon spotted frog (*Rana pretiosa*). However, common loon (*Gavia immer*) is one of the 14 Species of Greatest Concern, as defined by the HCP, and as such, there is a detailed write-up on status, range, habitat requirements and life history in the HCP, as well as a detailed conservation strategy and effects analysis for common loons contained in the HCP. There are also specific data on use of the Reservoir and reproduction records for several recent years. The reader is encouraged to look at section 3.5.5 of the HCP for details.

Pygmy Whitefish

As with common loons, pygmy whitefish (*Prosopium coulteri*) is one of the 14 Species of Greatest Concern in the HCP, and as such has a species-specific conservation strategy. There is a very thorough description of status, range, life history and habitat requirements of pygmy whitefish contained in section 3.5.7 of the HCP. This description includes information about the population of whitefish that exist in the Reservoir and spawn in the Reservoir's tributary streams.
For the balance of the Covered Species, the narratives contained in the HCP form the basis of the status reviews in this Opinion. However, the Service was compelled to update the information presented in the HCP using information at our disposal. The updated and more complete status reviews are included below.

Band-tailed Pigeon

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), however, the hunting season has been closed state-wide since 1996.

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 (WDW 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 (WDW 1991). West of the cascades the species is also known to occur in residential areas or city parks with suitable large coniferous trees (Smith et al. 1997).

Band-tailed pigeons feed on various plant foods, including the buds, flowers, and fruits of hardwood trees and shrubs, such as cascara sagrada, 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).

Population dynamics and 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); although recent coo count surveys in Washington have documented an increasing population trend since a low period in the early 1990's (Greg Schirato, biologist, WDFW, pers. comm. with Mark Ostwald, Biologist, USFWS).

Black Swift

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.

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."

The black swift is often observed in the Cascades, but documented nests are rare. In fact, there is only one confirmed breeding record and that consisted of observing a bird carrying an insect to a cliff. Other records indicate "probable breeding". Nesting appears to occur on cliffs 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)

Population dynamics and status
Smith et al. (1997) considers the black swift an uncommon breeder in Washington and there appears to be only one confirmed breeding record in the state from Whatcom County. Other records indicate " probable" breeding evidence in the Cascades.

Brown Creeper

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.

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. On managed forest lands in western Washington, it occurred in low abundance in stands aged 50 to 70 years old (Manuwal and Perason 1997). Optimal habitat appears to be unmanaged, interior old growth forests where abundance is highest (Altman 1999).

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).

Population dynamics and status

The brown creeper is considered to be common throughout its range in Washington (Smith et al. 1997). Breeding bird survey results from 1966 to 1996 show a +6.4 % ($P<0.2$) annual trend in Washington. However, breeding bird surveys in California and Oregon from 1966 to 1996 show a statistically significant annual declining trend; -2.4% ($P<0.05$) and -4.6% ($P<0.01$) respectively.

Golden Eagle

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.

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 (WDW 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 eagles' principal prey (Snow 1973; McGahan 1967). Mountain beaver are important prey on the west side of the Cascades (Bruce et al. 1982).

Population dynamics and status

Breeding Bird Survey trend data from 1966 to 1996 show a stable to slightly increasing population of golden eagles for the western United States (Sauer et al., 1997). The 1990 population estimate for Washington was 80 breeding pairs (WDW 1991).

Great Blue Heron

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. 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 (WDW 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).

Harlequin Duck

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.

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 (WDW 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; WDW 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 macro invertebrate 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 WDW 1991).

Foraging habitat includes fast-moving streams (Harlequin Duck Working Group 1993), while resting habitat is generally described as mid-stream loafing sites (WDW 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.

Population dynamics and 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. Winter surveys conducted by the WDFW indicate an increasing population trend (Greg Schirato, biologist, WDFW, pers. comm., with Mark Ostwald, biologist, USFWS).

Merlin

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.

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) subspecies more likely to occur in the Cedar River Municipal Watershed. The Taiga merlin likely 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. They prey mainly on small, open-country birds such as larks, swallows, and finches. Small mammals and insects are eaten occasionally. 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.

Population dynamics and status

According to Smith et al. (1997), the status of merlins in Washington "is very much a mystery", although there are approximately 15 to 20 known merlin sites with a minimum occupancy status of "presence" in the state of Washington (Joe Buchanan, ornithologist, WDFW, June 22, 1999, pers. comm. with Mark Ostwald, biologist, USFWS). In all likelihood there are more sites. Christmas bird count data shows that merlin populations are stable or increasing across North America, although this data is not specific to subspecies and may not accurately represent trends for a particular subspecies (Buchanan, pers. comm.).

Olive-sided Flycatcher

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.

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).

Population dynamics and 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).

Osprey

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 and is on state Priority Habitat and Species list.

Range
The osprey breeds along the sea coasts, rivers, and lakes of coastal North America, and winters in the West Indies, Central America, and South America (WDW 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; WDW 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 (WDW 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).

Population dynamics and status
Breeding bird survey data for the state of Washington from 1966 to 1996 show a highly significant increase of 16.3% ($P<0.01$). For the United States for the same time period there is a highly significant increase of 6.1% ($P<0.01$) and all survey regions report an increasing trend in ospreys.

There is an extremely high concentration of nesting ospreys along the Pend Oreille River in northeastern Washington (Smith et al. 1997).

Pileated Woodpecker

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.

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 generally breed in forest stands older than 70 years, though they can use younger stands if large snags are present (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 (WDW 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 1996). 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.

Population dynamics and status

Pileated woodpeckers typically begin breeding at one year of age, and generally breed annually thereafter (Bull and Jackson 1995). The most common clutch size is 4 eggs (Bull and Jackson 1995). In northeast Oregon, 2 nesting adults were >9 years old and 3 others were >7years old. In western Washington, 43% of radio tagged adults survived 1 year (Bull and Jackson 1995).

Breeding bird survey trend data show a -7.7%/year ($P < 0.08$, $n = 10$) from 1966 to 1979 and a +8.0%/year ($p < 0.00$, $n = 36$) from 1980 to 1997 (Sauer et al., 1997).

Rufous Hummingbird

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.

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). During the fall southward migration, it occurs in the Rocky Mountains (Calder 1993).

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).

In low to moderate elevation unmanaged forests throughout the Oregon Cascades, there is a significant association of rufous hummingbirds with old-growth forest (>200 years) and large western hemlocks (Gilbert and Allwine 1991). In low to moderate elevation unmanaged fir forests in the southern Washington Cascades, rufous hummingbirds increased in abundance with stand age through young (55-80 years), mature (95-190 years), and old growth (>200 years) (Manuwal 1991). At the landscape level, abundance in the southern Washington Cascades was positively correlated with 1) amount of clearcut area in stands adjacent to the sampled stand, and 2) amount of old growth area in the landscape (Lehmkuhl et al 1991).

Population dynamics and status

Concern for this neotropical migrant species stems from consistent marked declines in rufous hummingbirds detected during the Breeding Bird Survey throughout the western portion of its range (Sauer et al. 1997). Between 1966 and 1996, breeding bird survey detections for this species exhibited a statistically significant declining trend of approximately 2.7 percent per year ($P<0.01$). Oregon and Washington showed significant ($P<0.01$) declines of -5.3% and -2.3% respectively for the same time period. Causes of this decline are unknown.

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

Three-toed Woodpecker

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.

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 heartrot 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).

Population dynamics and 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 heartrot and bark beetles (Goggans, et al. 1989). The western breeding bird survey region data show a non-significant trend of -0.2% from 1966 to 1996 (Sauer et al., 1997).

Vaux's Swift

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.

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.

Population dynamics and status

Breeding Bird Survey data for Washington indicate a significant decline in the number of Vaux's swifts for the 1982-1991 period (Sauer et al., 1997). Concern over the welfare of the Vaux's swifts relates primarily to their use of large, hollow trees for nesting and roosting (WDW 1991; Bull and Collins 1993).

Western Bluebird

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.

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.

Population dynamics and 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). Breeding Bird Survey data from 1966 - 1996, indicates a negative trend for the state of Washington (Sauer et al. 1997).

Willow Flycatcher

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.

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).

Population dynamics and 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)." The Breeding Bird Survey data suggests a -2.5%/year trend ($P<.01$, $n=57$) for the state of Washington from 1966 - 1996 (Sauer et al. 1997).

Pacific Lamprey

Status
Pacific lamprey (*Lampetra tridentatus*) is listed as a federal species of concern in Washington. Pacific lamprey has no designated state listing status in Washington.

Species Description
Pacific lamprey is a member of the *Petromyzonidae* family, which is ancestral to most vertebrates and all fish. Adult Pacific lamprey can be identified by the three large supraoral lamina teeth cusps in the suckerlike mouth. Females have a well-developed ventral fin fold, but the males have none. Larvae or ammocoetes have a dark line of pigment above and below the tip of the tail (Wydoski and Whitney 1979).

Known range

The Pacific lamprey is distributed from Hokkaido, Japan, through the Bering Sea and Aleutian Islands to Baja California, Mexico (Ruiz-Campos and Gonzalez-Guzman 1996; Wydoski and Whitney 1979). Scott and Crossman (1973) describe this species as Apenetrating all major rivers, often to headwaters. Pacific lamprey have been seen in the Green River of Washington State, sometimes spawning on steelhead redds (Foley, S., WDFW, Pers. comm. June 29, 1998).

Life history

Like the river lamprey, Pacific lamprey exhibit an anadromous life history. Although, landlocked populations have been reported from California, Oregon, Idaho and British Columbia (ODFW 1996; Wallace and Ball 1978; Wydoski and Whitney 1979). Adults are parasitic on a wide variety of fish, including benthic groundfish species as well as pelagic species such as Pacific herring (*Clupea harengus*) and Pacific salmon (*Oncorhynchus* spp.) (Beamish 1980; Scott and Crossman 1973; Stewart 1981). Unlike river lamprey, Pacific lamprey appear not to be piscvorous during metamorphosis or the spawning migration (Richards and Beamish 1981; Whyte et al. 1993). Pacific lamprey generally attach to their prey ventrally, especially near the pectoral fins; while river lamprey commonly attach dorsally (Cochran 1986). Adult Pacific lamprey are at times a very important food source for both saltwater and freshwater predators. In the Rogue River estuary in Oregon, Roffe and Mate (1984) documented that California sea lion (*Zalophus californianus*); Steller (or Northern) sea lion (*Eumetopias jubatus*); and the Pacific harbor seal (*Phoca vitulina richardsi*) fed heavily upon Pacific lampreys. Beamish (1980) cited observations of Pacific lamprey in the stomachs of sperm whales (*Physeter catodon*). Blue heron (*Ardea herodias*) and mink (*Mustela vison*) have been observed eating Pacific lamprey in fresh-water environments (Beamish 1980; Wolf and Jones 1989).

After spending approximately 3.5 years in salt water, adults enter natal streams between July and October, and gradually move upstream to spawn the following spring (Beamish 1980; Hart 1973). Migrating adults have been known to pass vertical barriers such as dams by slowly ascending smooth walls by the use of their sucker-like mouth (Wydoski and Whitney 1979). The length of sexually mature adults in Canada has ranged from 16-72 cm, but adults will atrophy approximately 20% of their maximum length prior to spawning (Beamish 1980). The spawning nest or redd usually consists of a shallow depression built in sand and gravel substrates at the upstream edge of a low gradient riffle (Close et al. 1995; Hart 1973; Scott and Crossman 1973). Flow and depth seems to be important in redd site selection, where velocities range from 1.6 to 3.3 ft/sec (0.5 to 1.0 m/sec) and depths of 1.3 to 3.3 ft (0.4 to 1.0 m) have been observed (Close et al. 1995). Lake spawning has been observed, but is uncommon (Russell et al. 1987). Adults generally die soon after spawning, although Michael (1980 and 1984) has observed some occurrence of repeat spawning returns of marked adults in traps within Puget Sound, Washington. After fertilization, eggs hatch in 2 - 4 weeks (19 days at 59EC (15EC) and newly hatched larvae (ammocoetes) 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). Ammocoetes are filter-feeders that subsist on algae or other organic matter for up to 5-6 years in their freshwater habitat (Moyle 1976; Wydoski and Whitney 1979). Under experimental conditions, emergent larvae 0.3 to 0.4 inches (7 to 10 mm) in length preferred mud over sand and gravel substrates (Pletcher 1963 in Close et al. 1995). Current velocities greater than 1.0 ft/sec (0.31 m/sec) prohibited burrowing by emergent larvae in all substrates, but larger larvae 1.6 to 2.0 inch (40 to 50 mm) are capable of burrowing in sand. In Oregon, the current over ammocoete beds ranged from 0.3 to 1.6 ft/sec (0.1 to 0.5 m/sec) (Close et al. 1995). Metamorphosis begins in July and the known period of entry into salt water is from December to June, parasitic life starts soon after salt water entry (Beamish 1980; Whyte et al. 1993). Increased water flows during runoff can encourage outmigration, by washing away sand and silt the larvae require for anchoring themselves to the bottom (Hardisty and Potter 1971).

Population dynamics
Population dynamics of Pacific lamprey is unknown. Filter-feeding ammocoetes have a long (5-6 year) freshwater residence period that may benefit from increased nutrient input from salmonid carcasses.

Status and distribution
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 throughout its range (ODFW 1996; Renaud 1997). 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).

River Lamprey

Status
River lamprey (*Lampetra ayresi*) is a federal species of concern in Washington State. River lamprey is a Washington State candidate species of concern.

Species Description
River lamprey is a member of the *Petromyzonidae* family, which is ancestral to most vertebrates and all fish. Adult river lamprey can be identified by the two large supraoral lamina teeth cusps in the suckerlike mouth. Larval river lamprey have a black blotch in the membrane at the tip of the caudal fin (Wydoski and Whitney 1979).

Known 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.

Life history

Biological information is not as well defined for river lamprey as it is for the larger-sized Pacific lamprey. Salt water mature adults are parasitic almost exclusively on pelagic species such as Pacific herring (*Clupea harengus*) and Pacific salmon (*Oncorhynchus* spp.) (Beamish 1980; Beamish and Neville 1995; Scott and Crossman 1973). In most British Columbia streams, river lamprey become parasitic before reaching the ocean (Stewart 1981). In Lake Washington, sockeye (*O. nerka*) salmon smolts are thought to be the preferred prey for recently metamorphosed river lamprey (Warner, E., Muckleshoot Indian Tribe, 1998, Pers. comm.). In 1991, Beamish and Neville (1995) concluded that river lamprey in the Fraser River plume killed approximately 65% and 25% of the total Canadian hatchery and wild production of coho and chinook salmon, respectively. This predation is considered to be significant upon commercially important fish stocks in British Columbia (Stewart 1981). River lamprey generally attach to their prey dorsally, while Pacific lamprey tend to attach ventrally, near the pectoral fins (Cochran 1986). Unlike numerous reports on Pacific lamprey, the extent of other animals feeding on river lampreys is unknown.

Between September and late winter, river lamprey return to freshwater after spending approximately two years in salt water (Beamish 1980). Spawning occurs during winter to spring in clean gravel areas of small tributaries (Beamish 1980; Moyle et al. 1995). The mean length of mature marine adults in Canada were 9.8 inches (25 cm) in September, but adults atrophy approximately 20% of their maximum length prior to spawning (Beamish 1980). River lamprey larvae (ammocoetes) may 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). Metamorphosis occurs in late July with downstream migration occurring the following year from May to July (Beamish 1980; Beamish and Youson 1987). In the final stages of metamorphosis, lampreys congregate just upstream from salt water, entering the ocean in late spring (Moyle et al. 1995). From June until September they increase in size by an estimated 4.3 to 5.5 inches (11-14 cm) and 0.4 to 0.6 ounces (12-18 g).

Population dynamics

Population dynamics of river lamprey is unknown. Filter-feeding ammocoetes reside in natal streams for several years and may benefit from increased nutrient input from salmonid carcasses.

Status and distribution

Little is known regarding the status of river lamprey populations in Washington. Population declines of the related Pacific lamprey (*Lampetra tridentatus*) are primarily due to conditions both in oceanic and freshwater habitats; passage past hydroelectric and irrigation dams (ODFW 1996; Renaud 1997). 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, Pers. comm.). Within the Straits of Georgia in British Columbia, approximately 667,000 adult lampreys were thought to exist in 1975 (Stewart 1981).

Big Brown Bat

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. 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).

California Myotis

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. 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 water courses (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.

Pacific Fisher

Status
The Pacific fisher (*Martes pennanti pacifica*) is currently a federal species of concern. The Service was petitioned to list two populations of the fisher in the western United States in December 1994. In the March 1, 1996, Federal Register (61 FR 8016), the Service presented its conclusion that there was not substantial information indicating that the listing was warranted. In 1991, the Service declined to list the Pacific subspecies of fisher due to lack of information. In that finding (56 FR 1159), the Service determined that the fisher in Washington, Oregon, and California represented a population that should be monitored and that the Pacific form was "probably genetically, though not morphometrically distinct from the Rocky Mountain form." The Service made such a finding because the continuity of the fisher's range through Canada and between Canada and the United States, is believed to provide for genetic exchange throughout North America. The fisher is a listed species (endangered) at the state level in Washington.

Population Status
Fishers historically occurred at low densities throughout most of the forested areas of Washington (Stinson and Lewis 1998). The fisher was over-trapped in Washington in the 1800s and early 1900s,

leading to population declines. Predator-control programs, possibly in synergy with habitat loss and alteration (i.e., timber harvest), nearly caused the extirpation of the fisher in Washington early in the 1900s (Stinson and Lewis 1998). The fisher has been protected from legal harvest in Washington since 1933, but populations have not recovered.

Currently, the fisher is very rare, and may even be extirpated in Washington (Stinson and Lewis 1998). Therefore, habitat information presented below is based on research conducted in areas other than western Washington (e.g. Rocky Mtns. and New England), and could be considered speculative. 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 (Stinson and Lewis 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 (Stinson and Lewis 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 (Stinson and Lewis 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). According to Aubrey 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. A comparison of historic and recent sightings is presented by Maj and Garton (In Ruggiero et al. 1994), and includes recent sightings in the Puget Basin. 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 amounts of 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). However, no habitat-use research on fishers has been conducted in western Washington or northwestern Oregon, therefore, the following habitat information could be considered speculative. Fishers also typically 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 lake shores, 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 (Stinson and Lewis 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 amounts of canopy closure (at least 80 percent) seem to provide the most suitable habitat for this species, although younger forest and second-growth 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, such as large trees, snags, 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 (Stinson and Lewis 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 (Stinson and Lewis 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). This is particularly true when openings are small enough to exclude adult male fishers and other potential predators. Maternal den trees are typically large (Stinson and Lewis 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 may 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 (Stinson and Lewis 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 (Stinson and Lewis 1998). Fishers are generalized predators, and snowshoe hares are considered an important food item.

The primary determinants of sustainable fisher habitat appear to be low-elevation forests containing sufficient structure and prey, with little to no trapping pressure.

Fringed Myotis

Status

The fringed myotis (*Myotis thysanodes*) is a federal species of concern and a "monitor species" at the state level in Washington.

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

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 which 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).

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.

Hoary Bat

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. 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 street lights (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).

Keen's Myotis

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 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 over 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).

Little Brown Myotis

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 street lights (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).

Long-eared Myotis

Status
The long-eared myotis (*Myotis evotis*) is a federal species of concern and a monitor species at the state level in Washington.

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.

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).

Long-legged Myotis

Status

The long-legged myotis (*Myotis volans*) is a federal species of concern and a monitor species at the state level in Washington.

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 range lands (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 red cedar 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.

Population dynamics and status

The amount of ecological information currently published about long-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."

American Marten

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 (furbearer) species by Washington State (WDFW 1996). Marten populations in Washington State are considered to be of sufficient status to manage as a game species. Washington permits the harvest of marten during the fall trapping season.

Range

The marten occurs throughout the coniferous forests of Canada, Alaska, and the 11 western states except Arizona (WDW 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 Mountans) (Johnson and Cassidy 1997).

Habitat

Martens are closely associated with late-successional stands of mesic conifers, especially those stands containing 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 treeline (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, Douglas-fir, and lodgepole pine (Buskirk and Ruggiero 1994). Ruggiero et al. (1998) found martens in association with squirrel middens.

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) and Raphael and Jones (1997) 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 1997). Denning sites were primarily in natural woody debris, but artificial structures, standing dead trees, and live trees were also used (Raphael and Jones 1997). 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 treeline, especially talus fields, in mountainous area has been reported (Buskirk and Ruggiero 1994). Stand age may not be as important as stand structural characteristics, such as large trees, snags, large woody debris, that provide foraging, resting, and denning sites. Buskirk and Powell (1994) found that physical structure within a stand is more important than species composition of the overstory.

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).

Population Dynamics and Status

Most females mate at 15 months and produce first liters at age 2; average litter size is 2-3 with only one litter produced per year (Buskirk and Ruggerio In Ruggerio, et al. 1994). Breeding can occur at up to age 15 years (Buskirk and Ruggerio In Ruggerio, et al. 1994).

Marten populations fluctuate dramatically with prey populations, and can be heavily impacted by trapping pressure. Adult females are not as susceptible to trapping mortality as are males, especially young males (Buskirk and Ruggerio In Ruggerio, et al. 1994). Washington and all surrounding states and provinces continue to have legal fall trapping seasons for marten. In Washington, there does not appear to be any discernable trend in trapping harvest over the last decade or more (Cliff Rice, WDFW Game Surveys Coordinator, pers comm. April 7, 1999).

Masked Shrew

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. However, it must be noted that no status reviews were found by the Service or the City, and it is unlikely that anyone really knows the status of masked shrews in the Pacific Northwest.

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 treeline. 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.

Population Dynamics and Status

In general, shrews have one to several litters a year with 2 to 10 young born. A shrew's life span is 1-2 years, but most probably live less than a year (Whitaker 1980). 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.

Northern Water Shrew

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. However, it must be noted that no status reviews were found by the Service or the City, and it is unlikely that anyone really knows the status of northern water shrews in the Pacific Northwest.

Range

The water shrew occurs in montane and boreal areas of North America below treeline, 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 macro invertebrates, 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).

Population Dynamics and Status

In general, shrews have one to several litters a year with 2 to 10 young born. A shrew's life span is 1-2 years, but most probably live less than a year (Whitaker 1980). 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.

Silver-haired Bat

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. 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.

Townsend's Big-eared Bat

Status

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

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 (WDW 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) (WDW 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).

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."

Wolverine

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

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. 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). Maj and Garton present documentation of historic and recent sightings (In Ruggiero et al. 1994) and of the generalized species range (In Butts 1992).

Habitat

Wolverines are wide-ranging animals that inhabit a wide variety of habitats, but are generally associated with 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), particularly in the summer. Wolverines tend to avoid clearcuts, although tracks (which showed straight-line movements at a lope or gallop) have been observed crossing clearcuts (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). In Idaho, wolverines were observed to use avalanche debris as natal dens.

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." Similar findings were made by Van Zyll de Jong (1975) and Hornocker and Hash (1981). Snowshoe hares, porcupines, red squirrels, ground squirrels, and marmots can be important prey items depending on the geographic areas and season (Banci 1994).

Allen (1987) recommended a variety of successional stages in a mosaic. Wilson (1982) suggested that the "best way to manage this species is to do nothing". Butts (1992) stated that the key to wolverine management is: (1) The less development, the better. Roads, if necessary should be one way (not loops), as primitive as possible, and permanently closed after activities are completed; (2) Timber harvest should be accomplished in a manner that will provide the greatest biological diversity over the long term. Cuts should be relatively small, not adjacent to large openings, leave some down material and some understoiry for small birds and mammals, and provide travel corridors between secure cover areas; and (3) Carcasses of big game are an important component of wolverine late-winter diet, especially in areas with long and intense winters (most of wolverine range). Activities that encourage or maintain ungulates and their winter ranges will benefit wolverines.

Population Dynamics and Status

Females do not breed until their second year, and typically have 3-4 young per litter, and do not appear to bear young every year; males are not reproductively mature until age 2 (Banci, 1994 In Ruggerio, et al. 1994). Range-wide, wolverines are now found in remote, wilderness areas; typically at high elevations at the southern fringe of their range. Across their range, estimates of wolverine age and sex composition have suffered from small sample sizes (Banci, 1994 In Ruggerio, et al. 1994).

Wolverines are thought to have historically occurred at very low densities in the Cascades and northeastern Washington (Johnson and Cassidy 1997). Wolverines are now very rare in Washington State, with confirmed sightings only sporadically (Dvornich 1997). No data on reproduction or population densities are available for Washington state, and evidence of successful reproduction has never been found (Johnson and Cassidy 1997).

Yuma Myotis

Status

The Yuma myotis (*Myotis yumanensis*) is a federal species of concern in Washington.

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).

Population Dynamics and 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.

Cascades Frog

Status

The Cascades frog (*Rana cascadae*) is considered a species of concern by the Service. This species is not on the WDFW's Species of Concern list. The WNHP list indicates the Cascades frog is apparently secure, with many occurrences in the state (S4), but is a taxa of potential concern (e.g. monitor species).

Since the mid-1970s, populations of this species have experienced marked declines in Oregon and California (ODFW 1996; Blaustein et al. 1995). Blaustein and Wake (1990) estimate 80 percent of 30 populations monitored since the mid-1970s have disappeared at least temporarily. Causes of population declines may include drought conditions, non-native fish introductions, pathogens, habitat loss, and sensitivity to increased levels of ultraviolet radiation (Blaustein et al. 1995). Stream channelization and livestock grazing can affect the availability of suitable hibernacula and cover.

Lehmkuhl, Ruggiero and Hall (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 found in the Olympic Mountains of Washington and in the Cascade Mountains of Oregon, Washington, and northern California. This species generally occurs in montane meadows and moist forests at 2,000–6,200 feet in elevation (Leonard et al. 1993; Corkran and Thoms 1996).

Habitat

Cascade frogs are highly aquatic and typically are found in relatively small bodies of water, particularly in small pools adjacent to flowing streams in subalpine meadows, rather than large lakes (Leonard et al. 1993). Commonly used habitats include relatively small, unvegetated potholes, sphagnum bogs and fens, seasonally flooded forested swamps, small lakes and ponds, and marshy areas adjacent to streams; however, Cascade frogs are occasionally found in forests away from water (Nussbaum et al. 1983; Leonard et al. 1993; Blaustein et al. 1995). This species requires shallow, usually temporary, ponds for breeding and permanent ponds or streams with well-vegetated banks for hibernating and foraging during the non-breeding season. Hibernation sites probably include permanent ponds, springs, and streams in subalpine and mountain meadows.

Breeding sites generally occur in shallow, gently sloping margins of pond or lake shores, generally over soft substrates (Blaustein et al. 1995). Standing water must be present for the period of time required for eggs to hatch and tadpoles to transform. Changes in water levels or temperatures in breeding areas may reduce hatching success, tadpole survival, and the quality of streambank vegetation used for cover.

Population Dynamics and Status

Breeding begins as soon as the ice and snow melts in spring, from March to April at mid-elevations and May or June at higher elevations (Leonard et al. 1993). Males call both above and below water, and mating occurs in shallow water during the day. Egg masses containing 300–500 eggs are usually laid on top of each other on barely submerged mosses or other short vegetation in shallow water that is less than 8 inches deep. The egg masses may be partially exposed to the air, making the eggs vulnerable to loss due to drying from changing water levels or freezing temperatures (Nussbaum et al. 1983; Leonard et al. 1993; Blaustein et al. 1995; Corkran and Thoms 1996). Although some tadpoles do not metamorphose until their second summer, many tadpoles metamorphose into froglets in August or September of the first year (Leonard et al. 1993; Corkran and Thoms 1996. Sexual maturity is reached at the end of three years or possibly four, and life expectancy for both sexes is about five years (Slater 1939; Nussbaum et al. 1983).

Although the Cascade frog's 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.

Cascade Torrent Salamander

Status

The Cascade torrent salamander (*Rhyacotriton cascadae*) is not recognized by the U.S. Fish and Wildlife Service as a listed species, candidate species, or species of concern in Washington. It is recognized by the State of Washington as a candidate species.

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). Their typical haunt is the splash zone, where a thin film of water runs between or under rocks. Seeps running through talus provides ideal habitat (Leonard et al. 1993). 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^{0}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).

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). Notably, the torrent salamanders are intolerant to desiccation (Jennings and Hayes 1994). 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.

Population Dynamics and Status

The reproductive biology of the Cascade torrent salamander is virtually unknown, as courtship, behavior, and nests have not been reported. Indirect evidence suggests an extended breeding period that may be nearly year-round. Eggs may be laid at almost any time with the peak egg-laying season being late spring (Leonard et al. 1993). One account purports that apparently most eggs are laid in May (Blaustein et al. 1995). In California, oviposition appears to occur during fall or winter (Jennings and Hayes 1994). One study found females with an average of eight yolked ovarian eggs. Eggs hatch into 5/8 inch larvae after 290 days which, in turn, metamorphose after 4 to 5 years. Maturity is reached at 5 2 to 6 years (Leonard et al. 1993). 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). 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 by torrent salamanders (USDI 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).

Larch Mountain Salamander

Status

The Larch Mountain salamander (*Plethodon larselli*) is a federal species of concern and 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 and USDI 1994) and a sensitive species by the U.S. Forest Service.

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 may be declining (Herrington and Larsen 1985), though recent work by Crisafulli suggests that although patchily distributed, Larch Mountain salamanders may be locally abundant (Charlie Crissafuli, Research Biologist, USFS, pers.comm with Kathleen Cushman, biologist, USFWS; 12/98). Nearly one hundred sites are now known from western Washington. 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, Ruggiero, and Hall (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 1999 ield surveys unpublished data), 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.

Potential key 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

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. The long-toed salamander is listed as "demonstrably secure in state" by the Washington Natural Heritage Program.

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 westside prairies or bog meadows (Dvornich et al. 1997).

Habitat

The long-toed salamander has the broadest distribution of any salamander in Washington state (Leonard et al. 1993). They can be found in a variety of habitats from sea level to about 9,000 ft including: grasslands, sagebrush steppe, dry woodlands, wet coastal forests, conifer forests, alpine meadows, barren rocky shores of high mountain lakes, and disturbed areas (Nussbaum et al. 1983; Stebbins 1985; Corkran and Thoms 1996). In Washington, the long-toed salamander has only been reported from sea level to 6,190 ft (Leonard et al. 1993). Adults remain underground except when breeding, and may be found under rocks and logs near breeding areas during the rainy season (Stebbins 1985, Corkran and Thoms 1996).

Population Dynamics and Status

The long-toed salamander is the earliest breeding amphibian in Washington state (Leonard et al. 1993). 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 in water less than 1.6 ft (Corkran and Thoms 1996). The eggs are deposited singly or in small clumps containing from 6-57 individual eggs per clump and hatch in 2 to 4 weeks (Nussbaum et al. 1983;

Leonard et al. 1993). The larvae live in surface sediment or under logs or rocks in shallow water and feed on a variety of invertebrates (Leonard et al. 1993; Corkran and Thoms 1996). Larvae at low elevation sites may metamorphose in less than 1 year, while larvae at higher elevation sites may take 2-3 years to metamorphose (Leonard et al. 1993). 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). Early evidence suggests that long-toed salamander may be unable to coexist with introduced fishes due to the larvae being preyed upon by exotic fish (Leonard et al. 1993). Garter snakes and bullfrogs have been found to feed on adult salamanders (Nussbaum et al. 1983). 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).

Northwestern Salamander

Status

The northwestern salamander (*Ambystoma gracile*) is not a listed species, candidate species, or species of concern at the federal or state level in Washington. The northwestern salamander is listed as "demonstrably secure in state" by the Washington Natural Heritage Program.

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), but have only been found from sea level up to 5,725 ft elevation in Washington (Leonard et al. 1993). Northwestern salamanders are absent from areas lacking aquatic habitat (Beatty et al. 1991; Blaustein et al. 1995; Corkran and Thoms 1996). Both terrestrial and aquatic habitats are important to the adult northwestern salamander because it can mature into either a metamorphosed terrestrial form or an aquatic neotenic form (a sexually mature larval stage) (Blaustein et al. 1995; Corkran and Thoms 1996). Terrestrial adults spend most of their lives underground in such places as mammal burrows, rotting logs, and moist crevices, and may be found up to 1 mile from their breeding ponds (Nussbaum et al. 1983; Leonard et al. 1993; Dvornich et al. 1997). Neotenic adults live under submerged logs or in surface sediments in water deeper than 1.6 ft and emerge at night to feed on invertebrates (Blaustein et al.

1995; Corkran and Thoms 1996). 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).

Population Dynamics and Status
Breeding occurs in early to mid spring, in relatively permanent quiet bodies of water (e.g., permanent ponds, beaver ponds, lakes, and slow parts of streams) (Nussbaum et al. 1983; Corkran and Thoms 1996). Egg masses are attached to the stems of emergent vegetation, 1.5-6 ft below the water surface (Corkran and Thoms 1996). The egg masses contain between 40 and 270 individual eggs and take 6 to 8 weeks to hatch (Leonard et al. 1993). 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). Larvae of the terrestrial form remain in their natal ponds for 1-2 years before metamorphosis (Behler and King 1979). Neotenic larvae mature at 2-3 years of age and can be found in subalpine lakes and ponds of the Cascade and Olympic mountains (Nussbaum et al. 1983; Leonard et al. 1993). Thomas et al. (1993) identified northwestern salamanders as being closely associated with old-growth forest conditions, and Lehmkuhl Ruggiero, Hall (1991) put them at a medium risk of extinction, based on an assessment of their frequency of occurrence, abundance, body size, and vagility. The northwestern salamander is also one of the few native amphibians that have continued to survive the introduction of exotic fishes and bullfrogs into lowland lakes and sluggish streams (Leonard et al. 1993).

Pacific Giant Salamander

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. The Pacific giant salamander is listed as "demonstrably secure in state" by the Washington Natural Heritage Program.

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 cool, moist coniferous forests <u>near</u> mountain lakes and streams from sea level to 7,100 ft elevation, but are only found from sea level to 5,900 ft elevation in Washington and Oregon (Nussbaum et al. 1983; Leonard et al. 1993). Terrestrial adults are common in many areas, but are nocturnal and secretive. They can be found in burrows, talus slopes, under bark, logs, and rocks, and wandering about on the forest floor (Beatty et al. 1991;

Leonard et al. 1993; Blaustein et al. 1995). Both aquatic and terrestrial forms of this species require access to large cover, such as large gravel, small boulders, and logs, to avoid predators and to aid in hunting prey (Corkran and Thoms 1996). 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. 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. During the breeding season, they can be found in or near streams (Nussbaum et al. 1983; Stebbins 1985; Beatty et al. 1991).

Population Dynamics and Status

Pacific giant salamanders appear to breed in the spring and fall and there appears to be little synchrony (Nussbaum et al. 1983; Stebbins 1985; Leonard et al. 1993). The female lays 75-135 eggs in a hidden underwater chamber located in secluded microhabitats within cold, clear, lotic and lentic biological systems (Nussbaum et al. 1983; Leonard et al. 1993; Blaustein et al. 1995). The female remains with the nest until the larvae leave, a period up to 200 days (Nussbaum et al. 1983; Leonard et al. 1993). The larvae and neotenic adults feed on larval stone flies, caddis flies, and may flies, as well as fish and larval amphibians (Nussbaum et al. 1983). The aquatic forms of this salamander are preyed upon by fishes, garter snakes, water shrews, river otters, and weasels (Nussbaum et al. 1983). The larvae may metamorphose into a terrestrial adult in 2-3 years or remain aquatic as a neotenic adult (Stebbins 1985; Leonard et al. 1993). The adult terrestrial salamanders feed on insects, slugs, snails, and worms, as well as other amphibians, snakes, and small mammals (Leonard et al. 1993).

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).

Northern Red-legged Frog

Status

The northern red-legged frog (*Rana aurora aurora*) is considered a species of concern by the U.S. Fish and Wildlife Service, a tracking species by the BLM, and a sensitive species by the Forest Service. This species is not listed on the Washington Department of Fish and Wildlife Species of Concern List. It is designated as demonstrably secure within the state on the Washington Natural Heritage Program Animal Species List.

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, the northern red-legged frog occurs in the western Cascades (all vegetation zones up to and including western hemlock), in the Columbia River Gorge as far east as White Salmon in Klickitat County, in the Puget Sound lowlands, on the Olympic Peninsula, and in the southwestern part of the state (Leonard et al 1993; Dvornich et al. 1997).

Habitat

Northern red-legged frogs are found from sea level to 3,000 feet, or rarely to 4,700 feet, in moist coniferous or deciduous forest, riparian forests, marshes, bogs, ponds, springs, seeps, and slow-moving streams (Nussbaum et al. 1983; Stebbins 1985; Blaustein et al. 1995, Corkran and Thoms 1996). This species is highly terrestrial in the nonbreeding season and may occur in forests far from water in damp conditions (Nussbaum et al. 1983; Leonard et al. 1993). Adults and froglets are found along streams and pond edges, or under logs or debris, in the summer (Corkran and Thoms 1996). Northern red-legged frogs have been found overwintering in rivers and woods (Licht 1969). Not restricted to old-growth habitat, red-legged frogs are frequently found in forest of all ages (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 shallow water (1.5–6.5 feet deep) in cool, well-shaded, 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; Corkran and Thoms 1996). 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). 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.

Life History

Males emit mating calls, usually at night, from underwater but also call from surface vegetation (Licht 1969; Nussbaum et al. 1983; Leonard et al. 1993). Egg-laying begins in January or February near sea level. Females lay 750–1300 eggs in egg masses, which may be laid close together but not on top of each other (Leonard et al. 1993). Egg masses are attached below the surface of the water to stems of emergent vegetation or submerged branches, but float to the surface before hatching (Leonard et al. 1993; Corkran and Thoms 1996). Tadpoles, which live in the warmer parts of a pond, metamorphose into terrestrial froglets in May, June, or July. Froglets likely require three or four years to reach sexual maturity (Leonard et al. 1993; Corkran and Thoms 1996).

Northern red-legged frogs are widely distributed and known to breed in lentic habitats throughout the Cedar River Municipal Watershed. This species uses shallow and deep ponds, marshes and wet meadows, stream banks, and adjacent areas of mature forest from sea level up to 4700 feet. The adults are very mobile and are expected to be found in most upland habitats searching for prey. This species is highly terrestrial in the nonbreeding season and may occur in forests far from water in damp conditions. Adults and froglets are found along streams and pond edges, or under logs or debris, in the summer and have been found overwintering in rivers and woods.

Population Dynamics and 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 (Nussbaum et al. 1983; ODFW 1996). Hydrological alterations can affect the availability of shallow water for breeding. Removal of shade trees and other vegetation around ponds and streams can affect breeding by in elevating water temperatures.

Roughskin Newt

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. The roughskin newt is listed as "demonstrably secure in state" by the Washington Natural Heritage Program. The roughskin newt is perhaps the most common salamander in the Pacific Northwest (Nussbaum et al. 1983).

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 elevation, but have only been found from sea level to 5,040 ft elevation in Washington State (Nussbaum et al. 1983; Leonard et al. 1993). 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 quite far from breeding ponds, either above or just under surface litter (Nussbaum et al. 1983; Leonard et al. 1993; Dvornich et al. 1997). 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). The roughskin newt is the only member of the family Salamandridae to occur in the Pacific Northwest, and is the most aquatic species of its genus (Stebbins 1985; Blaustein et al. 1995). Mass migrations of roughskin newts crossing roads can be encountered during the spring and fall (Leonard et al. 1993).

Population Dynamics and Status

Breeding occurs from February to April at low elevations and June to July at higher elevations (Leonard et al. 1993). Mating and egg-laying takes place along the vegetated perimeters of in ephemeral and permanent ponds and lakes, as well as streams in areas of slow-moving water (Leonard et al. 1993; 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 in water 1.6 to 6.5 ft deep (Blaustein et al. 1995; Corkran and Thoms 1996). The eggs hatch in 20 to 26 days (Nussbaum et al. 1983). The hatchlings and larvae live in aquatic vegetation, sediments, and under debris (Corkran and Thoms 1996). The immature newts feed on a variety of aquatic invertebrates (Leonard et al. 1993). Larvae can metamorphose into a terrestrial or aquatic adult in 1 to 2 years, elevation dependent; a neotenic form with rudimentary gills has also been reported (Leonard et al. 1993; Blaustein et al. 1995). The terrestrial adults live in or under soft logs, foraging for invertebrates on the forest floor during damp conditions, even during the day (Corkran and Thoms 1996). The aquatic adults feed on amphibian eggs and larvae as well as invertebrates (Corkran and Thoms 1996). Due to its highly toxic skin, the roughskin newt has few predators except for the common garter snake (*Thamnophis sirtalis*) (Leonard et al. 1993).

Oregon Spotted Frog

Status

The Oregon spotted frog (*Rana pretiosa*) is a federal candidate species. The Service has been petitioned to list this species, and is in the process of responding to that petition. The Oregon spotted frog is listed as a State endangered species in Washington. The species is considered a sensitive species by the U.S. Forest Service.

Range

Historically, the range of the Oregon spotted frog in Washington State was distributed through the lowlands of the Puget Trough from the Canadian 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). Currently, only four populations are known to occur in Washington: two in the south Puget Sound lowlands (Dempsey Creek and Beaver Creek) and two in the south-central Cascade Mountains (Trout Lake and Conboy Lake) (McAllister and Leonard 1997). In Washington, the Oregon spotted frog has been documented historically in eleven localities in Clark, King, Klickitat, Pierce, Skagit, Snohomish, and Thurston Counties (Hayes 1997, McAllister and Leonard 1997). Populations are currently known to occur only in Klickitat, Skamania, and Thurston Counties (Leonard 1997, McAllister and Leonard 1997).

Habitat

The Oregon spotted frog inhabits emergent wetland habitats in forested landscapes, although it is not typically found under forest canopy. Oregon spotted frogs, however, have been found in riparian forests and areas with dense shrub cover (McAllister and Leonard 1997). This species is not an old-growth forest obligate, but forested areas may represent important refugia from further population losses (Blaustein et al. 1995). Historically, this species was also associated with lakes in the prairie landscape of the Puget Sound lowlands (McAllister and Leonard 1997). Oregon spotted frogs have been documented at elevations ranging from near sea level in Washington and in western Oregon to approximately 5000 feet in the Oregon Cascades (Dunlap 1955, Hayes 1997, McAllister and Leonard 1997).

This is the most aquatic native frog species in the Pacific Northwest and is almost always found in or near a perennial body of water (e.g., spring, pond, lake, sluggish stream). There is probably a relationship with fairly large marshes (approximate minimum size of 9 acres) that can reach suitably warm temperatures and can support a large enough population to persist despite high predation rates (Hayes 1994). Oregon spotted frog habitat includes zones of shallow water and abundant emergent or floating aquatic plants, which are used for basking and escape cover from predators (Leonard et al. 1993; Corkran and Thoms 1996; McAllister and Leonard 1997).

Oregon spotted frogs breed in shallow pools 2–12 inches deep that are near flowing water, or which may be connected to larger bodies of water during seasonally high water or at flood stage. Characteristic vegetation includes grasses, sedges, and rushes, although eggs are laid where the vegetation is low or sparse (McAllister and Leonard 1997).

Studies have indicated that adult frogs move to remnant pools in response to reduced water levels from spring to summer and disperse from these pools during increased precipitation during September and October (Watson et al. 1998). Telemetered Oregon spotted frogs in a Washington study stayed within 2600 feet of capture locations, and one Oregon study indicated that adult frogs often move less than 300 feet between years (Hayes 1998; Watson et al. 1998). Oregon spotted frogs at Dempsey Creek selected areas of relatively shallow water 4–12 inches deep, with less emergent vegetation but more submergent vegetation than adjacent habitats, and they avoided dry, upland areas of pasture grass (Watson et al. 1998). Cook (1984), however, stated that spotted frogs will forage for insects and other invertebrates in adjacent woods and meadows.

Overwintering sites are associated with springs or other locations with low-flow conditions, which may result from an avoidance of sites that could freeze. Oregon spotted frogs apparently burrow in mud, silty substrate, or clumps of emergent vegetation when inactive during periods of prolonged or severe cold (Hayes 1994; McAllister and Leonard 1997).

Life History

Oregon spotted frogs begin to breed by 3 years of age; males may breed at 1 year, but generally at age 2, and females breed by 3 years of age (McAllister and Leonard 1997). Male Oregon spotted frogs are not territorial and may gather in large groups of 25 or more individuals at specific locations (Leonard et al. 1993). Breeding occurs in February or March at lower elevations and in late May or early June at higher elevations, and may also vary with latitude (i.e., southern populations may breed earlier than more northern populations) (Leonard et al. 1993). Males and females probably separate soon after egg laying with females returning to fairly solitary lives. Males may stay at the breeding site, possibly for several weeks, until oviposition (egg laying) is completed (McAllister and Leonard 1997).

Oregon spotted frogs' eggs are extremely vulnerable due to the species' egg-laying habits. Females may deposit their egg masses at the same locations in successive years, indicating the sites may have unique characteristics (Licht 1971). Use of traditional oviposition sites that may have limited availability because of unique characteristics, and the possibility that adults may have limited flexibility to switch sites, makes the Oregon spotted frog particularly vulnerable to oviposition site modification (Hayes 1994). Egg masses are laid communally in groups of a few to several hundred (Licht 1971; Nussbaum et al. 1983; Cook 1984; Hayes et al. 1997; Engler and Friesz 1998). Eggs are laid in shallow, often temporary, pools of water, which can result in high mortality rates for eggs due to desiccation and/or freezing (Leonard et al. 1993). Oregon spotted frogs experience high mortality rates at all stages of the life cycle (Licht 1974).

Oregon spotted frogs have a number of documented and potential natural predators, including a variety of snake, bird, and mammal species (McAllister and Leonard 1997). Tadpoles may be preyed upon by numerous vertebrate predators including birds, snakes, newts, salamanders, and fish as well as some invertebrate species, such as beetles and leeches. Predation and competition with a number of non-native fish and bullfrogs, which have been introduced into the historic range of the Oregon spotted frog, have contributed to the decline of this species (Hayes and Jennings 1986; Hayes 1994;; McAllister and Leonard 1997).

Population Status

This species was considered conspecific with the Columbia spotted frog (*R. luteiventris*) until very recently, when spotted frog populations in the Columbia River basin were reclassified as Columbia spotted frogs (Green et al. 1997). Limited distribution and isolation of Oregon spotted frog populations have prompted concern for this species' survival (WDFW 1994a). Loss of wetland habitat (e.g., development, dams) and/or alteration of the character of wetlands (e.g., hydrological modifications, introduction of exotic plants such as reed canarygrass, grazing in some circumstances) 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).

Tailed Frog

Status

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

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).

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).

Van Dyke's Salamander

Status

Van Dyke's salamander (*Plethodon vandykei*) is a species of concern at the federal level, and a state candidate in Washington. It is also a U.S. Forest Service Survey and Manage species.

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).

Habitat
Van Dyke's salamanders are most commonly associated with headwater streambank or seep habitats, often in mature and old-growth coniferous forests (WDW 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 lake shores (WDW 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.

Population Status
Limited distribution and isolation of Van Dyke's salamander populations have prompted concern for this species' survival (WDW 1994). 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 and USDI 1994). Lehmkuhl, Ruggiero and Hall (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.

Northwestern Pond Turtle

Status
The northwestern pond turtle (*Clemmys marmorata*), or western pond turtle as referred to in the Seattle HCP Section 3.6, is a federal species of concern. In Washington, the Washington Department of Fish and Wildlife listed the northwestern pond turtle as a sensitive species in 1981 and as a state endangered species in 1983. The Service was petitioned in 1992 to list the northwestern pond turtle, but since the species still occurred in 90% of its original range and it was

estimated that it was not likely to become extinct in the foreseeable future, the Service determined that a listing was not warranted at that time. Regions 5 and 6 of the U.S. Forest Service have listed the northwestern pond turtle as sensitive (Hayes, et al.1999).

Range

The range of the northwestern pond turtle extends from the Puget Sound lowlands in Washington south to the Sierra San Pedros Martirs in Baja California Norte (Hays et al. 1999). Most populations occur west of the Sierra-Cascade Crest. Documented observations of northwestern 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).

Habitat

The western pond turtle forages in marshes, sloughs, moderately deep ponds, and slow-moving portions of creeks and rivers usually associated with emergent vegetation. 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). Uplands adjacent to water bodies are utilized by turtles for dispersal, to nest, overwinter, and to aestivate (Hays et al. 1999). Northwestern pond turtles are found from sea level to 4500 feet, but all records in Washington are below 975 feet in elevation.

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). They are known to utilize meadows as well as young seral stages of most forest types including hardwoods, mixed hardwoods, and conifer forests. Average home ranges in California for adult males, adult females, and juveniles are 2.47, 0.62, and 1 acres, respectively (Bury 1979, Holland and Bury 1998). Based on preliminary information from the Columbia Gorge population, home ranges in Washington maybe larger (Hays et al. 1999).

Population Dynamics and Status

Only about 250 to 300 northwestern pond turtles are known to remain in the wild in Washington with the majority of these residing in the Columbia Gorge (Hays et al. 1999). A total of 26 individuals were released at the Puget Sound reintroduction site near Lackwood, Washington. Two adult males were also released into wetlands at Northwest Trek in 1996. Other than maybe a few scattered individuals, it is thought that wild populations of the northwestern pond turtle have been effectively extirpated from the Puget Sound lowlands, since no breeding population of wild turtles has been located since the early 1980's (Hays et al. 1999).

In Washington, sexual maturity is thought to be reached at 10 to 12 years for male turtles and 14 to 17 years for females. Females are known to deposit eggs in alternate years, in successive years, or even double clutch is some years (Holland and Bury 1998, Hays et al. 1999). Mean clutch size ranges from 2 to 13 eggs and the mean for 36 wild nests studied in Washington was 6.64 eggs (Hayes et al. 1999). Mortality is thought to be high in younger age classes, then evening out as turtles approach sexual maturity (Hays et al. 1999). The northwestern pond turtle is declining in numbers throughout its range and it is now only common to a fraction of its original range (Bury and Holland 1998, Hays et al. 1999). Declines in populations of northwestern pond turtles can be attributed to predation form various fish, avian and mammalian species; introduction of exotic species such as bullfrogs and largemouth bass; intentional or accidental killing of individuals by humans; the loss of suitable habitat; severe drought; and disease and parasites.

Western Redback Salamander

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. The western redback salamander appears to be common and widespread throughout its range.

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). Although it has shown no clear association with old-growth forest (Blaustein et al. 1995), it does appear to be positively correlated with the presence of downed logs (Corn and Bury 1991). 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 years to reach maturity (Blaustein et al. 1995; Behler and King 1979).

Western Toad

Status

The western or boreal toad (*Bufo boreas boreas*) is not a listed species, candidate species, or species of concern at the federal level in Washington, it is listed as a candidate (warranted but precluded) species in Colorado, Wyoming, and New Mexico. The western toad is on the Washington state species of concern list as a state candidate species. The western toad has an intermediate state ranking between"rare or uncommon" and "apparently secure, with many occurrences" by the Washington Natural Heritage Program.

Range

The western toad occurs from southeast Alaska eastward through British Columbia, western Alberta, and western Montana, south to Baja California and east to Wyoming, Colorado and New Mexico (Behler and King 1979; Stebbins 1985; ODFW 1996). It is found throughout western Washington and in the mountainous portions of eastern Washington (Dvornich et al. 1997).

Habitat

Western toads, which are largely terrestrial as adults, occur near marshes and small lakes from sea level to 6,520 ft elevation in Washington state (Nussbaum et al. 1983; Leonard et al. 1993). They also occur in dry forested and brushy areas, but moist areas with dense cover are considered optimal (ODFW 1996). During dry weather, the toads are nocturnal and 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). Because they can be locally abundant, they 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).

Population Dynamics and Status

Western toads, which can breed in large aggregations, breed in early spring at low elevations and from late spring to early summer at higher elevations (Leonard et al. 1993; Blaustein et al. 1995). Western toads breed in springs, ponds (both seasonal and permanent), shallow areas in lakes, and slow-moving streams, and also use stock ponds and reservoirs in arid areas (Nussbaum et al. 1983; Corkran and Thoms 1996; ODFW 1996). At some sites, the toads appear to have a high degree of site fidelity, even though most females and some males do not breed every year (Blaustein et al. 1995). Male toads may reach reproductive maturity at age 3 and the females probably reach reproductive maturity at about 4 to 5 years of age (Blaustein et al. 1995). Female toads deposit up to 12,000 eggs in two long strips on the bottom in less than 1.6 ft of water (Leonard et al. 1993; Corkran and Thoms 1996). The eggs usually hatch in 3 to 10 days depending on water temperature (Leonard et al. 1993). Tadpoles form huge aggregations, generally in the warmest and shallowest 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; Corkran and Thoms 1996). The tadpoles, which metamorphose in the late summer or early fall, feed on filamentous algae, organic detritus, and carrion (Leonard et al. 1993). Adult toads eat a variety of invertebrates and are preyed upon by various mammals, birds, and reptiles (Nussbaum et al. 1983; Leonard et al. 1993). 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 lowlands of western Washington, 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). The Washington Department of Wildlife will begin surveying for western toad breeding sites in 1999.

ARTHROPODS

The City is requesting coverage of 14 arthropod species under the HCP; 12 beetles of the Order Coleoptera, one butterfly and one stonefly.

Background Information on Arthropods

Arthropods (insects and other joint-legged invertebrates) represent a major source of biodiversity in late-successional forests of the Pacific Northwest, accounting 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 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 inoculum; and aerate the soil (Lattin and Moldenke 1992).

Background Beetle Information (Order Coleoptera)

The City is requesting a total of 12 species of beetles be covered under the HCP. 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, pers. comm.).

In addition to the above 3 beetle species, 10 species were identified as regional endemics and habitat specialists with the potential to occur in the Cedar River Municipal Watershed: *Bembidion gordoni*, *B. stillaquamish*, *B. viator*, *Bradycellus fenderi*, *Nebria paradisi*, *N. gebleri cascadensis*, *N. kincaidi balli*, *Omus dejeanii*, *Pterostichus johnsoni*, and *P. pumilus* (Bergdahl 1996). All of these species are in the Family Caribidae, and do not have common names at this time. 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 northern spotted owl recovery plan (USDI 1992). 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 bio-indicators 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 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. 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). Many 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, pers. comm.).

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

The Beller's ground beetle is listed as a candidate species at both the federal and state level in Washington. 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 exotic 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.

Bembidion gordoni

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. 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, pers. comm.). 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.

Bembidion stillaquamish

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. The limited amount of ecological information currently available about *Bembidion stillaquamish* 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 stillaquamish 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, pers. comm.).

Habitat

Bembidion stillaquamish 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, pers. comm.). It is also found in streamside vegetation (*Salix* and *Equisetum* species) with sandy soil, often at the margins of large pools (Bergdahl 1996).

Bembidion viator

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. 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, pers. comm.).

Habitat

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

Bradycellus fenderi

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. 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, pers. comm.).

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).

Nebria gebleri cascadensis

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. 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, pers. comm.).

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)..

Nebria kincaidi balli

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. 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 Recovery Plan for the Northern Spotted Owl (USDI 1992).

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).

Nebria paradisi

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. 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).

Omus dejeanii

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. 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).

Pterostichus johnsoni

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. 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, pers. comm.).

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).

Fender's Soliperlan Stonefly

Status

Fender's soliperlan stonefly (*Soliperla fenderi*) is a federal species of concern in Washington State. The species has no designated listing status at the state level in Washington. 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 which may be negatively affected by exemptions for private landowners from the draft Recovery Plan for the Northern Spotted Owl (USDI 1992).

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).

Hatch's Click Beetle

Status

The Hatch's click beetle is listed as a candidate species at both the federal and state level in Washington. 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, pers. comm.).

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, pers. comm.). 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, pers. comm.).

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).

Johnson's (mistletoe) Hairstreak Butterfly

Status
Johnson's (mistletoe) hairstreak butterfly (*Mitoura johnsoni*) 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. 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 1992).

Range
Johnson's (mistletoe) hairstreak butterfly 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).

Long-horned Leaf Beetle

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. 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, pers. comm.) 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).

MOLLUSKS

The City is requesting coverage of 5 mollusk species under the HCP; two terrrestrial slugs (papillose taildropper, blue-gray taildropper), two terrestrial snails (Puget Oregonian, Oregon megomphix) and one aquatic clam. (*Valvata mergella*; no common name at this time).

Background Information on Mollusks

General life history and habitat use of forest-dwelling mollusks in Washington.
There are essentially two major groups within the Phylum Mollusca that are native to Washington; a) riparian snails and slugs and b) aquatic snails and bivalves.

Riparian snails and slugs
Within the shelled riparian snails, there are about 75 native taxa. They all have a simple life cycle, with adults laying eggs once/year in riparian or other very moist settings. Small snail species (<1cm diameter) usually live only 1 year and breed once; some large taxa (1-5 cm dia.), like the Puget Oregonian and the Oregon megomphix, may live up to 5 years and lay eggs several times. Most native slugs, like the papillose taildropper and the blue-gray taildropper (20 taxa currently) are annual and breed once, and like the shelled forms experience >90% population turnover each year; a few like banana slugs, may live 2-3 years and breed more than once per year. Larger snails and slugs are plant, animal and mineral detritivores. Small forms are gleaners of slimemolds, bacteria and algae. Both eat mushrooms; neither prefer green vegetation (common lawn and garden pests are non-native). Land mollusks are significant to forest ecosystems as soil makers, conditioners and waste recyclers. They are prey for amphibians, reptiles, small mammals, birds and insects.

Mobility is limited, most often to stream currents or self-transport. Colonization is usually at a snail's pace, best measured in geologic time. Distribution within a watershed is typically patchy, even in the most stable, secure and disturbance-free microhabitats, a trait which has led to substantial endemic speciation. Less than 50% of the Pacific Northwest taxa have likely been described thus far. In practice, each generation is essentially sessile, but colonies persist for very long times. Faunas east and west of the Cascades are very different. The Pacific Northwest's native slug fauna is the most diverse in the world. Nearly all need a perennially moist area with coarse woody debris and humus accumulation or similar cover. Most are small-scale perennial water obligates, needing only small, but perennially moist, areas to maintain populations. Moist areas are needed especially for egg laying and newly hatched juveniles, though dessication is a severe threat at all life stages. Rotting logs provides refugia within the forest for seasonal egg-laying and winter/summer aestivation. Most species are associated equally with lentic and lotic habitats, including seeps, springs, spring runs, and other very small perennially wet areas.

This group needs cool moist microhabitats to fare well. Populations are localized around perennial waters in summer but more dispersed in cool and wet seasons. Recovery from disturbance is extremely slow. As many are marrow endemics, state-wide protection measures are seldom appropriate; different strategies for each Physiographic Province would be most effective. For example, the Northwest Forest Plan (USDA 1994) acknowledges that most species will not be found in most locales. Surveys of appropriate habitats only where deemed necessary, with protection measures instituted only if particular species were found living at specific locales. Management emphasis should be on protecting permanent waters, regardless of size or connectivity to the channel network. Protection measures should consist of no- or partial-harvest zones to maintain microclimates around these perennial waters, and equipment and herbicide/pesticide exclusions around same. Such measures are likely to protect the majority of the sub-populations.

Aquatic snails and clams (aka bivalves)

There are 3 basic aquatic mollusk groupings, differing somewhat in life history and habitat ecology. Most of each are aquatic obligates found only within the stream, seep, or wetland proper; nearly all are limited to perennial waters; more that half are coldwater stenotherms (generally 12° C or colder). The largest group (ca. 65 native taxa currently known) is the aquatic gastropods, or snails. These have no terrestrial life stage and hatch directly from eggs with no intervening larval forms. Generally, they rely on their own limited locomotor abilities for dispersal, although egg masses may pass undigested through predators to found new populations. Many are gilled; some are pulmonates (air breathers). Adult sizes range from 2 mm to 4-5 cm. Many have one year life spans and breed only once; a few live up to 7 years and breed several times. About 50% are narrow endemics.

Freshwater bivalves make up the 2 remaining groups. Of these Sphaeriidae (aka fingernail clams) is the largest, with 24 taxa now recognized. These also have simple life cycles (eggs hatch into juveniles which grow directly to adulthood without metamorphosis). These are all aquatic obligates. A few are very rare or PNW endemics. Fingernail clams are mostly annual taxa. All are functionally sessile, relying on birds, fish, amphibians, reptiles, crustaceans or even insects to move them to new habitats. Some adhere to predators and are transported undetected. More often, adults (some with brooded hatched juveniles inside their shells) are eaten and passed alive.

The second group of freshwater bivalves are the larger-bodied freshwater mussels (Unioniam and Corbiculidae), which is comprised of just 6 native species in PNW. These are completely dependent on permanent waters large enough to support fish. Each mussel species shows some degree of host specificity. The larval form (glochidium) is parasitic or commensal for several weeks to months on host fish. It is thought that trout and salmon are the primary host fish in PNW. After the appropriate development period, the glochidia drop off the host fish, metamorphose into small adults, and fall to the substrate where they grow. Life spans range from 20-130 years for some species; onset of sexual maturity can take years. Breeding occurs only under optimal environmental conditions, once/year or considerably less (populations may persist for many years without successful breeding). Most species are sessile filter feeders, and therefore fully dependent on perpetually high quality water for survival.

Freshwater gastropods as a group are ubiquitous across all aquatic habitats, however certain species are restricted to lakes, or streams, or seeps, or wetlands. Endemism is most likely in springs or small streams; lake, headwater, or lower stream restrictions or endemics are not unknown however. Many prosobranchs, e.g. jugas and springsnails , are found in small perennial streams, seeps, springs, especially oligotrophic waters with cold temperatures, low sediment loads, and high dissolved oxygen. Some pulmonates (e.g. members of the *Physella* and *Stagnicola*) are tolerant of temperature change, prefer warm water, or thrive in areas with considerable siltation. Fingernail clams occur in an equally wide range of habitats. They derive nutrition by filter feeding small particles, absorption of dissolved nutrients and in some instances are effectively detritivores. A few are very sensitive to eutrophication, sedimentation, temperature and oxygen changes; additionally, several native species seem to be cold water stenotherms. Others that did not make the list are tolerant of eutrophication and sedimentation, and may even benefit. Some are also eurytopic in regard to temperature and pH tolerances. The larger freshwater mussels occur in larger permanent creeks, rivers and lakes. *Anodonta* is particularly typical of lakes; *Gonidea* and *Margaritifera* prefer streams. Stream species are much more sensitive to siltation that are lake taxa. As these clams are obligate filter-feeders with an intermediate (glochidial) life stage, they are sensitive to chemical pollutants, and restricted to waters that have healthy fish populations.

All three aquatic groups have most or all taxa requiring perennial waters; most cannot survive in areas that go dry even once in several years. They occupy a broad range of persistent aquatic habitats; streams of all sizes; a similar range of lakes and ponds and seeps, springs, and headwater streams above fish barriers. Many taxa are sensitive to temperature, dissolved oxygen, pH, siltation, sedimentation, and substrate changes; however, sensitivity varies widely between and among species and groups. Persistence of most populations may require preserving both stable hydrology and fluvial processes. Increased water temperature, eutrophication, reduced dissolved oxygen, increased sedimentation will all have negative impacts on many, particularly those that are coldwater stenotherms. Any actions that remove overstory, intermediate canopy or shrub canopy (reduce shade) or activities that increase sediment reaching the waters (road building and maintenance, harvest near waters, mass wasting events) will have negative effects on these taxa.

<u>Status Accounts for Mollusk Species</u>

Blue-Gray Taildropper

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. The blue-gray taildropper is a relatively small slug, distinctive in its ventral 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.

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 (Frest and Johannes 1993; USDA and USDI 1994). Frest and Johannes (1993) reported no success 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 which 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 and the east slopes of the Washington Cascades in the vicinity of Cle Elum (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 riparian forests or spring and seep borders (Frest and Johannes 1993).

Oregon Megomphix

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. 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 it increasingly rare over the last decade, and absent from many sites from which it had been previously reported. 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 and USDI 1994). 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."

Papillose Taildropper

Status

The papillose taildropper (*Prophysaon dubium*) is not a listed species, candidate species, or species of concern at the federal level in Washington. However, the papillose taildropper is a monitor species at the state level in Washington, and a Survey and Manage Species under the Northwest Forest Plan. The papillose taildropper 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). 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 and USDI 1994). 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, and the east slopes of the Washington Cascades in the vicinity of Cle Elum (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 riparian forests or spring and seep borders (Frest and Johannes 1993).

Puget Oregonian

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. 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). 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 and USDI 1994). 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 1997 field season, unpublished data). 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).

Valvata mergella

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. *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 (pers. 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.

ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress. Such actions include, but are not limited to, previous construction of water management facilities, river channel alterations, road construction, timber harvest, deforestation for agriculture, deforestation for urban/suburban development, and other land-use activities.

Species of Greatest Concern/Critical Habitat

Northern Spotted Owl

For updated information on the Environmental Baseline for owls in the Snoqualmie Pass area, including the most recent effects of other HCP actions, see the Re-initiated Intra-Service biological opinion for the Plum Creek/ US Forest Service I-90 Land Exchange (USFWS 1999a). For a detailed discussion of range-wide habitat conservation plans affecting the marbled murrelet, refer to the biological opinion for the North Boundary Area Unit Management Plan (USFWS 1998c).

Marbled Murrelet

For updated information on the Environmental Baseline for marbled murrelets in the Snoqualmie Pass area, including the most recent effects of other HCP actions, see the Re-initiated Intra-Service Biological Opinion for the Plum Creek/ US Forest Service I-90 Land Exchange (USFWS 1999a). For a detailed discussion of range-wide habitat conservation plans affecting the marbled murrelet, refer to the Biological Opinion for the North Boundary Area Unit Management Plan (USDI 1998a)

Bald Eagle

For updated information on the Environmental Baseline for bald eagles, the reader is encouraged to refer to the Biological Opinion for the Point Roberts Golf Course (USFWS 1999b).

Grizzly Bear

The most recent formal consultation for grizzly bears in the action area has been the Intra-Service consultation of issuance of an incidental take permit to the WA Department of Natural Resources for their HCP covering lands within the range of the owl (USFWS 1997). Also, the Intra-Service consultation for issuance of an incidental take permit to Plum Creek Timber Company for their HCP covering lands in the Snoqualmie Pass area addressed grizzly bears, and contains a more thorough accounting of the Environmental Baseline relative to grizzly bears in the immediate Cedar River area. (USFWS 1996b).

Gray Wolf

The most recent formal consultation for gray wolves in the action area has been the Intra-Service consultation of issuance of an incidental take permit to the WA Department of Natural Resources for their HCP covering lands within the range of the owl (USFWS 1997). Also, the Intra-Service consultation for issuance of an incidental take permit to Plum Creek Timber Company for their HCP covering lands in the Snoqualmie Pass area addressed gray wolves, and contains a more thorough accounting of the Environmental Baseline relative to gray wolves in the immediate Cedar River area. (USFWS 1996b).

Bull Trout

For the most recent update to the Environmental Baseline for bull trout in the Snoqualmie Pass area, the reader is encouraged to refer to the Re-initiated Intra-Service biological opinion to add Bull Trout to the Plum Creek Timber Company's HCP for the I-90/Snoqualmie Pass Area (USFWS 1998b).

Canada lynx

For the most recent update of the environmental baseline of Canada lynx in Washington state, please refer to the Service's listing announcement designating threatened status for the Canada lynx (65 FR 16052). The threatened status became effective March 24, 2000.

<u>Other Species – Not Listed as Threatened or Endangered</u>

Because these other species are not currently listed, proposed or candidates, the Service has not been doing section 7 consultations upon them, nor tracking take, as defined in the Act. However, within western Washington, there are 4 completed Forestry HCPs that have included regulatory assurances for all, or most, of the other species included in the City's HCP: Washington Department of Natural Resources HCP, completed in January of 1997, Port Blakely Tree Farm's HCP for the Robert B-Eddy Tree Farm in Southwest Washington, completed in July of 1996, Plum Creek Timber Company's HCP for the I-90/Snoqualmie Pass area, completed in June of 1996, and Murray Pacific Corporation's Amended Multi-species HCP in eastern Lewis County, completed in June of 1995. With the exception of Plum Creek's HCP these plans are "all-species" HCPs, and, as such, the landowners have assurances from the Services that absent a jeopardy finding, we will add any and all newly listed species to their Incidental Take Permits without imposition of additional mitigation or minimization measures, as per the No 3Surprises Regulations promulgated by the Services (50 FR 8859, Feb 23, 1998). Plum Creek's HCP is not an "all-species" HCP; rather, it covers 285 vertebrate species known or likely to occur in the habitats present on the tree farm. Plum Creek's HCP includes all vertebrate species being sought for coverage by the City, but not the invertebrates that the City is seeking coverage for in their HCP.

Of these completed HCPs, the DNR HCP, covering 1.6 million acres of forestland, has by far the greatest effect on the welfare of these other covered species. This HCP includes property adjacent to the watershed, including old growth and other habitat types of interest. Plum Creek's Draft HCP probably has the second-greatest effect upon the other species included in the City's HCP, due to it's acreage (160,000 acres), and it's proximity to the Watershed. Murray Pacific's and Port Blakely's HCPs have a substantially lesser importance to the other species included in The City's HCP due to their distance from the Watershed (>50 mi and >100 mi, respectively) and their smaller acreage (55,000 acres and 7,500 acres).

The Northwest Forest Plan, instituted in April 1994 on all US Forest Service lands and Bureau of Land Management lands within the range of the northern spotted owl (totaling > 24 million acres), is a multi-species, landscape-level forest management plan. The Northwest Forest Plan is designed to protect old growth- dependent species and provide a sustainable level of timber harvest. The Standards and Guidelines contained in the Northwest Forest Plan include survey requirements for many of the other species sought by the City for coverage, as well as protective measures such as buffers and seasonal restrictions designed to minimize deleterious effects of forest management upon these other species. Federal lands surround the upper portion of the Watershed, and contain most of the old growth habitat in the central Cascades.

At this time, most of the property surrounding the lower portion of Cedar River Watershed, below the City's ownership, is privately held, and managed as commercial forest land, or is in some other land use, such as rural residential, or at the extreme lower end of watershed, in urban land uses. Forest practices conducted on these lands are assumed to be conducted in compliance with Washington Forest Practices Regulations, as they exist currently (Washington Department of Natural Resources 1998), and as they will be amended in the foreseeable future (e.g. to conform to the April 1999 Forests and Fish Report (Washington Department of Natural Resources April 27th, 1999)). Land use conversions in the area surrounding the lower watershed have been occurring at a rapid rate, and are expected to accelerate in the near term. The Service has assumed that development activities will be in compliance with King County's Growth Management Plan (King County 1998) and Critical Areas Ordinances, as they exist currently, and as these ordinances will be amended in the future, including the proposed year 2000 amendments that are specifically designed to respond to the listing of salmon and bull trout under the Act.

STATUS OF THE SPECIES (in the action area)

Species of Greatest Concern/Critical Habitat

For the purposes of this consultation and for these Covered Species, the Service has determined the action area to be the Cedar River Watershed and its immediate surroundings (within 3 miles of the action area). However, for the aquatic species that occur downstream of the City's ownership, and could be affected by the Instream Flow Agreement and the Landsburg Fish Mitigation Agreement, the action area extends down to Lake Washington. These species include Pacific and river lampreys, bull trout, and potentially some aquatic invertebrates whose existence is not known within the basin but for which suitable habitat appears to exist.

Northern Spotted Owl

Section 3.5.2 of the HCP contains an extensive write-up of the current status of spotted owls in the watershed and the immediate vicinity. Surveys have been done for spotted owls in the watershed sporadically, beginning in 1988. Over the years, one reproductive pair, 2 resident singles and one single, status unknown have been documented, all within the upper half of the Watershed, all above 2,500' in elevation. Three of the 4 site centers have been in unharvested old growth. None of these site centers has been actively monitored in recent years.

There is an extensive write-up of forest successional stages in HCP section 3.5.2, as well as in Map 23 of the HCP Map Volume. There was a graduate -level research project conducted on spotted owls within the watershed from 1986-1987. The study focused on habitat use and general behavior of spotted owls within the watershed. The HCP discusses the results in detail in section 3.5.2.

Marbled Murrelet

Given the current state of knowledge of the nesting ecology of marbled murrelets on the west slope of the Cascades in central Washington, the greatest potential for suitable habitat to be available within the Cedar River Watershed exists primarily within the 13,889 acres of old-growth forest (greater than 190 years old), most of which is located in the upper watershed, some of which is above 3,600-ft elevation. The stands range in age from 190 to approximately 850 years, with most of the stands presumed to be in the 200-350 year range and only a few stands as old as 850 years. The oldest stands are essentially remnant islands in the heavily harvested upper Rex River drainage (HCP Map 5). Further details of the locations, elevations and stand composition can be found in the HCP section 3.5.3.

In 1991, City staff consulted with WDNR personnel who were actively studying marbled murrelet ecology in other areas of the western slope of the Cascades. Existing habitat conditions within the municipal watershed were reviewed based on topography, relative forest age, and existing cumulative knowledge of forest stand structural development. One area was identified as having the greatest potential for providing nesting habitat for murrelets. The area was surveyed late in the nesting season, and no murrelets were detected. However, in 1992 WDFW surveyed the same area during the nesting season and detected murrelet calls on two occasions (see HCP section 3.5.3; WDFW 1994b). No nest site was located and no additional surveys have been conducted to date.
Several potential habitat limitations for the marbled murrelet exist within the Cedar River Municipal Watershed. These potential limitations are outlined below:

1) A majority of old-growth forest stands within the municipal watershed have not reached the chronological age, nor presumably the required structural development, of stands preferred by nesting murrelets in regional studies (USDI 1997). Very few stands within the municipal watershed are over 350 years old or have developed the size or structure of forests commonly utilized by murrelets in Washington.

2) Much of the available old-growth forest exists at high elevations in the eastern one-third of the municipal watershed, while mature second-growth is mostly in the lower municipal watershed. Suitable nesting habitat is unevenly distributed within and among these stands, and some old growth is above the reported 3,600-ft elevation limit for murrelet nests

Bald Eagle

Bald eagles are present in the Cedar River Watershed regularly as transients and migrants They are most often associated with habitats adjacent to major streams and larger lakes, especially Chester Morse Lake. No comprehensive surveys have been conducted and no nests or breeding activity have been documented within the Cedar River Municipal Watershed to date.

Potential key habitat for the bald eagle in the municipal watershed is late-successional and old-growth forest within approximately 1 mile of larger water bodies (such as the Cedar River and Chester Morse Lake) (HCP Section 3.5.12).

Grizzly Bear

No comprehensive surveys to determine the presence or absence of grizzly bears have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. Additionally, recent sighting information suggests that the watershed is at the southern periphery of the current range of grizzly bears in Washington State (Interstate 90 forms the southern boundary of the North Cascades Ecosystem Recovery Zone; this is approximately 3 linear miles north of the Cedar River Watershed administrative boundary). The occurrence of highly reliable grizzly bear sightings south of the watershed within the past 10 years suggests that an occasional bear may travel through the watershed (e.g., while dispersing) (HCP section 3.5.14).

Gray Wolf

No comprehensive surveys to determine the presence or absence of gray wolves have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. Additionally, recent sighting information suggests that the watershed is at the southern periphery of the current range of gray wolves in Washington State. The occurrence of reliable gray wolf sightings east and south of the watershed within the past 10 years suggests that an occasional wolf may travel through the watershed (e.g., while dispersing) (HCP section 3.5.15).

Bull Trout

Two bull trout "native char" subpopulations occur in the HCP area. They are part of 34 subpopulations that comprise the Coastal-Puget Sound Distinct Population Segment of bull trout that was listed as threatened on November 1, 1999 (64 FR 58910). The Service believes that Lake Chester Morse (Upper Cedar River) bull trout subpopulation is "depressed", based on less than 500 spawning adults encountered during spawning surveys. The Lake Washington Basin (Lower Cedar River) also contains an "unknown" subpopulation of native char, but it is thought that they are migratory fish from other subpopulations (WDFW 1998).

A significant subpopulation of bull trout currently occurs within Chester Morse Reservoir-Masonry Pool and approximately 27 miles of four tributaries. These are 1) Cedar River 2) Rex River, 3) Boulder Creek, and 4) Rack Creek (HCP Section 3.5.6). The City estimates that bull trout currently utilize 27% of the 103 miles of fish bearing streams in the HCP area.

Since 1908, the Chester Morse drainage has been closed to public access, and no exotic fish species have been stocked or observed. Therefore, bull trout have been insulated from impacts of competition by exotic species, over-fishing and poaching as well as other anthropomorphic disturbances not attributed to forest related land-use practices or dam building

The number of Chester Morse Reservoir adfluvial bull trout was estimated to be approximately 3,100 fish in 1995 (R2 Resource Consultants, in preparation). However the annual number of bull trout redds counted from 1992-1997 in the municipal watershed has averaged only 38 (range 6-109) and it is unknown and unlikely that bull trout successfully spawn within the confines of the lentic habitats of the reservoir. These low redd counts prompted the Service to designate this subpopulation as "depressed" (64 FR 58910).

The highest densities of spawners and juveniles are found in the lower sections of the Rex and Cedar River drainages. Juvenile bull trout have been observed in one other independent tributary of Chester Morse Reservoir, Rack Creek. Survey results indicate that most of the bull trout in Chester Morse Reservoir are 3 years of age or older, although survey techniques used in Chester Morse Reservoir did not target fish smaller than 7.9 inches (200 mm). Bull trout in Chester Morse Reservoir become mature at approximately 5 years of age and may live to at least 12 years (R2 Resource Consultants, in preparation). This life span and age at maturity is consistent with observations of bull trout in other systems (McPhail and Baxter 1996). The absence of bull trout older than 2+ in the streams indicate this stock exhibits an adfluvial-migratory life history. Since Chester Morse Reservoir was a glacial relic lake located above a natural barrier falls prior to the present dam structures, bull trout evolution has selected for adfluvial-migratory life history rather than fluvial or anadromous-migratory.

A population of bull trout appear to occur in Lake Washington and into the Sammamish River/Issaquah Creek drainage. Within this "unknown" subpopulation (64 FR 58910), native char observations are rare and sightings are thought to be a result of anadromous strays from other subpopulations via the Ballard Locks (WDFW 1988). In the Lake Sammamish system, only one sighting of native char has occurred in the past 15 years (WDFW 1998). The native char habitat in Sammamish River/Issaquah Creek is disjunct from the immediate HCP planning area. Since Lake Sammamish is located upstream from Lake Washington, it is not influenced by discharges from the HCP planning area. Therefore, this drainage system's native char habitat is not considered likely to be adversely affected by HCP actions. Lake Washington and Cedar River are expected to be influenced by HCP's actions. Recent reports of native char within the Lower Cedar River will be considered in the effects analysis.

Extensive fish sampling in the Lake Washington system has yielded three native char in the past four years (Binkley, K., Seattle City Light; Martz, M., Army Corps of Engineers; and Warner, E., Muckleshoot Indian Tribe, Personal Communication 1999; Tabor et al. 1998). Two of these observations occurred in the Lower Cedar River below Interstate 405 and one near the City's powerhouse at Cedar Falls (Binkley, K., Seattle City Light, Personal Communication 1997). Until recently, only limited sampling of the Cedar River and its tributaries between Masonry Dam and Landsburg Diversion Dam had been conducted. Casne (1975, Cited in HCP Section 4.5.3) reported that rainbow trout were predominant in the river, but did not report observations of native char. Recently (1994), City personnel, with Taylor Associates, conducted systematic snorkel surveys of four, 1.0 mile (1.6 km) reaches and two, 328 ft (100-meter) reaches of the 12.5 mile (20.1 km) section of the mainstem Cedar River between Landsburg Diversion Dam and the natural passage barrier approximately 0.7 mile (1.2 km) upstream of Cedar Falls. All sample reaches were sampled during daylight hours and two, 1.0 mile (1.6 km) reaches were sampled at night. Of the total 5,250 salmonids observed, none were identified as bull trout.

Given extensive survey data from 1994, no substantive evidence to date indicates that either a self-sustaining population of native char or any significant number of individuals exists between Lake Washington and Masonry Dam. Although bull trout passage and survival over Masonry Dam is expected, it apparently has not been sufficient to support establishment of a significant population under the ecological conditions existing in downstream reaches.

Past forestry and dam building activities on City lands since the early 1900s have degraded spawning and rearing habitat. The legacy of these disturbances continues to impact bull trout.

The following three activities are currently affecting bull trout in and downstream of the municipal watershed and subsequently will be addressed in the "Effects of the action" section.

Activity	**Bull trout affected by**
Forestry Restoration	Habitat alteration
Reservoir Management	Reservoir Storage •Too High- Redd inundation • Too Low- Spawner migration Entrainment
Instream Flow Regulation	Flow quantity and timing,
Other	Monitoring and research

Other Covered Species – Listed as Threatened or Endangered

Canada Lynx

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. 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 key habitat for the lynx in the watershed includes late-successional forest above 3,000 feet elevation for denning habitat. About 32,000 acres, or about ~1/3 of the watershed, is above 3000' elevation. Of this, about 11,310 acres, or about 13% of the watershed, is classified as old growth greater than 189 year of age.

Documented elevations for lynx in the Washington Cascades ranged from 3,400 to 5,600 feet (Weaver and Amato 1999). Sites where lynx were identified from hair snagging samples (Weaver and Amato 1999) were flat to <15% slope, although it is likely they traverse slopes as great as 40% gradient traveling between suitable habitat (Camryn Lee, pers. comm., Biologist, USFWS, Portland, Oregon). Residency, though unlikely given where the watershed lies in relation to large amounts of lynx habitat, could occur at the upper elevations, e.g. late-successional forest above 3,400 ft elevation, within the watershed.

<u>Other Covered Species – Not Listed as Threatened or Endangered</u>

Peregrine Falcon

No comprehensive surveys to determine the presence or absence of peregrine falcons have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. Peregrine falcons have been sighted in the vicinity of Mt. Si since 1993. They were observed copulating in 1996, but no nest site was found. A nest was located in 1997 and 3 young were fledged that year; 2 were fledged in 1998 (Spencer, R., Wildlife Biologist, WDFW, North Bend, Washington, Sept. 21, 1998, pers. comm.). Falcons have been spotted flying from the Mt. Si site toward the general direction of Rattlesnake Lake, but foraging hasn't been confirmed in the Rattlesnake Viewshed (Spencer, R., Wildlife Biologist, WDFW, North Bend, Washington, Sept. 21, 1998, pers. comm.). Because an active nest site is located within approximately 4.5 linear miles of the watershed boundary on Mt. Si, and because presumably suitable nesting and foraging habitat are both present within the watershed, it is possible that peregrine falcons are currently nesting or will eventually nest within the Cedar River Municipal Watershed.

Potential key habitat of the peregrine falcon in the watershed include cliffs and rock outcrops, naturally open habitats (grass-forb meadows and persistent shrub communities) and open wetlands (palustrine emergent wetlands and palustrine scrub-shrub wetlands) (HCP section 3.5.13)

Northern Goshawk

No comprehensive studies of northern goshawk numbers or distribution have been conducted within the Cedar River Watershed to date. Specific knowledge concerning use of existing habitat is very limited.

Presently, only one northern goshawk nesting territory has been documented within the Cedar River Municipal Watershed. Identified in the summer of 1992 in unharvested native forest included within the northern spotted owl CHU during surveys by WDW personnel, the site was occupied, and two offspring were observed. The site was also occupied during 1996, but no offspring were observed (Spencer, R., WDFW, 1997, pers. comm.). This goshawk nesting territory is within a 1.8 mile spotted owl circle near the reproductive site center. No other information is known to be available on habitat use or activity in this territory.

Several potential habitat limitations for the northern goshawk exist within the Cedar River Municipal Watershed (HCP section 3.5.4). These potential limitations are outlined below:

1) The evaluation of northern goshawk habitat requirements and availability is complicated by the fact that there is a substantial degree of variation in habitat structural development, therefore in habitat quality, not only across successional stages but also within stands essentially equal in chronological age. Even unharvested native old-growth forest within the watershed is not of equal habitat quality, and only some of the available old-growth habitat may be adequate to support reproductive individuals.

2) No studies on the west side of the Cascades have documented thresholds of timber harvest levels, stand age distribution, or extent of disturbance that determine the demographic attributes or limits of goshawk populations in these coniferous forest ecosystems.

Common Loon

Below is a summary of the extensive write-up contained in HCP section 3.5.5:
Relatively little is known about the historic presence or reproductive success of common loons within the Cedar River Watershed prior to the last 20-25 years. The City assumes that loons have nested on the shores of Chester Morse Lake (reservoir) for many decades, and possibly on the original natural lake (Cedar Lake) for hundreds of years. In the period of the mid-1970s to late-1980s, loons were frequently sighted on Chester Morse Lake, and young chicks were observed by City staff on the Masonry Pool at least once in each of the years 1979, 1982, and 1988.

Beginning in 1989, City biologists have been conducting an ongoing research project investigating the ecology of common loons in the Cedar River Watershed, focusing primarily on the Chester Morse Lake/Masonry Pool reservoir complex. In addition to annual surveys of the extent of loon utilization on watershed lakes, the reproductive success of nesting pairs has also been monitored. Since 1990, a third component of the project has been the construction and experimental deployment of floating nest platforms to enable nesting pairs to deal more effectively and consistently with fluctuating reservoir levels (See HCP Section 4.5.5). Loons have consistently utilized several bodies of water within the watershed, and individual pairs have been reproductively successful on the reservoir complex in each of the years that the research and monitoring project has been conducted.

Common loons have established a total of 21 nests on Chester Morse Lake and the Masonry Pool during the period 1990-1997, since experimental nest platforms were first deployed in 1990. Of the 21 nests established during that 8-year period, 7 have been on natural nest sites and 14 have been on experimental platforms. A total of 24 chicks have hatched: 6 on natural nests (5 of which survived to fledging) and 18 on platforms (16 of which survived to fledging). Four chicks hatched and survived to fledging from 3 natural nests in 1989, before any experimental platforms were deployed. An average of 3 mated pairs are present on the Reservoir in an average year.

Pygmy Whitefish

Below is a summary of the extensive write-up contained in HCP section 3.5.6:
Much of the information in this section regarding the status of pygmy whitefish in Chester Morse Lake was obtained from a recent study on resident fish habitat and populations in the upper Watershed (R2 Resource Consultants, in preparation). Additional information on the pygmy whitefish population was gathered from other fisheries studies in the Cedar River Watershed (Wyman 1975; EVS 1984), published literature, and field observations by City biologists.

Pygmy whitefish are the most abundant salmonid in the lake, and they are one of the major prey items for the bull trout population (R2 Resource Consultants, in preparation). In the Cedar River Watershed, pygmy whitefish are found in Chester Morse Lake and Masonry Pool. They are also found in some tributaries to Chester Morse Lake, although their use of the rivers and tributaries ofthe system appears to be limited to spawning. City biologists observed spawning migrations of pygmy whitefish in the Cedar River, Rex River, and Boulder Creek during early December. Pygmy whitefish are a relatively short-lived species. In Chester Morse Lake, the population is comprised mostly of fish in the age class 2+ and 3+ and a few fish in age class 4+ (R2 Resource Consultants, in preparation).

Pygmy whitefish in Chester Morse Lake are the largest known pygmy whitefish in the world. The total length of fish in Chester Morse Lake ranged from 195 to 220 mm for age class 2+ fish (n=23), 208 to 216 mm for age class 3+ fish (n=10), and 210 to 246 mm for age class 4+ fish (n=2) (R2 Resource Consultants, in preparation). Known sizes of fish from other populations contain only one report of a fish larger than 200 mm. The greater body size of the Chester Morse Lake fish suggests that this is a relatively productive and unique stock.

The population of pygmy whitefish in Chester Morse Lake was estimated to be approximately 51,000 fish, based on the results of hydroacoustic surveys (R2 Resource Consultants, in preparation). However, hydroacoustic techniques underestimate bottom-oriented fish populations, such as the pygmy whitefish. When fish are near the lake bottom the hydroacoustic signal is compromised by bottom noise.

It is unknown if seasonal changes in lake levels from reservoir operations (sections 2.2.4, 3.2.4, and 4.5.6) significantly affect the pygmy whitefish population. Management of Chester Morse Lake can result in a maximum elevation change of 38 ft between maximum full pool and the gravity flow drawdown limit. The lake level of Masonry Pool can fluctuate 70 ft. At the higher lake levels, Masonry Pool and Chester Morse Lake join to form a single water body. At the lowest level, Masonry Pool is essentially a flowing channel. Because Masonry Pool supports such a low density of pygmy whitefish relative to Chester Morse Lake, the effect of such a drastic change in Masonry Pool is not expected to significantly affect the total pygmy whitefish population.

Band-tailed Pigeon

Band-tailed pigeons 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, though it is likely to occur. Key habitat for the band-tailed pigeon includes mineral springs in close proximity to low-elevation coniferous forest. No mineral springs have been identified in the Cedar River Municipal Watershed. However, the watershed is currently about 94.4% forested, and the vast majority of forest is conifer-dominated. Map 5 in the Map Volume that accompanies the HCP depicts distribution of forest seral stages in the watershed. About 75% of the watershed acreage could be suitable nesting habitat for pigeons at this time.

Black Swift

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. Black swifts are uncommon breeders in western Washington, but it is very possible that black swifts do breed in the watershed. Potential key habitats for the black swift in the municipal watershed includes cliffs, rock outcrops, headwalls and inner gorges, waterfalls on streams, and mature to old-growth forests, especially in riparian areas. There are numerous talus and felsenmeer slopes in the watershed (302 acres; see map 5), as well as several large cliffs that could serve as nesting sites. Additionally there are at least 26 waterfalls in the watershed that are large enough to serve as fish barriers (see map 6 of Map Volume), and these could potentially serve as breeding sites as well. There are almost 14,000 acres of old growth forests in the watershed and large snags at the edge of cliffs and other steep topography could serve as nesting sites for black swifts.

Brown Creeper

Brown creepers are present and known to breed in the Cedar River Municipal Watershed. They appear to be fairly common in the mature, late successional and old growth forests in the watershed. Potential key habitat for the brown creeper in the watershed includes mixed and coniferous forest, and late-successional conifer wetland forest. Because mature coniferous forest habitat is declining throughout Washington, and often exists as fragmented patches, key habitat for brown creepers is assumed to be limited. However, in the watershed, these forests comprise about 75% of the acreage, with 16.5%, or almost 15,000 acres being >80 years of age today.

Golden Eagle

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 key habitat for golden eagles in the municipal watershed include cliffs and rock outcrops and naturally open habitats (grass-forb meadows and persistent shrub communities). Though potential nesting habitat for golden eagles is abundant in the watershed, nesting is unlikely. There is a paucity of open habitat types for foraging; for example, less than 1% of the terrestrial habitat in the watershed is naturally unforested, and only 2% of the forested lands are in open grass/forb/shrub seral stages (defined as 0-9 yrs of age in HCP (See Map 5)). The amount of acreage in open habitat for hunting has been declining in the past decade, and is thought to be limiting reproductive opportunities for golden eagles at this time.

Great Blue Heron

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, aquatic and riparian habitats are potential key habitats for these species in the watershed. There are many wetland complexes within the watershed, and several large wetland complexes inhabited by fish and amphibians at the lower end of the watershed. In particular, the Walsh Lake basin contains many acres of shallow, warm water wetlands surrounded by dense mid-seral and mature forests. If seems likely that single herons are nesting in the watershed, and the potential for rookeries is high.

Harlequin Duck

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 key habitat for the harlequin duck in the watershed includes rivers and streams and associated bank vegetation and large woody debris.

Merlin

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. It is likely that breeding does occur, however, as there is an abundance of nesting structures. As with golden eagles in the watershed, the limiting factor may be open habitats for foraging.

Olive-sided Flycatcher

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. Males have been heard singing in the watershed during the breeding season, so it is presumed that breeding is occurring. Mature forests with large trees that have large horizontal branches, located at or near an edge, are common in the watershed. There are over 400 miles of streams in the watershed, dozens of miles of lake, wetland and reservoir shoreline, and many steep embankments that create forest edges along which flycatchers can sally. Potential key habitat for the olive-sided flycatcher in the Cedar River Municipal Watershed is mature and old-growth forest, and wet conifer forest, especially those forests with an abundance of snags. The watershed currently is comprised of 15,000 acres of forests >80 yrs of age, and most of this acreage is expected to contain suitable nesting structures.

Osprey

One to several pairs of osprey have nested annually within the Cedar River Municipal Watershed throughout the last three decades. Potential key habitats for osprey in the watershed include lakes, ponds, and riparian areas, especially Chester Morse Lake, Masonry Pool, Rattlesnake Lake, and Walsh Lake. These water bodies are without human habitations, and with the exception of Rattlesnake Lake, are without visitor access and closed to public fishing. Shorelines along these water bodies are in native vegetation, though not all the forest is mature or old growth at present, and contain suitable osprey nesting structures.

Pileated Woodpecker

The pileated woodpecker is considered common in and is known to breed in the Cedar River Municipal Watershed. Numerous large snags are present in the older forest of the watershed, including snags several feet in diameter in the old growth stands. Occasional large residual snags are found in the younger forest stands in the watershed as well. As stated previously, almost 14,000 acres (15%) of the forest in the watershed is >190 yrs old, and another 1165 acres are >80 yrs. old.

Rufous Hummingbird

Rufous hummingbirds are considered common in and are known to breed in the Cedar River Municipal Watershed. Potential key habitats for the rufous hummingbird in the watershed include meadow complexes, riparian areas, shrub communities, and other areas where nectar-producing flowers are abundant. These areas are generally not present in closed canopy conifer forests, which are the dominant cover types in the watershed; in fact, only about 2% of the forest stands and another 2% of the unforested terrestrial habitats are expected to have an abundance of flowering plants useable by hummingbirds.

Three-toed Woodpecker

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 key habitats for the three-toed woodpecker in the municipal watershed are high-elevation mature to old-growth forests. This species is uncommon in the WA Cascades, and becomes more common at northern latitudes, or, at higher elevations. It is unlikely that the species occurs regularly in the watershed due to the paucity of high elevation true fir and/or Engelmann spruce forests. However, there are several thousand acres of high elevation old-growth (>4500'; > 190 yrs. old), mostly located on mountain tops and ridges along the watershed divide, that could be used by three-toed woodpeckers.

Vaux's Swift

Vaux's swift are present and known to breed in the Cedar River Municipal Watershed. Potential key habitat in the watershed for Vaux's swift includes hollow snags in closed canopy forests. Due to the large amount of unharvested native forest (~15%) in the watershed, there are likely a large number of suitable "chimney-like" snags available to Vaux's swifts. At the lower end of the watershed, where the native forest was harvested many decades ago, using "sloppy" logging practices (e.g. much of the non-merchantable volume was left standing on-site), there are occasional large snags and some of these have the requisite hollow character that Vaux's swifts demand. Vaux's swifts are aerial foragers for insects, and they display a predilection for foraging over water. There are many wetland complexes and several large water bodies in the watershed, and these are near enough spatially to some of the old growth stands to be used as foraging areas.

Western Bluebird

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. Western bluebirds use cavity trees on the edge of a clearing, or in the middle of a clearing, and sally forth for insects from those snags. This is a situation that occurs occasionally within the watershed, such as at the edge of a clearcut, or a natural opening in the forest. However, this situation has become less frequent in the last decade, with the cessation of timber harvesting activities. Therefore, the overall suitability of the watershed for species dependent upon early-successional habitats such as golden eagles, merlins, game species, rufous hummingbirds and western bluebirds is declining as forests age and openings become closed canopy forests.

Willow Flycatcher

Willow flycatchers are present and known to breed in the Cedar River Municipal Watershed. Potential key habitats for willow flycatchers in the watershed include wetland and riparian areas and meadow complexes (considered a Special Habitat in the HCP). Also, this species is known to use dense shrubby vegetation that is commonly found in regenerating clearcuts. Many of these early successional deciduous thickets have become less common in the watershed with the cessation of timber harvesting, especially timber harvesting in riparian areas. Natural successional patterns in the western Cascades trend toward closed canopy conifer forests, and often the habitats used by willow flycatchers are ephemeral, by definition, in this region. Exceptions in the watershed include naturally-open habitats such as meadows, unstable slopes, and meandering stream channels.

Pacific Lamprey

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, dead Pacific lampreys have been observed below the Landsburg Diversion Dam (Foley, S., WDFW, June 29, 1998, Pers. comm. with Scott Craig, Biologist, USFWS). It is possible that this species is currently able to pass above the Landsburg

Diversion Dam, as a number of lamprey species are known to pass beyond barriers that other fishes cannot pass.

River Lamprey

River lampreys are present and known to breed in tributaries of the Cedar River from the Ballard Locks to 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. It is possible that this species is currently able to pass above the Landsburg Diversion Dam, as a number of lamprey species are known to pass beyond barriers that other fishes cannot pass.

Big Brown Bat

This widely-distributed, very common bat has not been seen in the watershed. However, no comprehensive surveys to determine the presence or absence of big brown bats have been conducted in the Cedar River Municipal Watershed. 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 key habitats in the municipal watershed for big brown bats are considered to be mature to old-growth forests, forested areas in aquatic buffers and riparian areas, open wetlands and other open water bodies, naturally open habitats (meadows and persistent shrub communities), and caves, cliffs, and rock outcrops. Human activity has also created numerous structures known to be used by these bats, such as many bridges as part of the 615 mile road system in the watershed (map 10 in the Map Volume) numerous buildings at Cedar Falls, water delivery structures, and 3 dams.

California Myotis

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 this common forest bat species, and because much 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.

Pacific Fisher

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 Stinson and

Lewis 1998), no fishers have been detected in the vicinity of the Cedar River Municipal Watershed in recent years; it appears that fishers are extirpated from most of Washington, and from the Puget Sound Region specifically. Thus, although the watershed is within what is considered to be the current geographic and elevation ranges (less than 5,900 ft) 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 resident fishers presently occur in the Cedar River Municipal Watershed.

The watershed probably presents one of the best opportunities for fisher occupancy or re-introduction in the western Cascades, however. The large expanse of closed canopy forest at very low elevations (<2000') in the lower watershed is unique, and compounded with the fact that there is no trapping pressure (fishers are extremely susceptible to trapping) leads the Service to believe that if fishers are present in the area, they will eventually colonize the watershed and become resident.

Fringed Myotis

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 (however, reliable censuses are lacking 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.

Hoary Bat

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. This species is thought to be common in forested environments in WA, thought breeding may not occur here. Therefore, 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.

Keen's Myotis

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. This is probably the least studied of all the bats in the region, and it is hard postulate what current conditions are for this species in the watershed.

Little Brown Bat

This small ubiquitous bat is found everywhere that supports adequate insect populations, which are this bats prey. As such, it is expected to occur throughout the watershed, except perhaps at the very high elevations. 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). Roosting and foraging sites are ubiquitous throughout the watershed. However, few potential natural hibernacula (e.g. caves or mines) have been documented in the watershed. Human-made structures are fairly common, such as bridges, buildings at Cedar Falls, dams, and these could be used as hibernacula by this bat.

Long-eared Myotis

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 very common, there is moderate to high likelihood that long-eared myotis occur, at least during summer, in the Cedar River Municipal Watershed. Current understanding of this species indicates it is a common denizen of dry forests, which are not present in the watershed. Therefore, breeding may not be occurring in the watershed. Few potential natural hibernacula have been identified within the watershed, although a limited number of potential human-created hibernacula (buildings, mines) do exist.

Long-legged Myotis

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.

American Marten

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 Stinson and Lewis 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. WDFW data indicate about 100-300 marten are taken each year in Washington state by trappers. For 1996, the most recent data available, 302 marten were harvested by 46 licensed trappers, in 835 trap-days of effort; in the area encompassed by Snohomish, King and Pierce Counties, 11 trappers harvested 64 marten in 178 trap days of effort; in King County alone, 2 trappers harvested 9 marten in 21 trap days of effort

(Cliff Rice, WDFW Game Surveys Coordinator, pers comm. April 7, 1999). Thus, the Service believes that marten are fairly common in the watershed.

Masked Shrew

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. There are over 400 miles of streams in the watershed, and many wetland complexes that are expected to be occupied by this species.

Northern Water Shrew

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. There are over 400 miles of streams in the watershed, and many wetland complexes that are expected to be occupied by this species.

Silver-haired bat

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 common, there is high likelihood that silver-haired bats occur in the Cedar River Municipal Watershed. Potential natural hibernacula have been identified within the watershed, including rock crevaces, snags, loose bark and other structures, as well as a limited number of potential human-created hibernacula (buildings, mines). Potential key habitats in the municipal watershed for silver-haired bats are considered to be mature to old-growth forests, forested areas in aquatic buffers and riparian areas, open wetlands and other open water bodies, naturally open habitats (meadows and persistent shrub communities), and caves, cliffs, and rock outcrops.

Townsend's Big-eared Bat

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 key habitats for the Townsend's big-eared bat in the municipal watershed include aquatic and riparian habitats, wet meadows, and old-growth forests, old mine shafts and caves, if any caves exist.

Wolverine

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 Stinson and Lewis 1998). Thus, there is low probability that wolverines presently occur in the watershed as resident individuals. Although the Cedar River Municipal Watershed has vegetation types and prey availability suitable for wolverine use, the small size of the watershed relative to wolverine requirements for large amounts of space 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. On the broader landscape scale, the heavily used I-90 corridor to the immediate north, the urbanized landscapes to the west, and the heavily roaded and cut-over Green River to the south make the watershed a narrow linear projection of suitable wolverine habitat extending westward from the crest of the Cascades. The Service believes, therefore, that the general area is inhospitable to a nomadic species that demands huge tracts of wilderness habitat, such as the wolverine, and does not expect sustained use of the watershed by resident wolverines.

Yuma Myotis

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 common, 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 (caves or mines) have been identified within the watershed.

Cascades Frog

Cascade frogs are present and known to breed in the Cedar River Municipal Watershed, and appear to be fairly common in the high elevation lentic habitats scattered throughout the watershed. Also, they appear to be using the alpine meadows and alpine forests surrounding these aquatic habitats for foraging.

Cascade Torrent Salamander

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. However, the watershed is not within the range currently predicted for torrent salamanders. The range of this species, as for many amphibians, is the result of sporadic and poorly coordinated survey efforts, and is expected to expand as more surveys for this species are completed. Potential key habitats for this species in the municipal watershed include perennial, cold water streams, seeps and springs that do not contain fish. Fish are believed to eat the larvae, and essentially no overlap is seen in those streams with fish populations. It is also believed that streams, seeps and springs at higher elevations and older forests are better habitat for this species, due to it's need for cold water and lack of sedimentation of the gravels the larvae use.

Larch Mountain Salamander

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. Until recently, this species was thought to be confined to the Columbia Gorge, about 100 miles to the south of the watershed. In the mid-90's, however, surveys have been done further north, on the west side of the Cascades Crest, which have significantly expanded the species northern range limit. The Service now expects Larch Mountain salamanders to be found in the Cedar River Watershed. Potential key habitats for this species in the municipal watershed include forested areas with rocky substrates, talus with organic debris overlain, and mature and old-growth forest on steep rocky slopes. These habitat types are fairly common in the watershed, with vegetated talus and felsenmeer slopes alone accounting for about 330 acres, or about 0.4% of the watershed (see map 5 in the HCP Map Volume).

Long-toed Salamander

Long-toed salamanders are present and known to breed in lentic habitats in the Cedar River Municipal Watershed. This common species is believed to breed throughout most of the wetlands and marshes of the watershed, and adults can probably be found in upland habitats throughout watershed. The species may not be present in the moistest, coolest forests of the watershed, as it seems to avoid those areas. Rather, it prefers drier, warmer sites for reasons unknown at this time.

Northwestern Salamander

Northwestern salamanders are widely distributed and known to breed throughout the Cedar River Municipal Watershed. They use standing water of all sizes as breeding sites, and often use ephemeral pools in clearings, roadside ditches, or small forested wetlands as breeding sites. Adults are mobile in upland habitats and expected to be present throughout forests of the watershed. Potential key habitats for this species in the municipal watershed include ponds and marshes, and adjacent forested areas and riparian zones.

Pacific Giant Salamander

Pacific giant salamanders are widely distributed and known to breed in the Cedar River Municipal Watershed. This species of stream-breeding salamander can compete well with fish, unlike the torrent salamander above, and hence is expected to occur in the fish-bearing as well as the non-fish bearing perennial streams in the watershed. Also, the adults are mobile in upland environments and are expected to be found throughout forests adjacent to streams.

Northern Red-legged Frog

Northern red-legged frogs are widely distributed and known to breed in low and mid elevation lentic habitats throughout the Cedar River Municipal Watershed. Also, the adults are very mobile, for an amphibian, and are expected to be found in most upland habitats, searching for prey.

Roughskin Newt

Roughskin newts are common breeders throughout low and mid elevation lentic habitats in the Cedar River Municipal Watershed. Unlike most amphibians, this species can even be expected to occur in larger rivers and lakes inhabited by large predatory fish. Also, the adults are mobile, and free to move about the uplands, again, due to their toxicity to predators.

Oregon Spotted Frog

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. No historical records are known within 6 miles of the Cedar River Municipal Watershed (Dvornich et al. 1997). Historical records of the species' occurrence in King County and the availability of appropriate habitat for the Oregon spotted frog, however, suggest the possibility that some small populations of Oregon spotted frogs are present. The lack of public access limits the likelihood that exotic plant or animal species will be introduced into the wetlands of the watershed. Potential key habitats for this species in the municipal watershed include ponds and marshy areas at all elevations. In particular, shallow water wetlands dominated by persistent herbaceous vegetation appear to be the preferred wetlands of this species.

Tailed Frog

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 key habitats for the tailed frog in the municipal watershed include clear, cool perennial streams associated with mature or old-growth forest.

Van Dyke's Salamander

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. This is a Survey and Manage Species, as defined under the Record of Decision that accompanied the EIS for the Northwest Forest Plan. As such, much effort has been expended in the last 3 years surveying for this species, and these efforts have enlarged the known range of Van Dyke's salamander. Therefore, it is the Service's opinion that this species is likely to be found further north, and may very will ultimately be documented within the Cedar River watershed.

Potential key habitats for the Van Dyke's salamander in the municipal watershed include riparian habitats along small streams, and perhaps larger rivers, flowing through mature and old-growth coniferous forest. Key habitats could also include moist talus covered with moist organic debris.

Western Pond Turtle

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. One historical record exists near the western end of the Cedar River Municipal Watershed (Dvornich et al. 1997). Although the historic range of the northwestern pond turtle included the South Puget Sound lowlands, all recent observations have come from Skamania and Klickitat counties along the Columbia River. There are only a few low-elevation ponds and lakes within the Cedar River Watershed that one would expect to find northwestern pond turtles (Walsh Lake complex or Little Mountain wetland complex). Given the fact that these locations have been visited often by biologists performing research and monitoring activities in the watershed and the relatively high visibility of the species, it is unlikely that any turtle that may exist in these areas has gone undetected. Therefore, based on known range and habitat availability, this species is not likely to occur within the municipal watershed.

Western Redback Salamander

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. However, the Service is assuming that their presence is evidence of breeding behavior within the watershed (this is a safe assumption for a low-mobility species like a terrestrial-breeding amphibian). This amphibian is thought to be the most common of all the endemic amphibians in Cascadia, and thus, the Service believes this species to be common throughout the forested habitats of the watershed.

Western Toad

Western toads are considered common in and are known to breed in lentic habitats within the Cedar River Municipal Watershed. Also, the adults are fairly mobile, and are expected to be using upland habitats, including forested and non-forested, throughout the watershed.

Bellers' Ground Beetle

Beller's ground beetles have been documented at two sites in the Cedar River Municipal Watershed (both sites are sphagnum bogs <3000' elevation, located 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.

Carabid Beetle (*Bembidion gordoni*)

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. However, the watershed is within the species known range (Western WA, western OR and coastal BC), and suitable habitat (gravel banks along perennial streams) are common in the watershed. Thus, the Service believes the likelihood of this species being present in the plan are is high.

Carabid Beetle (*Bembidion stillaquamish*)

No comprehensive surveys to determine the presence or absence of *Bembidion stillaquamish* 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 stillaquamish is present in the Cedar River Municipal Watershed. (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, pers. comm. with City Staff).

Carabid Beetle (*Bembidion viator*)

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, pers. comm.). 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, pers. comm. with City staff).

Carabid Beetle (*Bradycellus fenderi*)

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, pers. comm.). However, based on range and habitat availability (low-elevation swamps and forested marshes, and foothill streamsides; Bergdahl 1996), it is likely that Bradycellus fenderi is present in the Cedar River Municipal Watershed (Bergdahl, J.C., Northwest Biodiversity Center, June 19, 1998, pers. comm. with City staff).

Carabid Beetle (*Nebria gebleri cascadensis*)

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, pers. comm. with City staff). The genus Nebria is adapted to cold temperatures and represented in northern and mountain regions; most species are 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). 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*)

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. Nebria kincaidi balli occurs along small high-elevation (subalpine) streams (Bergdahl 1996), and given the current known range of this species (a few scattered sites in WA and OR) it could occur in the watershed.

Carabid Beetle (*Nebria paradisi*)

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. However, given it's known range today (NW OR and SW WA, and the habitat it uses (small streams at high elevations) Nebria paradisi could occur in the watershed.

Carabid Beetle (*Omus dejeanii*)

Omus dejeanii is present in the Cedar River Municipal Watershed (Bergdahl , J.C., Northwest Biodiversity Center, June 19, 1998, pers. comm. with City staff) However, no comprehensive surveys to determine the extent of the distribution of the species within the watershed have been conducted.

Carabid Beetle (*Pterostichus johnsoni*)

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. However, 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, pers. comm. with City staff), and the habitat used by the species, found at middle elevations in headwaters of wall-based channels and in steep, wet, unstable sand-mud-scree slopes (Bergdahl 1996), leads the Service to believe the species is likely to be found in the watershed.

Fender's Soliperlan Stonefly

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 low likelihood that Fender's soliperlan stoneflies may be present in the Cedar River Municipal

Watershed, therefore the City wishes coverage for this species under the Incidental Take Permit. Potential key habitats for Fender's soliperlan stonefly in the municipal watershed are seeps, streams and riparian areas.

Hatch's Click Beetle

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. However, suitable habitat (low elevation sphagnum bogs) does occur in the watershed, and the watershed is within the known range of the species (formerly Snohomish and King Counties, now known only from 3 bogs in King County). Though bogs in the watershed have been inventoried by knowledgeable scientists, the unique characteristics of this species (largely sub-surface activity) make it very hard to locate. Therefore, the Service believes there is a significant chance this species is present in bogs within the watershed.

Johnson's (mistletoe) Hairstreak Butterfly

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

Long-horned Leaf Beetle

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.

Blue-gray Taildropper

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 with the highest use areas likely to be near water, such as seeps, springs, wetlands and streams.

Oregon Megomphix

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.

Papillose Taildropper

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

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

Aquatic Snail (*Valvata mergella*)

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. Furthermore, it appears that this species is limited to low to mid elevation kettle lakes of mid-trophic level. It does not appear that any lakes or ponds within the watershed meet these criteria. Potential key habitats for this species in the watershed include lakes with mud substrates and well-oxygenated water.

EFFECTS OF THE ACTION

Organization of this Section

This section is written to conform with the species grouping as described in the HCP (see Table 4.6-1), in which the 77 covered species under the purview of the Service are placed into 38 groups, based on similar life history attributes and habitat use patterns. Effects Analyses for Covered Species has been done by group. Grouping is a method of placing species with similar roles in their ecosystems into categories. For the purposes of this Biological and Conference Opinion, the grouping is based on the way a species uses it's habitat and habitat features. The groups generally include 2-4 taxonomically similar species that have very similar life history and habitat use traits. However, in 25 of 41 instances the species are unique enough, either taxonomically or in the way they use habitats, or both, that they were treated independently and not as a group. In three of 41 instances, the groups contain more than four species (11 bat species; 8 pond/wetland breeding amphibians and reptiles; 8 flightless, ground-dwelling detritivorous invertebrates). Table 4.6-1 of the HCP (Section 4.6.2) describes the species that comprise each group, the unique number of that group, and brief notes on the common habitats or habitat features the group uses in the Plan Area.

The Group Number (e.g. Group #4) refers to the Grouping conventions used in the HCP, and is provided to the reader to assist them in correlating the HCP's presentation of information to the analyses presented below. Seventy-seven of the 82 species are addressed in this document; 38 of 42 species groups are addressed in this document. Several of the Group Numbers pertained to fish species under the purview of National Marine Fisheries Service. Group #7 (sockeye salmon), Group #8 (Chinook, Coho and Steelhead), Group #30 (Kokanee) and Group #31 (Sea-run Cutthroat Trout) are all addressed in NMFS's Biological Opinion on the Cedar River Watershed HCP (NMFS 2000).

Effects of the HCP upon Covered Species are categorized as a) habitat-based effects (effects likely to result in take in the form of harm), b) disturbance-based effects (effects in the form of harassment), or c) incidental injury/mortality of individual animals.

The effects analyses for all groups follow a similar format:

Group number; followed by listing of all Covered Species included in the group.

I. Introduction- summary and synthesis of complete presentation in Status section of this document. Includes only those facets of species' or group's life history, habitat use and occurrence within the municipal watershed that has a direct influence on the effects determinations.

II. Summary of Pertinent Mitigation and Minimization Measures- summary of measures contained in the HCP that are expected to provide minimization or mitigation for impacts to a particular species or group. Excerpted from Section 4 of the HCP.

III. Primary Beneficial and Detrimental Effects of the HCP

a) Habitat Effects-this sub-section describes negative effects in the form of habitat modifications, or harm .

b) Disturbance Effects-this sub-section describes negative effects in the form of harassment of individual animals by human actions, such as noise, lights, etc.

c) Injury/Mortality-this sub-section describes those activities of the HCP that could result in injury or mortality of Covered Species, such as animal/vehicle collision. Note the Disturbance Effects and Injury/Mortality sub-sections are combined when the two forms of negative effect are caused by the same set(s) of Covered Activities.

IV. Other Effects - If the City has made explicit commitments to implement adaptive management or do research upon a group of Covered Species, these commitments and their effects upon the efficacy of the conservation measures are discussed. If there are no explicit commitments for a group, then this section is omitted.

V. Summary/Conclusion (including Population-level Effects) - this section includes the Service's determination of the affect of the proposed action upon the survival of the species, or collectively, upon the group of species. These effects are described for the population within the municipal watershed, and for the larger regional and/or range-wide population.

Post-termination mitigation is an issue described in the Implementation Agreement, sections 6.3, Permit Suspension and Revocation, and 6.4, Relinquishment of the Permit. The Service's determinations regarding post-termination mitigation are contained at the end of this section.

Effects Analyses, by Group, for all Covered Species

Group #1 – Northern Spotted Owl

Introduction
Northern spotted owls are present in the Cedar River Municipal Watershed. One recently active reproductive site center and one currently inactive reproductive site center have been documented in the watershed. Both of these site centers are within the CHU. Two single, resident site centers and one single, status-unknown spotted owl have been documented in the watershed. One of the two single, resident site centers is also within the CHU.

Potential key habitats for the northern spotted owl in the Cedar River Municipal Watershed are primarily mature, late-successional, and old-growth forests. Coniferous forest in older age classes is the most likely to have developed "old forest habitat" structural characteristics needed by spotted owls for nesting, roosting, foraging, and dispersal (N/R/F/D) as defined in WAC 222-16-085(1), or "sub-mature habitat" characteristics needed by owls for roosting, foraging, and dispersal (R/F/D) as defined in WAC 222-16-085(1). Three of the four spotted owl site centers documented within the watershed are in unharvested native forest greater than 189 years old (i.e., old growth as defined by SPU). Both reproductive site centers are in forest older than 250 years. All four documented site centers are in the eastern (higher elevation) section of the municipal watershed; three of the four are within the CHU.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the northern spotted owl are detailed in Section 4.2.6 of the HCP and summarized as follows: (1) protection of all existing old-growth forest; (2) elimination of timber harvest for commercial purposes in the watershed, including within the spotted owl CHU; (3) natural maturation of second-growth forests into mature and late-successional seral stages; (4) restoration thinning of about 11,000 acres, ecological thinning of about 2,000 acres, and restoration planting of about 1,400 acres designed to facilitate structural development of mature forest characteristics in second-growth forest in some areas; (5) removal of 38 percent of existing watershed roads; (6) monitoring and research; and (7) protection from human disturbance (within 1 4 mi) around reproductive site centers with actively nesting pairs.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All watershed forest (outside limited developed areas), including 13,889 acres of old growth, is placed in reserve status under the HCP and no timber harvest for commercial purposes will occur. Therefore, all forest in the municipal watershed that has documented spotted owl site centers, that currently has "old forest habitat" structural characteristics preferred by spotted owls for N/R/F/D, and virtually all other forest habitat that could be used for dispersal is protected. The oldest forest present in the watershed, with the exception of old growth (over 189 years old), is second growth classified as mature (over 80 years old). The remaining forested area is in younger seral stages (some recently harvested). Because no existing second-growth forest is sufficiently old enough at present to reach 189 years of age over the 50-year term of the HCP, it follows that no additional old-growth forest (as defined by age) will be produced in the watershed by 2050. However, increases in the quantity of both mature and late-successional forest seral stages are expected under the HCP as a result of natural maturation of second-growth forests and silvicultural treatments to accelerate such development. Approximately 13,889 acres of old-growth forest, 23,918 acres of late-successional forest and 34,932 acres of mature forest are projected to exist in the watershed by the year 2050 under the HCP (Section 4.2.2). This represents nearly a five-fold increase in combined mature, late-successional, and old-growth forest compared to current conditions.

Not all of the mature, late-successional, or even old-growth forest in the watershed is expected to provide N/R/F/D or R/F/D habitat of equal quality or potential for northern spotted owls either on a short-term (year 2020) or long-term (year 2050) basis. This is because forest characteristics, e.g., species composition, canopy closure, number of canopy layers, tree density, snags and logs, average tree diameter, not only vary naturally in unharvested forest as a result of different site conditions, aspect, and elevation, but also vary in second-growth forest as a result of historic harvest practices and recent forest management regimes.

Under the HCP, potential northern spotted owl habitat in selected second-growth forest stands within the watershed is expected to benefit from management actions - ecological thinning and restoration thinning - intended to accelerate development of second-growth forests with "old forest habitat" structural characteristics needed by owls for N/R/F/D or "sub-mature habitat" characteristics needed by owls for R/F/D. Natural maturation and silvicultural restoration of upland forests, including restoration thinning of second-growth regeneration stands, and eventual ecological thinning of older developing stands, will hasten the establishment of forest cover on recently harvested areas of the upper watershed and promote increased forest habitat connectivity over the term of the HCP. Increases in connectivity of forested habitat, especially between extant patches of old-growth forest, will be of particular significance in the CHU. In addition, silvicultural treatments including ecological thinning and limited restoration thinning, in selected, second-growth reserve forest in the lower elevations of the watershed may also improve habitat conditions for spotted owls by fostering the development of mature and late-successional structural characteristics. Approximately 11,000 acres is projected to be treated by restoration thinning and approximately 2,000 acres by ecological thinning.

Management actions to accelerate development of late-successional characteristics may have immediate, short-term, negative effects upon owls living in the immediate vicinity. The thinning operations could reduce habitat suitability for owls in the near term by altering and/or removing structural characteristics important to owls, such as snags, perching sites, shrub understory, or intermediate canopy layers. However, approaches to thinning should ameliorate risks to owls. Such features as large trees and snags will generally be preserved by the City during thinning, because of their contribution to natural forest structure and function, and efforts will be made to minimize disturbance of shrubs and other features of importance to owls. In the long term, the Service anticipates that these treated stands will respond favorably to the thinning, and after several years to a decade, the thinning treatment will have produced a net positive effect on habitat for spotted owls. Importantly, there is a commitment by the City to not operate within 1/4 mile of known site centers during the breeding season. This commitment should ensure that nest sites are not disturbed by the restoration activities.

Removal of 38 percent (approximately 240 miles) of forest roads in the watershed will also improve habitat conditions for spotted owls over the long term by reducing the amount of forest fragmentation and thus the amount of non-forested edge habitat present in the watershed. A reduction in non-forested edge habitat would be expected to make forest habitat conditions in general less favorable to other avian species that are predators of spotted owls (Section 3.5.2). An additional benefit derived from the combined effects of habitat protection (especially of old growth), natural maturation of second-growth forest, and silvicultural treatments to foster the accelerated development of "old forest" structural characteristics in younger forests is the long-term development of a more natural distribution, and adjacency of habitat types, and stand age classes across the landscape than currently exists. Eventually, reserve forests within the watershed will be restored to conditions typical of landscapes prior to logging in the region and will provide significant benefits to highly mobile, late-successional-dependant species such as the northern spotted owl.

Disturbance Effects

The primary activities that could result in disturbance, and possibly take of spotted owls in the watershed, include any operations that involve human activities on roads or in suitable habitat, including the following Covered Activities: restoration thinning of about 11,000 acres, ecological thinning of about 2,000 acres, and restoration planting of about 1,400 acres; and road removal of about 240 miles over the first twenty years, maintenance of about 520 miles of road/year at the beginning of the HCP, diminishing as roads are removed over time to about 380 miles/year at year 20, improvement (about 4-10 miles year, occasionally more), or use. However, the likelihood of disturbance to any actively nesting spotted owl pair in the watershed is expected to be low and short-term in nature because of the specific mitigation and minimization measures committed to in section 4.2.2 of the HCP: (1) protection of all documented spotted owl nest sites, all suitable habitat for nesting pairs, and reproductive site centers in the watershed; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) avoidance of construction and other activities within 1/4 mile of active nests that could disrupt successful nesting; (4) the City's policy restricting unsupervised public access (including no access for hunting, including tribal hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting spotted owl pairs and other resident or transient owls; and (5) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement and use over the long term.

Injury/Mortality

There is no explicit commitment in the HCP to do thorough species surveys, including owl surveys, prior to embarking on a restoration activity, and this does create some, albeit limited, risk for Covered Species, including spotted owls. Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the Service believes the likelihood of direct injury to or death of any spotted owl resulting from restoration planting or thinning; ecological thinning; road removal, maintenance, improvement or use, or other operational activities is very low. However, Injury/Mortality could occur if restoration actions directly affected a nest tree or were conducted near a nest site occupied by juvenile owls. The Service assumes that flighted birds would be able vacate the area prior to being injured, thus resulting in a low likelihood of injury or mortality.

Other Effects

The monitoring and research program committed to in the HCP (Section 4.5) will, through adaptive management, be used to determine if the mitigation and minimization strategies for the northern spotted owl (Section 4.2) are achieving their conservation objectives. This program will facilitate adjustments needed to ensure the strategies achieve these objectives.

Summary/Conclusion

The mitigation and minimization measures committed to in the HCP will substantially decrease, and nearly eliminate, habitat fragmentation within the CHU and the watershed as a whole during the 50-year term of the HCP, thereby increasing the effectiveness of the CHU (and the entire municipal watershed) as habitat for the northern spotted owl population in the Snoqualmie Pass area. In addition, the watershed, especially the CHU, is an important north-to-south link for spotted owls dispersing from the Alpine Lakes Wilderness Area and Forest Service lands designated as Late-successional Reserve (LSR) to the north, and a spotted owl CHU centered on the Green River and Greenwater River watersheds to the south. The development of potential spotted owl habitat in a more natural pattern of distribution over the entire landscape of the watershed will also allow individual owls to locate potentially suitable habitat in a substantially greater area of the watershed than at present and possibly foster potential population expansion within and adjacent to the watershed.

The Service believes the HCP will result in more useable owl habitat than is currently within the watershed (a five fold increase in potential habitat), enable colonization of the watershed by additional owls, and foster reproduction within an area that has not had documented spotted owl reproduction in over a decade. Hence, on the local level, the HCP is expected to be a net benefit to spotted owl populations in the Snoqualmie Pass area. At a regional level, the HCP will, over time, enable movement of spotted owls north and south along the Cascade Mountains, thus indirectly contributing to the regional population. Further, under the HCP the Cedar River Watershed may develop additional NRF habitat and reproductive site centers, thus contributing directly to increasing owl numbers at the regional scale.

Group #2 – Marbled Murrelet

Introduction

Marbled murrelets were detected during one survey period in the Cedar River Municipal Watershed in recent years. The detection site is located in an upper elevation sub-basin that contains remnant patches of old-growth forest that are among the oldest (approximately 850 years) remaining in the watershed.

Marbled murrelets winter on marine waters and move inland up to a maximum of 66 miles (most located within 40 miles) during summer to nest in west slope coniferous forests. The eastern-most extent of the municipal watershed is within 45 miles of marine waters. Potential key inland habitat for the marbled murrelet is older mature, late-successional, and old-growth forest. Most remaining old growth is at higher elevations in the eastern portion of the watershed and the western, lower elevations support mostly young and mature second-growth forest. Forest in the mature and late-successional stages is lacking throughout most of the watershed landscape. It can be expected that, at least in the short term, upper elevation old-growth forests may continue to receive a relatively higher level of use by nesting murrelets. However, on a long-term basis, as second-growth forests at lower elevations mature and develop suitable habitat characteristics, they may become of equal or even greater significance to murrelets because of their closer proximity to marine wintering and foraging areas.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the marbled murrelet are detailed in Section 4.2.2 of the HCP and summarized below: (1) protection of all existing old-growth forest; (2) elimination of timber harvest for commercial purposes within the watershed; (3) natural maturation of second-growth forests into mature and late-successional seral stages; (4) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests (note that there will not be any commercial timber harvesting done in the Watershed under the HCP); (5) habitat and occupancy surveys of potential second-growth habitat, as well as surveys in old growth; (6) experimental silvicultural treatments in second growth to promote forest structure conducive to murrelet nesting; (7) removal of 38 percent of watershed roads; and (8) prohibitions on human disturbance within 1/4 mile of occupied nesting habitat.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Because no timber harvest for commercial purposes will be conducted in the watershed, all forested land outside limited developed areas is in reserve status, including all 13,889 acres of old growth and virtually all second-growth forest. The protected, low-elevation forest represents a substantial portion of the watershed and although in mostly young and mature seral stages at present (50-80 yrs old), potentially could provide an important source of suitable habitat for marbled murrelets on a long-term basis.

The oldest forest present in the watershed, with the exception of old growth (over 189 years old), is second growth classified as mature (over 80 years old). The remaining forested area is in younger seral stages (some recently harvested). Because no existing second-growth forest is sufficiently old enough at present to reach 189 years of age over the 50-year term of the HCP, it follows that no additional old-growth forest (as defined by age) will be produced in the watershed by 2050. However, increases in the quantity of both mature and late-successional forest seral stages are expected under the HCP as a result of natural maturation and silvicultural treatments designed to accelerate the development of mature forest characteristics in second-growth forests and, thus, have the potential to increase the quantitiy of suitable marbled murrelet habitat. Approximately 23,918 acres of late-successional forest and 34,932 acres of mature forest are projected to exist in the watershed by the year 2050.

Not all of the mature, late-successional, and even old-growth forest in the watershed that currently exists or will mature during the term of the HCP, is expected to provide nesting habitat of equal quality or potential for marbled murrelets. This is because forest characteristics (e.g., species composition, canopy closure, snags, average tree diameter, branching structure) not only vary naturally in unharvested forest as a result of different site conditions, aspect, and elevation, but also vary in second-growth forest as a result of historic harvest practices and recent forest management regimes. For example, only one minor subbasin (8,089 acres) in the entire watershed, containing just 788 acres of old growth (less than 6 percent of the 13,889 acres of old-growth forest in the watershed), has had documented use by murrelets. This subbasin contains several of the oldest patches of forest in the watershed, ranging up to 850 years old. In marked contrast, the majority of the old growth in the watershed ranges from 250-350 years old. Also, most of the old growth in this subbasin is in a single, contiguous stand (444 acres) that exhibits advanced development of both vertical and horizontal structural characteristics and ecological function. The remainder of the surrounding habitat is in variable stages of post-harvest seral development (mostly advanced conifer regeneration). The reader is referred to HCP section 3.5.2, wherein the history of murrelet surveys in the watershed is fully described.

Considerable acreage of low-elevation mature and late-successional coniferous forest is also expected to develop over the 50-year term of the HCP as a result of natural maturation and silvicultural treatments designed to accelerate the development of mature forest characteristics in second-growth forests. The Service expects that these stands will begin to develop suitable nesting structures for murrelets after about age 80, and perhaps earlier if subjected to disturbance events. Overall, the municipal watershed is expected to have 33,858 more acres of mature forest and 23,827 more acres of late-successional forest by the year 2050 under the HCP, representing a near five-fold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.2). Most of this older forest habitat in year 2050 will develop at low elevations, where the second-growth is currently older than in most other parts of the watershed (Section 4.2.2). Second-growth forest will be evaluated to determine its potential as marbled murrelet habitat (sections 4.2.2 and 4.5.5), for the purposes of planning habitat improvement projects and monitoring change in murrelet use over the term of the HCP .

The following management actions committed to in the HCP will provide significant benefits to marbled murrelet habitat in the watershed: (1) elimination of timber harvest for commercial purposes in the municipal watershed, with consequent recruitment of a substantial amount of potential habitat over the 50-year term of the HCP; (2) restoration thinning of about 11,000 acres, ecological thinning of about 2,000 acres, and restoration planting of about 1,400 acres designed to facilitate structural development of mature forest characteristics in second-growth; (3) an experimental program to try to create murrelet nesting trees in selected second growth (Section 4.2.2); (4) removal of 38 percent (240 miles) of the forest roads, and (5) a restriction in the HCP precluding disturbance activities within 1/4 mi of occupied murrelet habitat during the nesting season- see section 4.2.6). As was the case for the northern spotted owl, removal of forest roads in the watershed is expected to improve habitat conditions for marbled murrelets over the long term by reducing the amount of forest fragmentation and thus the amount of non-forested edge habitat present in the watershed. A reduction in non-forested edge habitat would be expected to make forest habitat conditions in general less favorable to predators of marbled murrelets (HCP Section 3.5.2).

Restoration and ecological thinning activities entail some risk of negative effects on nesting murrelets, both directly through accidental destruction of active nests or indirectly by influencing habitat, such as overstory removal or other disturbance. However, the risk is minimized by the commitments to conduct a habitat assessment program and site occupancy surveys in potential second-growth habitat (Section 4.5.5) and to forbid the removal of any suitable murrelet nest trees during ecological thinning (Section 4.2.2). Further, the ecological and restoration thinnings will typically be limited to stands 60 years or younger, which is usually thought to be far too young to constitute murrelet nesting habitat. All activities conducted under the HCP will have to abide by timing and distance restrictions when near occupied habitat. With these mitigation and minimization measures in place, the likelihood of take resulting from habitat loss for marbled murrelets is extremely low.

Also important for murrelets will be development, under the HCP, of older forest at lower elevations, nearer to marine waters, that could develop characteristics adequate for nesting. Finally, the combined effect of protection of all old growth, natural maturation of second growth, and silvicultural treatments to foster the accelerated development of "old forest" structural characteristics in younger stands (see below) will ultimately serve to produce a broader distribution of potential marbled murrelet nesting habitat over the entire landscape of the watershed than currently exists.

Disturbance Effects

Primary activities that could result in disturbance, and possibly take, of marbled murrelets in the watershed include any operations that involve human activities on roads or in suitable habitat, including the following: restoration thinning of about 11,000 acres, ecological thinning of about 2,000 acres, and restoration planting of about 1,400 acres; and removal of about 240 miles of road over the first twenty years, maintenance of about 520 miles of road/year at the beginning of the HCP, diminishing as roads are removed over time to about 380 miles/year at year 20, improvement of about 4-10 miles year, or on-going road-use. However, the likelihood of disturbance to any actively nesting marbled murrelets by silvicultural treatments, road management or use, or other operational activities is expected to be low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) elimination of timber harvest for commercial purposes (including virtually all log hauling) in the entire watershed; (2) habitat and occupancy surveys of potential second-growth habitat (though not comprehensive levels of surveys in all suitable second growth); (3) seasonal restrictions of disturbance-causing human activities within 1/4 mile of occupied habitat; (4) prior to ecological thinning, identification of potential habitat in second growth and avoidance of removing potential nest trees; (5) implementation of the City's policy restricting unsupervised public access (including no access for hunting, including tribal hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting marbled murrelet pairs; and (6) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use in the watershed over the long-term.

However, since there will not be protocol murrelet surveys done in all nearby suitable habitat prior to beginning the restoration activities, there is some likelihood that these restoration activities could cause disturbance to undetected murrelets nesting nearby. The Service beleives this disturbance would be of a short-term nature and would not diminish the suitability of current habitat to support murrelet nesting in subsequent years.

Injury/Mortality

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to or death of any marbled murrelet resulting from silvicultural treatments, road management or use, or other operational activities is expected to be extremely low.

Summary/Conclusion

Considered in concert with other efforts to conserve forested lands in the vicinity of the Cedar River Municipal Watershed, e.g., Mountains to Sound Greenway Project, Rattlesnake Mountain Scenic Area, Tiger Mountain State Forest, federal late-successional reserves northeast of the watershed, and U.S. Forest Service efforts to consolidate ownership through land exchanges, the HCP is expected to have an overall positive effect on marbled murrelets. This overall positive effect will be critical to the regional marbled murrelet population as development pressure from the Seattle/Tacoma metropolitan area continues to push eastward, diminishing both the quality and quantity of forest habitat as it proceeds in the region.

Group #3 – Northern Goshawk

Introduction

Currently, only one northern goshawk nesting territory has been documented within the Cedar River Municipal Watershed. The site is in unharvested native conifer forest, in close proximity to regenerating stands, within the 22,845-acre CHU at higher elevation in the eastern end of the watershed. Potential key habitats for the northern goshawk in the Cedar River Municipal Watershed are primarily mature, late-successional, and old-growth forests. Coniferous forest in these older age classes is the most likely to have developed the structural characteristics, particularly large diameter trees, closed canopy and large snags, that northern goshawks prefer for nest and roost sites. Younger seral stage forest constitutes secondary habitat, with potential for use as foraging habitat by goshawks.

The northern goshawk could be negatively affected by road management or other operational activities in watershed forests, especially in mature to old-growth forest, as well as by silvicultural treatments and restoration activities in younger second-growth forest. Such effects could be direct, through destruction of active nests or injury to individuals, or indirect through influences on habitat, e.g., removal of tree canopy or specific nest trees or disturbance.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the northern goshawk are detailed in Section 4.2.2 of the HCP and summarized below: (1) protection of all existing old-growth forest; (2) elimination of timber harvest for commercial purposes within the watershed; (3) natural maturation of second-growth forests into mature and late-successional seral stages; (4) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; (5) removal of 38 percent of watershed roads; (6) monitoring and research; and (7) protection of nesting pairs from human disturbance.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the municipal watershed, all forests outside limited developed areas, including both old growth and second growth, are in reserve status. As a result, all key habitat (mature to old-growth forest), as well as secondary and potential habitat, for the northern goshawk within the municipal watershed is protected.

A relatively small amount of mature (1,074 acres) and late-successional forest (91 acres) totaling 1,165 acres is distributed in small patches, mostly in the western portion of the lower watershed. However, most of the 13,889 acres of old-growth forest, with the exception of a few, relatively small, isolated patches, is concentrated in the eastern portions of the watershed within the CHU. Coniferous forest in these older age classes is the most likely to have developed the structural characteristics, especially large diameter trees, closed canopy and large snags, that northern goshawks prefer for nest and roost sites.

With respect to foraging habitat, of the 54,592 acres of mid-seral forest (30-79 years old) present in the watershed, 23,339 and 31,252 acres are found in upper and lower portions of the watershed, respectively. Although mid-seral forest is found throughout the watershed, about 75 percent (22,511 acres) of the second growth exhibiting the most advanced structural development (60-69 and 70-79 year-old age classes), and therefore the most potential as foraging habitat for goshawks, is found at lower elevations. It is notable that some of the second-growth forest in these older mid-seral stages is already developing structural characteristics typical of mature forest and thus has considerable potential for providing not only improved foraging habitat, but also some future nesting and roosting habitat for northern goshawks during the 50-year term of the HCP.

Two areas in particular within the watershed, the owl CHU/Rex River Basin and the Chester Morse and Taylor Creek basins, are especially important to the northern goshawk on both a short- and long-term basis. The CHU, including the Rex River Basin, currently contains the majority of the remaining old-growth forest, interspersed with large areas of younger seral stage regenerating forest. These areas presumably provide the most optimal combination of nesting and foraging habitat currently present within the watershed and are expected to improve over the long term as young forest matures. Although a much smaller amount of old-growth forest currently exists within the Chester Morse and Taylor Creek basins, a substantial area of these basins is currently in older young and mature forest stages that will mature over the term of the HCP to provide considerably more mature and late-successional habitat for northern goshawks. In addition, maturation of the forest in these basins will also decrease the existing level of fragmentation of old growth and create larger contiguous blocks of potentially suitable habitat for goshawks on a long-term basis during the 50-year term of the HCP. Such large blocks of suitable habitat are important to the long-term viability of the northern goshawk nesting population within the municipal watershed.

Increases in the quantity of mature and late-successional coniferous forest habitat for the northern goshawk are expected over the 50-year term of the HCP because of natural maturation of all second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in second-growth in some areas. As a result, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a five-fold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.5).

Under the HCP, some northern goshawk habitat in the municipal watershed is expected to benefit from ecological thinning and restoration thinning that is intended to produce mature and late-successional forest habitat characteristics in second-growth forests. Ecological thinning and restoration thinning in second-growth forests in the CHU and other parts of the watershed is expected to hasten the development of late-successional and old-growth characteristics in those forests, thereby effectively connecting all extant patches of old-growth forest within the term of the HCP. Under the HCP, approximately 11,000 acres are projected to be treated by restoration thinning and approximately 2,000 acres are projected to be treated by ecological thinning in the watershed.

The natural maturation and silvicultural treatment of select forest lands in the CHU, Rex River, Chester Morse, and Taylor Creek basins, and throughout the watershed as a whole, will not only increase the amount of potentially suitable habitat, but will also decrease the existing level of fragmentation of old growth. These two factors will thereby create larger, more contiguous blocks of potentially suitable habitat for goshawks on a long-term basis during the 50-year term of the HCP. Such large blocks of suitable habitat will be important to the long-term viability of a northern goshawk nesting population within the municipal watershed.

Habitat protection (especially for old growth) and maturation of second-growth forest within the watershed will also facilitate the long-term development of a more natural distribution and adjacency of habitat types and forest age classes across the landscape than currently exists. This distribution of habitat will approach that of pre-harvest conditions typical of the region, in which forest openings were created solely by natural events. This more natural and improved habitat distribution will likely provide a significant benefit to a highly mobile species such as the northern goshawk. However, it is possible that nearly complete loss of early successional habitat within the watershed may reduce prey availability for goshawks.

Disturbance Effects

The primary activities that may result in disturbance, and possibly take, of northern goshawks in the watershed under the HCP include any operations that involve human activities on roads or in suitable habitat including the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years; (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year; and (7) routine road use.

The HCP does not contain explicit commitment to survey all suitable goshawk habitat in the vicinity prior to beginning watershed restoration or maintenance activities. Therefore, there is some likelihood that these restoration activities could cause disturbance to goshawks nesting nearby. However, this disturbance would be of a short-term nature and would not diminish the suitability of current habitat to support goshawk nesting in subsequent years.

The likelihood of disturbance to any actively nesting northern goshawk pair in the watershed is expected to be very low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) protection of active northern goshawk nest sites from human disturbance, including prohibitions on use of heavy equipment and tree felling within 0.5 mi of known active nests during the nesting season; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term. It is notable that previously undocumented goshawk nests within the municipal watershed will have a high probability of being detected (and thus protected) during spotted owl and marbled murrelet nest site surveys and monitoring efforts committed to in the HCP.

Injury/Mortality

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of any goshawk resulting from silvicultural treatments, road management, or other operational activities is expected to be low.

Summary/Conclusion

The Service expects that the HCP will have net positive effect on goshawks in the watershed and in the region. Under the HCP, the current substantial amount of watershed forest in fragmented condition will mostly be replaced by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early or mid-seral stage forest habitat (less than 50 years old) will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation), because forest now in early seral stages as a result of recent commercial logging will mature over the term of the HCP and no additional commercial harvest will be conducted. The total amount of late seral habitat (over 80 years) is expected to increase by a factor of nearly five. The improved landscape connectivity and increased acreage of preferred forest habitat within the municipal watershed should benefit the northern goshawk population in the vicinity by providing improved forest habitat conditions that facilitate movement and/or dispersal of individuals throughout the watershed and by providing critical older forest habitat for nesting and foraging.

The HCP also promotes the development over time of a large block of older forest in the CHU, and throughout the watershed as a whole. The CHU block is contiguous with lands to the north, east, and south of the watershed at its upper (eastern) end, including lands within the network of federal late-successional reserves (LSR). This landscape connectivity may benefit northern goshawk populations on a more regional level by facilitating movement and dispersal of individuals between the Cedar River Municipal Watershed and other watersheds to the north, east, and south.

Group #4 – Common Loon

Introduction

Although common loons use many lakes in Washington as foraging and resting habitat, often tolerating high levels of human activity, only very few (approximately ten) of these lakes support breeding pairs in any given year or on a regular basis. Common loons are very sensitive to human disturbance when nesting, and such disturbance can substantially reduce nesting success. Because common loons nest very near the waterline, water level fluctuations during the nesting period in spring can also cause nesting failure, and loons require adequate populations of prey fish to reproduce successfully. In general, common loons use large wooded lakes (typically 30 acres or more in size) with high water quality, dense fish populations, and undisturbed shorelines (Vermeer 1973).

Adult common loons are present spring through fall in the Cedar River Municipal Watershed as migrants, non-reproductive individuals, breeding pairs, and fledglings in successful reproductive years. Transient common loons are regularly observed during spring and fall migration on the reservoir complex, Rattlesnake Lake, and Walsh Lake, but loons have not nested on Walsh or Rattlesnake lakes, at least during the last decade of study, and no historic observations of nesting have been confirmed. Additionally, loons are not expected to nest on either Walsh Lake or Rattlesnake Lake on any regular basis because of unfavorable habitat factors relative to Walsh Lake (e.g., largemouth bass) and current levels of human disturbance in the case of Rattlesnake Lake. Three mated pairs of common loons have been present on Chester Morse Lake and Masonry Pool, however, during each nesting season for the years 1989-1997. Two of the three nesting territories have been occupied by reproductive pairs during all 9 years of the City's research study (Section 3.5.5). A pair has been present consistently in a third territory during all 9 years, but no nests were established during 3 of those years. In order to help protect nesting loons from the adverse effects of reservoir fluctuations, the City has conducted a program since 1990 that entails deployment of floating nesting platforms, when practical relative to seasonal timing, loon reproductive behavior, and prevailing reservoir level conditions.

Key habitat for common loons within the Cedar River Municipal Watershed includes Chester Morse Lake and Masonry Pool, with the amount of habitat available varying with lake and pool elevations, (for breeding, foraging, and resting), Rattlesnake Lake (for foraging and resting), and, to a substantially lesser degree, Walsh Lake (for foraging and resting), along with associated riparian vegetation important to provide nesting cover, protect these aquatic habitats, and to maintain high water quality (e.g., cool water temperatures, low sediment levels). Periodically there is a high likelihood that nesting common loons will be negatively affected by fluctuating reservoir levels. Fluctuating reservoir levels could prevent nest initiation, or alternatively, destroy active nests. There is a much lesser likelihood that silvicultural treatments, road management, or other operational activities in or near streams and lakes will affect loons. Such effects could be direct through destruction of active nests or injury to individuals or indirect, through influences on habitat or water quality (e.g., removal of overstory vegetation, increased stream temperature). Common loons could also be negatively affected on a short-term basis by management actions that contribute sediment to streams (e.g., stream restoration projects, silvicultural treatments in riparian areas, road maintenance, use, and decommissioning).

Pertinent Mitigation and Minimization Measures
Mitigation and minimization measures for the common loon are detailed in Section 4.2.2 of the HCP and summarized as follows: (1) protection of all large lakes and associated riparian habitat, as well as restrictions of human activities on the reservoir during the breeding season; (2) protection of, and improvements in, water quality (e.g., reduced sediment, lower temperature) and lakeside habitat of particular importance to foraging and reproduction for this species; (3) protection of the rainbow trout, bull trout, pygmy whitefish, Cottids, and aquatic invertebrate populations that is afforded by the HCP is important to maintaining the prey base for loons (see effects analyses for Group #5, bull trout, and Group #6, pygmy whitefish); (4) deployment of artificial nesting platforms that provide more stable alternatives than many natural nest sites to ameliorate some of the effects of fluctuating reservoir levels; (5) protection of nesting pairs from human disturbance; (6) protection in reserve status of the reservoir, all other large lakes, and all lakeshore habitat, which will support reproduction and foraging; (7) protection of all old growth and recruitment of a substantial amount of mature and late-successional forest over time in riparian areas, resulting in potential improvements in water quality, protection of lakeside cover, and eventual recruitment of organic substrates to the lake (i.e., large logs for nesting); (8) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of disturbance, both to habitat and to nesting birds; (9) silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests, improving riparian habitat conditions; (10) stream habitat restoration projects, reestablishing more natural stream function and potentially increasing the availability of some prey fish species; (11) streambank stabilization projects to reduce sediment input to streams and lakes; (12) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams and lakes; (13) guidelines and prescriptions designed to reduce sediment production during watershed management activities; (14) removal of 38 percent of watershed roads, reducing the potential for human disturbance; (15) overall expected improvement in water quality; (16) closure of the municipal watershed to unsupervised public access, reducing the levels of human disturbance on nesting loons; and (17) monitoring and research related specifically to common loons.

Primary Beneficial and Detrimental Effects of the HCP
Habitat Effects
Potential Effects of Land Management Activities on Habitat
Because no commercial timber harvest will be conducted in the municipal watershed, all lands outside limited developed areas, including all aquatic and riparian ecosystem elements, are in reserve status. As a result, all key habitat for the common loon within the municipal watershed (large wooded lakes and associated riparian habitat) is in reserve status.

Common loons may also be adversely impacted indirectly by negative impacts to prey populations (fish and aquatic invertebrates). Such impacts are typically caused by elevated fine sediment input to streams and aquatic systems resulting from silvicultural treatments in or near riparian areas, or potentially by fishing mortality. A major focus of the HCP is the reduction of fine sediment input to streams and aquatic systems, both to improve the quality of drinking water provided through the supply system and to improve the habitat potential of all aquatic systems in the watershed by protecting and/or restoring naturally functioning terrestrial and aquatic ecosystems.

Major components of the HCP directed at reduction of sediment input to aquatic systems include: (1) elimination of timber harvest for commercial purposes in riparian and upland areas; (2) restrictions on the use of mechanical equipment and cutting of trees within 50 feet of streams; (3) planning and evaluation by interdisciplinary teams of silvicultural and operational projects in any key habitat, especially within riparian zones; (4) during restoration or ecological thinning activities, prohibition of any tree removal with the potential to reduce streambank stability within 25 feet of any stream; and (5) inclusion in the HCP of a comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) and other management guidelines (Section 4.2.2) intended to minimize the potential for erosion and mass wasting associated with silvicultural treatments in riparian areas and with road construction, maintenance, decommissioning, and use. These measures and other forest management strategies are expected to result in improvements in water quality over time. Closure of the watershed to unsupervised public access (Section 4.2.2), including access for fishing, virtually eliminates any quantitatively significant mortality of loon prey fish as a result of fishing.

The HCP also includes management actions designed to help restore and enhance aquatic and riparian habitats and develop a more naturally functioning aquatic/riparian ecosystem , which, over time, should serve both to improve water quality (and underwater visibility) for foraging loons and support, or potentially increase, prey fish populations. Stream bank stabilization projects, placement of large woody debris, a stream bank revegetation program, and a program of restoration planting, restoration thinning, and ecological thinning in riparian areas are expected to help accelerate (1) the restoration of natural aquatic and riparian ecosystem functioning and (2) the development of mature or late-successional characteristics in younger second-growth forests, especially in selected riparian corridors. Implementing these programs will indirectly benefit the common loon over the long term by reducing sediment and improving water quality as discussed above. Because these management actions may cause some localized, short-term impacts, site evaluations by interdisciplinary teams will be conducted to ensure that impacts to common loon habitat are minimized.

Road repair, maintenance, decommissioning, and use can all impact stream and riparian areas. The comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) and other management guidelines (Section 4.2.2) are, however, intended to minimize the probability of erosion and mass wasting associated with forest roads. Implementing these prescriptions, along with the program to improve many roads and to decommission a substantial part of the total road system (Section 4.2.2), will reduce the rate of sediment loading to streams and help maintain high water quality. It is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads come near streambanks, but improved road maintenance and a relatively low level of road use under the HCP will help mitigate those impacts.

Potential Effects of Reservoir Operations on River Delta Vegetation

Operation of water supply reservoirs typically involves large seasonal fluctuations in water levels that can vary in magnitude, timing, and duration from year to year. The pattern of fluctuations establishes a dynamic equilibrium with wetland plant communities and riparian forest along the reservoir edge, and operational changes in the pattern of fluctuations of reservoir elevation are known from experience on many reservoirs to have effects on wetlands and riparian forest within and around these reservoirs. As described in Section 4.5.6, changes in operation of the City's reservoir in the municipal watershed that have occurred over the last decade or two have substantially affected and are expected to continue to affect wetlands of the Rex and Cedar river deltas to an unpredictable degree.

A 10-year study of the extensive wetland communities of the Cedar River and Rex River deltas (Raedeke 1998) documented effects on delta wetland vegetation communities resulting from higher late winter and early spring water levels and extended reservoir fill regimes, including recession of delta sedge and willow communities, and death of mature deciduous and coniferous trees on some of the Cedar River floodplain. These changes in delta vegetation could negatively affect the suitability of the delta areas as common loon nesting habitat by reducing lakeshore cover and other available cover, as well as reducing availability of suitable nesting substrate, such as logs (Section 4.5.6). While it is possible that drawdown of the reservoir could also impact these deltas, extended low levels did not occur during the study, so it was not possible to measure such effects, if they might occur at all. As discussed for bull trout (Group #5) below and in Section 4.5.6, the magnitude of drawdown in the fall under the HCP is not expected to differ significantly from drawdown during the past 20 years.

The Service does not expect, although it is possible, that significantly more reduction in the total area of sedge wetlands around Chester Morse Lake will occur as a result of the faster, higher, and longer duration spring refill that has characterized recent reservoir operations and that will characterize future operations. Changes in forest and willow vegetation around the reservoir, however, especially in delta zones, are likely to continue, as effects on these plant communities lag the changes in reservoir operations that initially caused them, and such changes may extend over a longer period of time than the period in which documented changes in the sedge communities occurred. The willow thickets have served and continue to serve as cover for nesting loons, so a further reduction in willows would reduce potential nesting cover in some locations within the delta zones. In the near term, further death of mature trees in delta and upstream zones should result in some degree of recruitment of additional logs to delta zones, some of which could possibly be used as nesting substrate for loons. Eventually, recruitment of logs from the riparian forest along the deltas and in upstream areas will increase as the forest matures, trees grow larger, and natural tree mortality occurs under a new dynamic equilibrium with reservoir operations.

Operation of Chester Morse Lake and the Masonry Pool during the term of the HCP will be similar to that which occurred in recent years (see discussions in HCP Section 4.5.6 and in the effects analysis for bull trout, Group #5), however, and it can be expected that wetlands and lakeshore forests are progressing toward establishment of a new dynamic equilibrium with the current reservoir operating regime over the long term. Re-equilibration of willow communities, along with natural maturation of riparian forest may eventually lead to an overall improvement in nesting conditions on the deltas, compared to current conditions, by providing more recruitment trees and more willow for cover. However, it is difficult to precisely predict what future lakeshore habitat will look like.

Implementating the Cedar Permanent Dead Storage Project, which is an activity not analyzed by this Opinion, nor authorized by the incidental take permit, could have a substantial impact on the level of reservoir fluctuations, and thus on wetlands and riparian forests that provide important habitat elements for common loons. The Cedar Permanent Dead Storage Project would alter fill and drawdown regimes of Chester Morse Lake from the current regime, and changes would include likely modification of seasonal timing, extent, and duration of drawdown and fill. Although the Cedar Permanent Dead Storage Project may have potential negative effects on common loon habitat, such effects will be evaluated during a 5-year study, and mitigation will be developed if the project is implemented (Section 4.5.6). Implementating the Cedar Permanent Dead Storage Project would require a plan amendment under Section 12.2 of the Implementation Agreement (Appendix 1).

Disturbance Effects and Injury/Mortality

Disturbance of common loons could occur as a result of land management activities, other kinds of human activities, and reservoir operations during the nesting season. Potential for injury/mortality of common loons could occur as a result of reservoir operations during the nesting season; large fluctuations in reservoir elevation has been proven to result in nest abandonment within Chester Morse Reservoir (see HCP sections 4.6.4 and 4.5.6 for predicted effects of future reservoir management upon loons). This source of mortality is expected to persist under the HCP.

Potential Disturbance Effects of Land Management

The primary activities under the HCP that may result in disturbance, and possibly injury or mortality of common loons in the watershed include any operations that involve human activities on roads and in or near suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) instream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about

380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) some monitoring and research activities.

The likelihood of disturbance to any actively nesting common loons as a result of land management activities in the municipal watershed, however, is expected to be very low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of common loon habitat prior to silvicultural or road management activities that could disturb loons; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed, reducing the overall levels of habitat disturbance and human activities; (3) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term.

Because of specific mitigation and minimization measures committed to in the HCP, as described above, the likelihood of disturbance to, direct injury to, or death of common loons as a result of silvicultural treatments, road management, or other land management activities is expected to be very low. In addition, most active roads are either substantial distances away from known nest sites or are effectively screened by existing habitat or landscape features.

Potential Disturbance Effects of Other Human Activities

In addition to the activities listed above, adverse impacts from a wide variety of human disturbances, such as recreational activities, traffic, noise, and pets, especially near highly sensitive nest sites, pose a serious threat to common loons throughout their range. This fact is especially true in Washington State, because so few pairs are known to nest in any given year. Such effects are largely indirect and occur as a result of impacts on habitat (e.g., water quality) or through disturbance. Because disturbance, especially at nest sites or during foraging activity, can adversely affect common loons both directly and indirectly, the restriction of unsupervised public access to the Cedar River Municipal Watershed under controlled access regulations (Section 4.2.7) will continue to benefit loons throughout the watershed by minimizing such disturbance. In addition, the City's policy of carefully controlling the use of boats on the reservoir complex (boat use is typically sporadic and minimal), especially during the loon nesting season, minimizes disturbance and provides added protection for loons during the sensitive reproductive period.

Because Rattlesnake Lake and much of its surrounding shoreline are not closed to public access and are available for many recreational activities, however, disturbance in this area is much less restricted. While it is possible that lack of nesting activity on Rattlesnake Lake may be attributed to significantly higher levels of human activity (non-motorized boating, fishing, and swimming) than those experienced by loons using the protected reservoir system, there is no specific evidence that this is the case, and there has been no confirmed nesting of common loons on Rattlesnake Lake to the knowledge of current City staff. Despite the high and increasing level of human activity on Rattlesnake Lake, the numbers of loons foraging and resting on the lake and the extent of time they are present (i.e., foraging, resting) have typically been relatively high over the past decade, with some exception.

The likelihood of disturbance to any actively nesting common loons as a result of human activities in the municipal watershed other than land management activities is expected to be very low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) the City's policy restricting unsupervised public access (including no access for hunting or fishing) to the Cedar River Municipal Watershed, with the exception of Rattlesnake Lake, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds, as well as reducing potential fishing mortality on prey fish species; and (2) the City's policy of restricting boating activities on the reservoir during the common loon breeding season. The likelihood of disturbance to any transient common loons on Walsh Lake as a result of human activities in the municipal watershed other than land management activities is also expected to be very low and short-term in nature, because of the above listed mitigation and minimization measures. Some disturbance of transient common loons foraging or resting on Rattlesnake Lake during migration, however, is likely to occur as a consequence of recreational activities on and around the this lake. Rattlesnake Lake get a large number of recreationists, especially in the summer. Loons are typically present on Rattlesnake Lake during the fall and spring migration periods, when recreational use is lower. Therefore, the Service expects there will be little substantive disturbance of any transient or migratory loons using Rattlesnake Lake. The Service does not expect loons to begin nesting at Rattlesnake Lake, and therefore, does not expect the abandonment of nests or reproduc tion of loons to be compromised by these disturbance actions.

Because of specific mitigation and minimization measures committed to in the HCP, as described above, the likelihood of disturbance to, direct injury to, or death of common loons as a result of human activities in the municipal watershed other land management activities is expected to be very low for nesting adults.

The likelihood of disturbance to, direct injury to, or death of transient common loons as a result of human activities in the municipal watershed other activities related to land management is expected to be very low, as well, except for the disturbance of loons on Rattlesnake Lake by recreationists, as described above.

Potential Disturbance Effects of Reservoir Operations on Common Loon Nesting

Common loons typically nest at the water's edge, and nests are vulnerable to fluctuations in water level, either through inundation or dropping water levels which prevent adult loons from accessing the nest. On natural lakes and ponds, loons can sometimes compensate for small changes in water levels by modifying nest structure. However, large fluctuations in reservoir levels that can inundate or strand nests can have substantial negative effects on the reproductive success of loons. Nesting habitat and structures are potentially available in willow-dominated zones of the Cedar and Rex River deltas and in specific small areas of Masonry Pool. However, this nesting habitat is currently subject to springtime water level fluctuations over the course of the nesting season (April through mid-June) of up to 10 ft or more under the present reservoir operating regime.

A simple modeling exercise was completed to assess the incremental effect of the proposed HCP instream flow regime on Chester Morse Lake reservoir levels compared to the current regime, called the IRPP regime (Section 4.5.6). Based on conditions represented in the 64-year period of record, weekly lake levels under the proposed HCP flow regime averaged 0.01 ft lower than under the IRPP flow regime during the typical 11-week common loon nesting season, although differences between the flow regime would occur during some years. The differences between the projected lake levels for the two operating regimes varies less than 1 ft (higher or lower) 94.9 percent of the time during the common loon nesting season. The relatively smaller decrease in reservoir elevation projected under the HCP than the decrease projected under the IRPP regime would constitute a positive effect on nesting loons (Section 4.5.6). Overall, the model results indicate that the incremental differences in lake levels, and fluctuations in lake levels, projected under the HCP flow regime will probably have little, if any, additional negative effect on common loon nesting success. However, the overall negative effect of relatively large seasonal fluctuations in reservoir water levels during the loon nesting season that currently exists, and will continue to exist, does represent a potential impact to nesting common loons.

In order to reduce adverse effects of reservoir fluctuations on nesting loons, since 1990 the City has been conducting an experimental nest platform program in which artificial floating platforms with native vegetation are deployed at the beginning of the loon nesting season, or when reservoir water levels allow, to provide more stable nest sites (sections 3.5.5 and 4.5.6). Although the platforms are not sufficient to counteract the effects of large reservoir fluctuations (more than about 5-8 ft), such as occur during a prolonged, early season drought, this program has demonstrated some success. Platforms were used by nesting loons in at least one, and typically two, of the three nesting territories on the reservoir in each of the 8 project years during the period 1990-1997; a platform was used in 7 consecutive years in one territory; and a platform was used in 6 of 8 years in a second territory. Of 21 nests on the reservoir during the period 1990-1997, 14 (two-thirds) were on platforms. Of the 24 chicks produced during this period, 6 chicks hatched on natural nests and 18 chicks (three-fourths) hatched on the platform nests. As part of the Species Conservation Strategies for the common loon (Section 4.2.2), the City intends to continue the experimental nest platform project, as long as monitoring continues to document the efficacy of the program.

The likelihood of disturbance to any actively nesting common loons in the watershed as a result of reservoir operations, however, is expected to be very low and short-term in nature in most years. As described above, artificial nest platforms are deployed to ameliorate some of the adverse effects of reservoir fluctuations on loon reproductive success.

Potential of Injury/Mortality of Loons from Reservoir Operations

It is likely that fluctuating reservoir levels will sporadically prevent loons from initiating nesting. It is also possible that loons would nest but that eggs could be lost, or there could be chick mortality due to reservoir fluctuations. Nesting opportunities, some eggs, or young chicks could be lost in years of extreme reservoir fluctuation during the nesting season, especially on natural nest sites, but also on artificial platforms under some environmental conditions (e.g., drought, high velocity winds, storms) to which platform nests are vulnerable under some deployment conditions. It is difficult to quantify the number of injuries or mortalities because of unpredictable future environmental conditions.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of disturbance to, direct injury to, or death of adult common loons as a result of reservoir operations is expected to be very low. However, eggs and unfledged young are expected to be lost during some years, as described above.

Implementation of the Cedar Permanent Dead Storage Project, which is not an activity analysed by this BO/CO, could affect the extent, duration, and timing of reservoir fluctuations and thus impact nesting loons during the nesting season from April through mid-June. The Cedar Permanent Dead Storage Project would alter, and likely exacerbate, fill-and-drawdown regimes of Chester Morse Lake from the current regime, and changes would include modification of seasonal timing, extent, and duration of drawdown and fill. Because the Cedar Permanent Dead Storage Project will have negative, unquantifiable effects on the common loon and other species, the Service has refused to cover this project at the time of theis BO/CO. Such effects will be evaluated during a 5-year study and mitigation will be developed if the project is implemented (Section 4.5.6). Implementation of the Cedar Permanent Dead Storage Project would require a plan amendment under Section 12.2 of the Implementation Agreement (Appendix 1).

Other Effects

Common loons may also be adversely affected by deterioration of water quality resulting either from contamination by chemical pollutants (e.g., petroleum products and other toxic chemicals) directly by impacting individuals (potential mortality) or indirectly by impacting the prey base (fish and aquatic invertebrates). However, because the Cedar River Municipal Watershed is the major source of drinking water supply for the City of Seattle and many of the surrounding municipalities, rigorous water quality standards and regulations are set and enforced by regulatory agencies. Furthermore, use of many chemicals is restricted and/or tightly controlled within the municipal watershed, and Seattle Public Utilities has stringent standards designed to reduce the risk of spills of toxic materials and protect water quality in the case of any spill. These standards are maintained by controlling public access to the municipal watershed and by adhering to the strict regulations ascribed to all operational and other activities conducted in the watershed.

The monitoring and research program included in the HCP (Section 4.5) will, through adaptive management, be used to determine if the mitigation and minimization strategies for the common loons are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives. The monitoring program includes annual surveys of common loons during the term of the HCP, and additional research will be done early in the HCP to better understand the effects of reservoir fluctuations on nesting loons and their habitat (Section 4.5.6).

Summary/Conclusion

The substantial degree of habitat protection and water quality and habitat improvement provided under the HCP is expected to benefit nesting, transient, and other common loons which use the Cedar River Municipal Watershed. Under the HCP, all key aquatic and riparian habitat for common loons will be protected through reserve status, and, overall, is expected to improve in quality over time. Water quality will also improve over time as a result of a reduction of sediment input to aquatic habitats through habitat restoration, improved road maintenance, road improvement projects, substantial road decommissioning, and a reduced level of heavy road use under the policy of no commercial timber harvest. Any short-term, local impacts to common loons resulting from restoration activities in aquatic and riparian areas will be more than offset by long-term, landscape-level benefits.

Measures included in the HCP to protect and restore aquatic and riparian habitats and improve water quality over time may increase production of some of the fish that are prey of common loons and facilitate movement of some of these fish into and out of tributaries to the reservoir, potentially increasing prey availability for nesting loons. Measures in the HCP that reduce human activity levels will protect any nests in the watershed from human disturbance, also increasing the potential for nesting success. Overall, the Service expects that population-level effects of the HCP on the common loon will be positive.

The importance of the Cedar River Municipal Watershed as habitat for common loons takes on added significance when considered in a regional or statewide context, as the three pairs of common loons that typically nest in the municipal watershed have constituted more than one-quarter of the loons nesting in Washington State in many recent years. The production of fledglings from the watershed has, in many years, constituted an even larger fraction of the fledged loons produced in the state, likely as a result of the degree of security within the watershed compared to the high levels of human disturbance to nesting loons on lakes open to the public. As population growth and development pressures from the Seattle/Tacoma metropolitan area continue to diminish the quantity (through housing development around lake and reservoir shorelines) and quality (through increasing recreational boat use of lakes and reservoirs, and through sediment input) of habitat for common loons, the availability of undisturbed habitat in the municipal watershed will play an increasingly critical role in maintaining the viability of populations of common loons that nest in the Puget Trough and the western Washington Cascades.

Group #5 – Bull Trout

Introduction

The Service listed the coterminous range of the bull trout in the United States as threatened under the Act on November 1, 1999 (64 FR 58910). The only known viable population of bull trout in the Cedar River Municipal Watershed occurs above Masonry Dam, which is located just upstream of Cedar Falls (a natural barrier to anadromous fish). The habitat supporting this subpopulation represents approximately 1% of the river miles of bull trout habitat by length within the Coastal-Puget Sound DPS (Washington Rivers Information System Database (WARIS)). WARIS utilizes a 1:100,000 scale hydrography layer for the base coverage. No substantive evidence to date indicates that either a self-sustaining population of native char or any significant number of these individuals exists between Lake Washington and Masonry Dam. Extensive day and night fish sampling conducted in 1994 yielded 5,250 salmonids observations, but none were identified as char. Although bull trout passage and survival over Masonry Dam is expected, it apparently has not been sufficient to support establishment of a significant population under the ecological conditions existing in downstream reaches. The river and its tributaries below Cedar Falls may be used occasionally by a few individual adult bull trout.

Bull trout are present in the Cedar River Municipal Watershed upstream of Masonry Dam. The adfluvial life history form of bull trout, in which spawning and juvenile rearing take place in rivers, and fish grow to full maturity in lakes, is the only one known at this time to occur in the municipal watershed. Bull trout spawn and rear in the Cedar and Rex Rivers, primarily within approximately five river miles and three river miles of Chester Morse Lake, respectively. Spawning and juvenile rearing also take place in some of the smaller tributaries of the Cedar and Rex Rivers and Chester Morse Lake. Spawning in these smaller tributaries occurs mostly in lower reaches relatively near the river or lake confluence. Substantial rearing also occurs in several small tributaries that are apparently not utilized for spawning. Adult bull trout, for the most part, mature in the Chester Morse Lake and Masonry Pool reservoir complex. It is unknown if any lake spawning, observed in bull trout populations on an uncommon basis, occurs along the shores of Chester Morse Lake (see Section 3.5.6).

Low-velocity, shallow side-channels, alcove pools, and woody debris are important habitat features for newly emerged bull trout fry and juveniles in the municipal watershed, as are cool water temperatures and adequate food, both of which depend on channel structure and the condition of riparian vegetation. Potential key habitat for bull trout in the municipal watershed includes the reservoir complex, the Cedar and Rex Rivers, and several smaller tributaries to the rivers and reservoir, as well as riparian habitat associated with the reservoir and its tributary system.

Bull trout could be negatively affected by reservoir operations, silvicultural treatments, road management, or other operational activities in riparian or upland areas that could affect streams or the reservoir. Such effects could be direct through direct injury to, or death of, individuals, or indirect through influences on habitat, e.g., removal of overstory riparian vegetation. Bull trout could also be negatively affected by management actions that may contribute sediment to aquatic habitats on a short- or long-term basis such as stream habitat restoration projects, silvicultural treatments in riparian areas, road maintenance, road use, and road decommissioning. It is possible that bull trout using the river below Cedar Falls could be affected by the instream flow regime that is part of this HCP.

It is important to note that the Service and the City are not considering the Cedar Permanent Dead Storage Project to be a Covered Activity at the time of this writing (see HCP section 4.4.2). It is assumed that after completion of the studies described in HCP section 4.5.6, the City may propose to have the permanent pumps installed, and request that the Service add the Cedar Permanent Dead

Storage Project to the HCP as a Covered Activity. The Service will revisit this Biological Opinion/ Conference Opinion at that time, and determine whether adding the Cedar Permanent Dead Storage Project to the HCP, via the amendment process described in the IA, section 12, would be possible.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the bull trout are fully described in HCP Section 4.2.2 Section 4.4.2, 4.3.2 and Section 4.5.6, and summarized below: (1) protection of all streams and the reservoir complex; (2) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance; (3) protection of all riparian forest, as well as upland forest, with recruitment of substantial mature and late-successional forest over time in riparian and upland areas, improving the habitat quality of forests associated with the reservoir complex and its tributaries; (4) silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests; (5) stream restoration projects, which are expected to improve microhabitat conditions, e.g., temperature regimes and instream habitat complexity in many reaches; (6) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams and other aquatic habitats; (7) guidelines and prescriptions designed to reduce sediment production during watershed management activities; and (8) monitoring and research related to bull trout, including research targeted at determining the level of impacts to bull trout by future reservoir operations, with emergency provisions for upstream passage for spawning adults if needed during the fall.

For those bull trout that may occasionally use the river downstream of Masonry Dam or Cedar Falls, the following mitigation and minimization measures apply: (1) instream flow regime that will ensure more water for fish use in the summer and fall than has been occurring without the HCP (section 4.4.2); (2) funding, about $4.9 million, for protection and restoration of habitat downstream of Landsburg (section 4.4.2), and, (3) construction of fish passage facilities at Landsburg, which will open up about 17 miles of additional habitat for anadromous fish (section 4.3.2).

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

The effects of the HCP on bull trout habitat are of three types: (1) the effects of land management, (2) the effects of reservoir operation, and (3) instream flow management, which only applies to those occasional bull trout present in the lower river. Reservoir operations can affect bull trout habitat in two primary ways (Section 4.5.6): (1) by inundation of redds during spring reservoir refill, potentially resulting in mortality of eggs, or possibly of alevins; and (2) by potentially impeding the fall passage of spawning adults upstream into the Rex and Cedar Rivers, or lake tributaries, during severe droughts. Because both of these potential effects of reservoir operation could involve some form of disturbance, they are discussed below under "Disturbance Effects and Injury/Mortality." Effects of land management are discussed immediately below. The occasional bull trout that may use the river below Masonry Dam would benefit from the fish passage facilities, downstream habitat improvements below the watershed, and improved management of instream flows.

Habitat Effects Related to Land Management in the Municipal Watershed

The effects of past land management in the municipal watershed have included (1) removal of riparian forest during timber harvest, reducing shade, the supply of food (invertebrates) to streams, and recruitment of large woody debris; and (2) construction and use of hundreds of miles of forest roads, which has increased sediment loading to streams through erosion and mass wasting (landslides). The current, disturbed condition of the majority of aquatic and riparian habitats in the municipal watershed presents opportunities for habitat rehabilitation and, over the long term, restoration of the natural ecological functions of the aquatic/riparian ecosystem.

All habitat for bull trout within the municipal watershed, i.e., the reservoir complex and its tributaries, along with associated riparian habitat, is protected in reserve status. In addition, protection in reserve status of *all* forested areas of the watershed will decrease the likelihood of land management activities adversely affecting bull trout in the future. In the short term, bull trout will benefit by increased levels of habitat protection and by active intervention to increase habitat complexity, such as through projects to retain and/or add large woody debris to streams deemed to be deficient in these features. In the long term, bull trout will benefit from the different elements of the HCP designed to help restore a naturally functioning complex of aquatic, riparian, and upland forest habitats, so that the ecosystem itself can supply, on a sustained basis, the important habitat elements, such as large woody debris, that are important to bull trout. For example, approximately seven percent of the HCP area resides within the rain-on-snow (ROS) transition zone. Since bull trout spawning areas are located wholly within and below the ROS zone, these areas are susceptible to increased frequency and duration of ROS induced flood events in basins that currently lack substantial mature conifer vegetation.

The proposed management plan for the road network should reduce negative impacts to bull trout and their habitat, by reducing erosion and sediment loading of streams. Currently, 93% of the City's roads have a very low erosion hazard, 3% were assumed to be low, and 3% were rated as high. High road erosion segments are located in bull trout drainages of Rack and Boulder Creeks, while low erosion roads are located in the mainstem Cedar River. Roads will still create negative impacts to stream habitat (even when not actively used) until they are stabilized and abandoned. Mean road density within five drainages supporting bull trout in Chester Morse Reservoir is 1.5 mile /mile^2 and these range from 1.1 to 1.8 mile/ mile^2. In Columbia River watersheds with unrestricted public access, bull trout populations were typically absent when road densities were >1.7 mile mile^2 (Quigly et al. 1997). Given bull trout's sensitivity to increased sediments at certain life stages, areas of new road construction and activity are likely to adversely affect bull trout in these particular locations. Only rarely can roads be built that have no negative impacts on streams (Furniss et al. 1991). Depending on the site of road construction, riparian buffers may act to sufficiently reduce these negative effects. An indirect effect of the net increase in roads within management areas is the elevated fishermen's access to rivers and streams containing bull trout, but this is not expected to occur in the HCP area because the municipal watershed is closed to public entry and patrolled by security. Therefore, poaching and other non-timber harvest activities (such as harvesting special forest products, mining, off-road vehicles, etc.) performed by the public are expected to be minimized to the maximum extent possible. It is interesting to note that 25% of the known native char populations in Washington are adversely affected by poaching (Mongillo 1993).

Short-term and long-term gains in the quality of stream and riparian habitats are expected under the HCP as a result of the natural maturation of younger seral-stage forest in riparian areas. Development of mature and late-successional forest significantly contributes to the re-establishment of a more naturally functioning ecosystem, thus benefitting bull trout, and their primary prey, pygmy whitefish. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of the HCP, "riparian" zones of 300 ft on Type I-III waters, 150 ft on Type IV waters, and 100 ft on Type V waters were established using GIS data, and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase. This increase should help restore more natural ecological functioning in the riparian/aquatic ecosystem as a whole, in part by restoring habitat complexity through natural recruitment of large woody debris, increasing food production for fish, and maintaining cooler water temperatures.

The HCP also includes management actions designed to improve and help restore aquatic and riparian habitats. These actions include: stream bank stabilization projects; placement of large woody debris (LWD); a stream bank revegetation program; a program of restoration planting, restoration thinning, and ecological thinning in riparian areas; a program to eliminate, modify, or replace stream-crossing culverts that could impede the passage of bull trout using tributaries, restoring habitat connectivity and continuity; a program to eliminate, modify, or replace stream-crossing culverts that are inadequate for passing peak storm flows, reducing the chance of failure and resulting sediment deposition in downstream habitat; programs to improve problem roads and the maintenance of roads that can affect streams, in both cases to reduce sediment loading to streams associated with erosion and mass wasting; and a program to decommission (remove) about 38 percent of forest roads, further reducing sediment loading to streams.

Collectively, these conservation and mitigation activities should (1) restore natural aquatic and riparian ecosystem functioning and (2) accelerate the development of mature or late-successional characteristics in younger second-growth forests in riparian areas. Although restoration of a more naturally functioning aquatic ecosystem will benefit bull trout over the long term, some of these management interventions may cause some localized, short-term decline in habitat function, and therefore result in short-term negative effects to bull trout. Such impacts might include reduced canopy cover that could lead to increased solar heating of stream water or to increased rates of soil erosion, or disturbance of soils that could result in some level of erosion and sediment release into streams or the reservoir.

To ameliorate these potential negative effects, the HCP requires site evaluations by an interdisciplinary team prior to such activities in riparian areas to help minimize any such impacts on bull trout habitat. In addition, the HCP also includes Watershed Assessment Prescriptions (Appendix 16) and other guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with silvicultural treatments, especially in riparian areas. These prescriptions and guidelines will help reduce the rate of sediment loading to aquatic systems and will help maintain high water quality in potential habitats for bull trout. One important set of constraints is that, during restoration or ecological thinning activities, no mechanized equipment will be allowed within 50 ft of streams, no tree removal that has the potential to reduce streambank stability will be allowed, and no tree removal will be allowed within 25 ft of any stream.

Because many of the types of habitat rehabilitation and restoration measures included in the HCP are experimental, monitoring within the context of adaptive management is essential to the long-term success of these efforts (Section 4.5.7). The HCP includes two types of monitoring relevant to these efforts (Section 4.5.4): (1) long-term monitoring of stream habitat quality, to detect trends, and (2) monitoring of specific aquatic and riparian restoration projects, to provide feedback on the adequacy of project designs. Interdisciplinary teams will be involved in the design and monitoring of restoration projects.

Habitat Effects Related to Instream Flow Management

The instream flow regime under the HCP will protect any bull trout in the mainstem Cedar River by providing assurances that flows throughout the majority of the reach between Lake Washington and Lower Cedar Falls would be equal to or greater than the levels provided by the existing WDOE IRPP recommended flows for most of the year (Section 4.4.2). Bull trout within the municipal watershed spawn from early October through early December, which is within the spawning period for chinook salmon in the lower Cedar River. Assuming any bull trout that spawned in the lower Cedar River would spawn on this schedule, flows during bull trout spawning under the HCP should be much higher than the flows that would provide maximum habitat. This should be true because flows during this period are established for the much larger and stronger chinook salmon, and the flows during this period will be as high as or higher than the flow providing maximum habitat for chinook.

Insofar as any bull trout may spawn in the mainstem Cedar River, the elements of the instream flow regime designed to protect the redds of salmon that spawn in shallower areas near the river margin from dewatering will also afford protection to any bull trout redds that may occur in these mainstem areas, particularly because bull trout spawning, at least within the municipal watershed, broadly overlaps with the spawning period for chinook salmon (Section 3.5.6).

In addition, as part of the proposed instream flow management regime, the compliance point of stream flow will be moved approximately 20 miles upstream near the Landsburg Diversion Dam (Section 4.4). Because of this change, flows will remain higher downstream of Landsburg as a result of the groundwater and surface water inputs that occur downstream of the measurement point.

The change in the location of the measurement point will also allow flows to fluctuate in a more natural manner in the lower river.

The City is anticipating no alterations in its flood management practices as a result of the HCP. Consequently, the City anticipates little or no change in the magnitude, frequency, duration, or timing of peak flow events. Channel forming processes associated with these peak flows serve to maintain habitat that could be used by bull trout, should any occur in the lower Cedar River.

Habitat Effects Related to Funding for Downstream Habitat
The lower Cedar River downstream of the Municipal Watershed has been severely impacted by urbanization and other development, channel modifications, and riparian zone disturbance (King County 1998). Mainstem and side-channel habitat quantity and quality have been reduced substantially compared to original conditions in the lower river largely by land management actions beyond the control and responsibility of the City.

The HCP provides $4.9 million for habitat protection and improvement downstream of Landsburg and in the Walsh Lake subbasin, which could potentially include construction of groundwater-fed spawning channels and the protection and/or purchase of lands adjacent to the river or its tributaries, which should benefit bull trout. Both National Marine Fisheries Service and the Service have informed Seattle that these actions will not be covered by the permit, and that the City and partners will need to acquire all necessary state and federal permits before embarking on these activities.

Habitat Effects Related to Mitigation for the Landsburg Diversion Dam
When the fish passage facilities are constructed at Landsburg, expected to be in HCP year 3, these facilities will provide access to approximately 17 miles of mainstem and tributary stream habitat that will be protected and restored under the Watershed Management Mitigation and Conservation Strategies included in the HCP (Section 4.2.2). Accessible miles of mainstem habitat will be increased 12 miles , or by 55 percent, and at least 5 miles of new, highly protected tributary habitat would be also available. Any bull trout in the Cedar River below Landsburg should be able to ascend the fish ladders and enter the municipal watershed, if such fish were to move upstream that far.

Disturbance Effects and Injury/Mortality
Potential disturbance effects and injury or mortality of the HCP originate from 2 types of management actions: (1) the effects of reservoir operation, which is subservient to instream flow management and (2) the effects of land management. The primary disturbance effects and injury or mortality related to reservoir operations are:

1. The potential effects of reservoir drawdown during severe droughts, which could impede passage of adult bull trout into tributaries to the reservoir during the fall spawning season (with timing and duration of impedance varying both within and among years), when relatively steep sections of the face of the delta fans of the Cedar and Rex Rivers may be exposed;

2. potential effects of inundation of redds, especially in lower reaches of the Cedar and Rex Rivers, during spring reservoir refill, potentially causing reduction of oxygen and rate of removal of metabolites from eggs as a result of both sediment in interstitial spaces and reduced water velocity through spawning gravels; and

3. potential entrainment at facilities in the Chester Morse Lake/Masonry Pool complex.

Analysis of reservoir levels for the evaluation of the first two kinds of potential effects (drawdown and refill) was accomplished in two ways:

1. Projected reservoir levels under the IRPP flow regime (the modeled proxy for the current instream flow regime) were compared to projected reservoir levels under the new HCP instream flow regime, using a simplified numerical water balance model of the Cedar River system (see Section 4.5.6); and

2. The frequency of different reservoir elevations under past and current operational regimes were compared with the expected frequency of elevations under the HCP by using analytically derived reservoir elevations for the HCP regime (Section 4.5.6 and Appendix 38), rather than modeled elevations.

Because it allows a consistent comparison of the two flow regimes, the first approach (i.e., modeled weekly elevations) is a reasonable approach to show the *differences* in reservoir elevation under the two operational regimes. Because the modeled elevation method does *not* do a good job of capturing short-term reservoir changes and actual operational decisions that can affect reservoir elevation in the short term, however, the second approach, the comparison of analytically derived reservoir elevations (Appendix 38), is best suited for evaluating the expected frequency of reservoir conditions under the HCP. This latter analysis looked at two time intervals (periods of record): (1) 1940-1999, representing a long-term record, and (2) 1980-1999, representing a shorter-term record that covers the period during which reservoir operations were most like current operations (the period following promulgation of the 1979 IRPP flows by the WDOE, during which the City tried to adhere to the IRPP flows).

As noted in Appendix 38, reservoir elevations are essentially the same under both flow regimes (IRPP and HCP) during the recent period (1980-99), but some differences exist between the recent period and longer period of record (1940-99). The recent (20-year) period of record is used to represent the HCP for all comparisons to the longer (60-year) historic record below, with the exception noted in Appendix 38 that the longer period of record was used to characterize annual changes in reservoir elevations from late November until the end of February to better represent the range of conditions expected during the 50-year HCP.

For the analysis using analytically derived reservoir elevations, five operating zones of reservoir elevation were defined for bull trout (Figure 4, Appendix 38):

1. Very infrequent high elevations, of concern during spring incubation. Expected frequency of 1 in 50 years with a duration of 1 week, and 1 in 10 years with a duration of less than 1 week.

2. Infrequent high elevations, of concern during spring incubation. Expected frequency of 1 in 10 years with a duration of 1-2 weeks. This zone includes floods, which are short-term events.

3. Normal operating zone, with a 20 percent chance of short excursions outside this zone in any given week. In fall, elevations expected to be below 1540 ft 1 in 4 years, with a duration of 1-3 weeks.

4. Infrequent low elevations, of concern during fall spawning. Expected frequency of 1 in 10 years with a duration of 1-3 weeks, with the possibility of being in this zone for many weeks in the June-September period during droughts.

5. Very infrequent low elevations, of concern during fall spawning. Expected frequency of 1 in 50 years with a duration of 1 to several weeks. This zone includes severe droughts.

Effects Related to Land Management

The primary activities under the HCP that may result in disturbance and direct injury, including death, of bull trout in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) instream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (8) routine road use.

Disturbance to, direct injury to, or death of, bull trout is expected to result from silvicultural treatments, road management, and other operational activities. However, the effect is expected to be short-term in nature, because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of bull trout habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which minimizes potential mortality from fishing; and (4) removal of 38 percent of forest roads, which will reduce the potential for negative effects related to road maintenance, improvement, and use over the long term.

The restriction of public access into the municipal watershed will provide benefits for bull trout by reducing potential disturbance and direct take from fishing. Little or no angling disturbance will occur when the species ascends the river to spawn in the fall, a period in which bull trout are highly susceptible to angling pressure, with the potential for fishing disturbance only by trespassers. The Service expects illegal angling pressure to be very low because the reservoir and lower Cedar and Rex Rivers are completely contained within the portion of the watershed closed to the public, and patrolled by the City's enforcement personnel.

Effects Related to Reservoir Drawdown

Chester Morse Lake pool levels under the current reservoir operation range from a normal high pool of 1,563 ft above sea level to a minimum drawdown of 1,532 ft. Under extreme emergency conditions, Chester Morse Lake can be lowered below 1,532 ft to as low as 1,502 ft using the existing emergency pumps. Access to tributary streams by fall spawning bull trout may be impeded or blocked because of the exposure of the steeply sloped faces of delta fans where the Cedar River delta (14 percent slope) and Rex River delta (17 percent slope) meet the main body of Chester Morse Lake. Exposure of several feet of the steep faces of the delta fans may present either a partial or a complete barrier to migrating bull trout, with timing and duration of impedance varying both within and among years, if the exposed channel gradient and resultant stream conditions exceed the swimming and leaping capabilities of bull trout.

A very conservative estimate is that the potential for exposure of the steeply sloped faces of the delta fans of the Cedar and Rex River deltas begins to occur initially as reservoir levels drop below about 1,540 ft. The degree of potential impact is relatively minor immediately below 1,540 ft, however, because water depths sufficient to allow fish passage (approximately 1-3 ft) typically remain, and because only some parts of each steeply-sloped delta face could be completely exposed, if any parts are exposed at all. Although some uncertainty exists, the Service does not expect that any substantial portions of the steep-gradient stream channels on the deltas are actually exposed or that each delta face, as a whole, will not carry flow sufficient to pass fish, at 1,540 ft surface elevation. As the reservoir level drops below 1,540 ft and approaches 1,535 ft, however, the steep channel gradients are believed to extend for sufficient length to potentially impede or block migration (R2 Resource Consultants, in preparation). The question regarding the potential impedance of passage of bull trout at the face of the delta fans during occasional low drawdown events, including the timing, extent, and duration, has been raised only recently. Since Chester Morse Lake levels have not dropped below 1,540 ft since 1991 and none of the critical portions of the channel confluence or face of the delta fans has been exposed, the City's and Service's staff biologists have not had the opportunity to directly observe the substrate structure or flow conditions that exist either where or when impedance of passage of bull trout is thought to be the most likely to occur. However, the Service's expectation is that impedence will not be an issue until reservoir elevations drop below 1540 feet, and approach 1535 feet.

A comparison of *modeled* reservoir levels projected under the IRPP (current) flow regime to projected reservoir levels under the new HCP instream flow regime was done using historical data sets for the period of record (64-plus years including the annual 13-week bull trout spawning season) (see Section 4.5.6). Overall, the modeling analysis indicated that differences between current reservoir management and reservoir management under the HCP are small, with reservoir levels in the fall slightly lower under the HCP regime (an average weekly difference of –0.41 ft) as a result of commitments to higher summer streamflows for steelhead in the mainstem Cedar River downstream of Cedar Falls. The difference in reservoir levels was less than 1 ft (higher or lower) 78 percent of the time.

The modeling indicated that the IRPP flow regime resulted in reservoir levels below 1,540 ft elevation a total of 5.1 percent of the 843 weeks modeled. Projected reservoir levels dropped below 1,540 ft at least once every 5 years and were at those low levels for an average of 3.6 weeks, and remained continuously at those levels for an average of 3.3 weeks. Projected lake levels below 1,535 ft elevation were less common (1.4 percent of the modeled weeks), and occurred at least once every 13 years for an average of 2.4 weeks during the bull trout spawning season.

The modeled results for the IRPP flow regime showed that, when the reservoir drops below levels estimated to be sufficient to expose the steeply sloped faces of the Cedar and Rex River delta fans, those low levels exposing the steely sloped faces of the delta fans are rarely, such as once during the 50-yr permit period, sustained for more than one-half of the 13-week bull trout spawning period (see Appendix 38). Additionally, as water levels drop, the Cedar and Rex Rivers may cut newer, less steep channels in the delta sediment that would aid fish passage, but the time necessary for such a process to occur is not known. Furthermore, because the short, steep reaches occur at the mouths of the rivers, bull trout encounter the deltas at the onset of their upstream migration, when individuals are relatively fit for successful ascent through potentially marginal passage conditions. To date, there is no empirical evidence that suggests existing operations limit the numbers of bull trout that ascend the Cedar and Rex Rivers to spawn or the timing of migration, which appears to be more related to river flow and temperature conditions.

Under the new HCP flow regime, modeled reservoir levels were projected to be below 1,540 ft elevation 6.4 percent of the time as compared to the 5.1 percent of the time for the IRPP flow regime. Modeled reservoir levels were projected to drop below 1,540 ft at least once every 4.5 years, to be at those low levels for an average of 3.9 weeks, and to remain continuously at those levels for an average of 3.6 weeks.

Differences in the percent of time that projections of modeled lake levels were below 1,535 ft elevation between the new HCP instream flow regime and the IRPP flow regime were minor. Projected modeled reservoir levels under the HCP flow regime were below 1,535 ft about 1.2 percent of the modeled weeks and occurred at least once every 16 years for an average of 2.5 weeks during the bull trout spawning season, whereas projected modeled reservoir levels under the IRPP flow regime were below 1,535 ft about 1.4 percent of the modeled weeks and occurred at least once every 13 years for an average of 2.4 weeks during the bull trout spawning season. Over the 64-plus years of projected 13-week bull trout spawning seasons, the modeled lake levels under the new HCP flow regime averaged 0.41 ft lower than under the IRPP flow regime (Section 4.5.6, Table 4.5-2).

As mentioned above, the analysis of reservoir elevations comparing actual past elevations to *analytically derived* elevations under the HCP (Appendix 38), as opposed to the modeled elevations described above, gives a better picture of the likelihood of potential impacts of reservoir drawdown on bull trout during fall spawning (mid-September until mid-December). Inspection of Figure 2 in Appendix 38 indicates that from early October through December reservoir elevations under the same environmental conditions should be nearly the same under the HCP as during the 60-year historic record, except for a few weeks in which there is a slightly higher frequency of lower elevations. As indicated by Figure 4 in Appendix 38, reservoir elevations can be expected to be below 1535 ft at frequencies of 1 in 10 years or less of the fall spawning period, and then only for periods of 1-3 weeks (within the "infrequent" operating zone, zone 4, as defined above). To place this effect in context, it should be noted that some delay of adults entering the Cedar and Rex Rivers can be expected during the fall period in many years as a result of *natural* variability in both timing and volume of attraction flows that depend on the onset of heavy fall rains. Delays of several weeks during the fall migration upstream probably occur under natural conditions, although extreme reservoir drawdown could exacerbate this situation.

The Service believes that the new HCP flow regime will probably have little additional negative effect on bull trout spawning migrations compared to current operations. Although the timing of bull trout entry into the Rex River and Cedar River potentially might be affected by extraordinary low reservoir levels during the fall, it is unlikely that these relatively short and infrequent delays will cause an overall reduction in the number of fish ascending the rivers to spawn or overall spawning success in most years. In addition, the potential for blockage or impedance of bull trout spawning migrations during infrequent periods of low reservoir levels will be thoroughly studied and analyzed under the HCP Monitoring and Research Program as part of Environmental Evaluation of the Cedar Permanent Dead Storage Project (Section 4.5.6). Furthermore, a passage assistance plan will be developed that can be implemented, if needed, pursuant to the contingency plan for droughts (Section 4.5.7). Steps taken under this plan should serve to ameliorate effects of lake level fluctuations on impedance to bull trout passage at river delta fans during annual upstream spawning migration.

Effects Related to Inundation of Redds

Inundation of bull trout redds by rising winter and spring reservoir levels occurs in the lower reaches of the tributaries of Chester Morse Lake. The probable result of this occurrence is diminished water flow over and through the redds and the death of some developing eggs or, possibly, alevins. The extent to which actual bull trout redds are inundated varies among years, depending on redd location, precipitation and operationally-related fluctuations in the reservoir level (Section 2.2.4; Appendix 22, Figure 22-1).

The analysis of modeled reservoir elevations in the spring reveal virtually no differences in reservoir elevation between current operations (under the IRPP flow regimes) and operations under the HCP (Table 4.5-2, Section 4.5.6). Considering the longer (60-year) historic period of record, the analysis of analytically- derived reservoir elevations (Appendix 38) suggests the following comparisons and conclusions regarding the spring incubation period:

1. For the same environmental conditions, reservoir elevations are expected to be essentially the same until late February under the HCP as during the 60-year historic record.

2. During the period March through the end of emmergence (mid-June), higher reservoir elevations are expected to occur with slightly higher frequency under the HCP than during the 60-year period of record, but the elevations expected under the HCP should be similar to the elevations that occurred during the last 20 years under similar environmental conditions.

3. Reservoir elevations are expected to be slightly higher under the HCP than levels during the longer (60-year) historic period of record for only several weeks at the end of the incubation/hatching period (mid-December through mid-March) (Appendix 38).

Because most emergence of fry in the upper Cedar River (above the reservoir) occurs prior to the end of April (see HCP section 3.5.6, Table 3.5-3), and because most redds in the Cedar River have been located upstream of the zone of inundation during most years of observation (see HCP section 3.5.6, Figure 3.5-6), potential adverse effects on bull trout eggs or alevins in the Cedar River are likely minimal. Bull trout redds in the Rex River are typically at greater risk from inundation than those in the Cedar River, because many redds in the Rex River are located at lower elevations (i.e., down to about 1550 ft), and because bull trout fry emergence in the Rex extends into May (Section 3.5.6). The actual level of mortality caused by inundation of redds in the lower Rex and Cedar Rivers is not known. It should be noted, however, that a substantial percentage of Rex River bull trout redds have been observed in recent years at elevations that have been inundated annually by impoundments in Chester Morse Lake for the 85-year period that occurred after the Masonry Dam was constructed and the reservoir began to be operated at new, much higher elevations (Section 3.5.6), but the bull trout population has persisted during this period.

Nonetheless, bull trout apparently have persisted in spawning within the inundation zone on the Rex River, suggesting that mortality of eggs or alevins from inundation may not be high. It is possible, as well, that eggs may be relatively more sensitive to these potential impacts than alevins, which can move around to increase oxygen consumption, and potential effects of inundation may be relatively smaller post-hatching than during incubation.

In any event, severe mortality of eggs and alevins over a period of many decades usually would be expected to exert a strong selective pressure against those bull trout spawning in the regularly inundated stream reaches. One potential hypothesis that could explain the lack of evidence of such selection is that the degree of impact is somewhat reduced by groundwater upwelling through the spawning gravels in the inundated stream reaches. Upwelling in spawning gravels serves to aerate eggs and alevins and remove metabolic wastes. It is not known whether upwelling actually occurs in bull trout spawning areas in the lower Cedar or Rex Rivers. Because regular inundation has been occurring for decades in much of the area in which bull trout now spawn, however, it seems likely that there has been relatively little selection (through differential egg mortality) exerted on bull trout to avoid these areas. Furthermore, even if a high degree of mortality from inundation does occur, it is possible, even likely, that the limiting factor for bull trout in the watershed is not associated with spawning but rather with juvenile rearing (Section 3.3.4; Foster Wheeler Env. Corp. 1995d).

Although there are possibly other mitigating factors, the Service has made the conservative assumption that the inundation and change from a running-water to a lacustrine environment does kill a large fraction of the developing bull trout eggs or alevins in the inundated redds. The fact that the reservoir's bull trout population has persisted for almost a century despite some annual level of redd inundation indicates that inundation has not significantly reduced the population's viability. However, as part of the City's effort to learn more about bull trout ecology in the Cedar River Watershed, a study will be conducted to evaluate bull trout mortality associated with redd inundation during HCP years 1-9.

Effects Related to Entrainment

The Service expects there will be direct mortality of bull trout in the Chester Morse Lake/Masonry Pool system resulting from entrainment through the intakes of the Cedar Falls Hydroelectric Project at Masonry Dam and through the Overflow Dike into Masonry Pool. A recent study concluded that loss of fish from the Chester Morse Lake/Masonry Pool system is likely having little effect on the reservoir's population (Section 3.5.6, Appendix 19). The study estimated that about 200 bull trout per year may be lost to entrainment through Masonry Dam, with a possible range of 10 fish to several hundred fish (Knutzen 1997). An estimate of 200 fish lost, or 6.4 percent of the estimated 3,100 bull trout in Chester Morse Lake, is considered to be sustainable, in part because entrainment has continued for most of this century. In other systems, trout have been able to maintain stable population levels with annual exploitation rates greater than 20 percent (Nehring and Anderson 1982).

Entrainment losses from the Overflow Dike between Chester Morse Lake and Masonry Pool can occur whenever the reservoir level drops near or below 1,550 ft (the top of the modified Overflow Dike spillway), which occurs during about 36 percent of a typical year. At these lake levels, the flow from Chester Morse Lake to Masonry Pool is primarily through a 6.5 feet diameter discharge pipe and then onto a concrete energy dissipation block. It appears that some fish may likely be injured or killed from passing through this Overflow Dike pipe, but definite conclusions cannot be drawn from available information (Knutzen 1997). Knutzen postulated that the fish population probably incurs less damage from passing through the Overflow Dike than from entrainment from Masonry Pool.

The health and long-term sustainability of the Chester Morse Lake bull trout population, in spite of entrainment described in Section 3.5.6, is further supported by the fact that losses to the population above Cedar Falls have always occurred, even before the first dam was built on the original Cedar Lake in 1901 and Masonry Dam was constructed during World War I. Historically, any trout or char in the upper Cedar River watershed that migrated downstream on its own volition or during storm events would have made a one-way trip over Cedar Falls, which is a natural barrier to upstream passage.

Disturbance Effects Related to Operation of Landsburg Diversion Facilities
If bull trout occur in the lower Cedar River in the future, some fry or juveniles could be injured as a result of impingement on the screens at Landsburg, or going over the top of the Landsburg Diversion Dam. Improvements in fish protection, however, include new screens and modifications to the dam, both designed to lessen the potential for injury or death of fish (section 4.3.2). Because of the new fish screens and dam modifications, and because there is no reason to believe there is a viable population of bull trout below Masonry Dam, the Service does not think there will be any efects with population-level consequences.

Disturbance Effects Related to Instream Flows
Rapid downramping of stream flows in the Cedar as a result of City water supply and hydroelectric operations can and does occur, which can strand bull trout fry and juveniles, if any are present downstream of the facilities. A recent analysis of the frequency and magnitude of instream flow changes on the Cedar suggests that large downramping events can occur quite frequently during normal City operations (section 3.5.10). Prior to the HCP, no formal downramping criteria were used to guide downramping events. The Service does not believe spawning or rearing of bull trout is occurring in these reaches, but if it does occur, downramping could have deleterious effects. The Service does not expect that adult fish would be stranded by these downramping events because of their mobility in the channel.

The HCP will moderate the rate of downramping. This moderation is expected to greatly reduce deleterious effects to any fry or juveniles that might be present, when compared to current conditions (see section 4.4). Because of the downramping protections contained in the HCP, and because few if any fry or juvenile bull trout are believed to exist in the mainstem below Masonry Dam, the Service the likelihood of disturbance, injury or death of bull trout to be very low from these activities.

Other Effects
Integral to the bull trout conservation strategy is a comprehensive program of monitoring and research. Elements within this program are designed to provide a better understanding of the life history, habitat needs, and population status of the Chester Morse Lake bull trout, to assess the success of restoration projects, to determine the impacts of reservoir management on reproductive success, to mitigate for any potential adverse impacts on the bull trout population from reservoir management, and to provide information needed for adaptive management. Monitoring and research pertinent to bull trout include population monitoring, spawning surveys, juvenile and fry surveys, telemetry studies of adult movement, stream distribution surveys, and a redd inundation study to evaluate the magnitude of potential egg and fry mortality as a result of spring refill.

As part of the evaluation of the Cedar Permanent Dead Storage Project as a Covered Activity, additional studies will focus on the potential impacts of reservoir elevation changes on the fall spawning migration of bull trout and development of an upstream passage assistance plan for bull trout should one be necessary. This plan is included in the contingency plan for droughts under provisions for changed circumstances (Section 4.5.7).

Summary/Conclusion

The Service believes that the relatively small incremental differences in lake levels projected under the HCP regime will have little influence on spawning migrations, redd inundation, and entrainment as compared to current operations. Annual high and low levels in the reservoir are expected to be changed minimally under the HCP as compared to the current regime. Modeling indicates that reservoir elevation will be an average of only 0.41 ft lower in the fall, when differences would be expected to be largest, and will be essentially the same in the spring for the current and HCP operational regimes (Section 4.5.6; Appendix 38).

The HCP provides a number of distinct benefits to bull trout as part of the Watershed Management Mitigation and Conservation Strategies (Section 4.2), including protection of key habitat through reserve status, improvements and substantial decommissioning of forest roads, and measures to help restore stream and riparian habitats over the long term to more natural conditions (see above). Any short-term, local impacts to bull trout from these restoration activities in streams and riparian areas will be offset by long-term, landscape-level benefits. Increases in the quantity and quality of accessible habitat, in both stream and riparian areas, will benefit the bull trout population.

The Service believes that the HCP will not jeopardize the watershed's bull trout population over the long term for the following reasons:

1. The watershed adfluvial bull trout population is currently believed to be in good condition;

2. Incremental adverse effects of reservoir operations under the HCP on bull trout are expected to be minimal;
3. The Permanent Dead Storage Project is not a Covered Activity in the HCP and cannot be proposed by the City for inclusion in the HCP until the studies detailed in section 4.5.6 are completed;

4. It is likely that juvenile rearing habitat, not spawning habitat, is the limiting factor for bull trout (Section 3.5.6); and

5. The HCP provides substantial benefits to key habitat for both juveniles and spawning adults.

Under the HCP, a monitoring and research program will be funded to track the status of the bull trout population and further investigate the influence of reservoir operations on bull trout. The HCP bull trout conservation strategy is designed to avoid, minimize, or mitigate for any incidental take of bull trout. The Service believes that the negative effects described in the paragraphs above do not constitute a threat to the bull trout population in the municipal watershed. The Service also believes that the substantial measures in this HCP for the protection of bull trout and bull trout habitat, the implementation of an extensive monitoring and research program, and the incorporation of an adaptive management strategy are sufficient mitigation for potential negative effects of the City's operations on bull trout during the term of the HCP.

Any bull trout that might be present in the lower municipal watershed are expected to benefit from the waershed protection measures and restoration measures of the HCP. Any bull trout in the mainstem Cedar, below Masonry Dam, are expected to benefit from both fish passage improvements and improved instream flow management. Collectively, these HCP measures are expected to provide an overall beneficial effect to bull trout, assuming they actually occur in the lower river.

Group #6 – Pygmy Whitefish

Introduction

Pygmy whitefish are present in the Cedar River Municipal Watershed upstream of Masonry Dam. Adults occur in the deep waters of Chester Morse Lake and Masonry Pool, migrating into the Cedar and Rex Rivers and several of their smaller tributaries to spawn during late fall and early winter; and juveniles apparently return to the lake for rearing. It is not known from recent observations whether any adults spawn along the margins of the reservoir complex (Chester Morse Lake and Masonry Pool), but Wydoski and Whitney (1979) state, without citation, that pygmy whitefish spawn in Chester Morse Lake in late December and early January.

The quality of stream habitat for spawning pygmy whitefish depends on water temperature, water quality, and habitat quality, including availability of pools and riffles, substrate structure, and cover (e.g., woody debris), which in turn depend, at least in part, on the condition of riparian vegetation and the extent of sediment loading incurred from anthropogenic sources. Potential key habitat for pygmy whitefish in the municipal watershed include the reservoir complex, the lower sections of the Cedar and Rex Rivers upstream of Chester Morse Lake, and lower Boulder Creek, as well as riparian habitat associated with the reservoir and its tributaries. Other potential key habitat may include additional low-gradient streams that feed into the Cedar and Rex Rivers or directly into the reservoir complex.

Pertinent Mitigation and Minimization Measures

The mitigation and minimization measures of the HCP, detailed in the Section 4.2.2 and Section 4.5.6, are expected to maintain the natural processes important for creating and maintaining habitat for pygmy whitefish in the watershed. In brief, they include: (1) protection of all key habitat (streams, the reservoir complex, and riparian habitat); (2) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance and potential for delivery of fine sediment; (3) protection of all riparian forest, as well as upland forest, with recruitment of substantial mature and late-successional forest over time in riparian and upland areas, improving the habitat quality of forests associated with the reservoir complex and its tributary system; (4) silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests; (5) stream restoration projects, which are expected to improve microhabitat conditions (e.g., temperature regimes and instream habitat complexity) in many reaches; (6) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams and other aquatic habitats; (7) guidelines and prescriptions designed to reduce sediment production during watershed management activities; and (8) monitoring and research related to pygmy whitefish.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

The effects of the HCP on pygmy whitefish habitat are of two types: (1) the effects of land management and (2) the effects of reservoir operation. Reservoir operations can affect pygmy whitefish habitat by potentially impeding the upstream passage of spawning adults into the Cedar or Rex rivers during severe drought conditions (Section 4.5.6). Reservoir operations are discussed below under "Disturbance Effects and Injury/Mortality". Effects of land management on habitat are discussed in this subsection.

The effects of past land management in the municipal watershed have included (1) removal of riparian forest during timber harvest, reducing shading, the supply of food (invertebrates) to streams, and recruitment of large woody debris; and (2) construction and use of hundreds of miles of forest roads, which has increased sediment loading to streams through erosion and mass wasting (landslides). The current, disturbed condition of the majority of aquatic and riparian habitats in the municipal watershed presents opportunities for habitat rehabilitation and, over the long term, restoration of the natural ecological functions of the aquatic/riparian ecosystem.

All key habitat for pygmy whitefish within the municipal watershed (i.e., the reservoir complex and its tributaries, along with associated riparian habitat) is protected through reserve status. In addition, protection in reserve status of *all* forested areas of the watershed will decrease the likelihood of land management activities adversely affecting pygmy whitefish. In the short term, pygmy whitefish will benefit by increased levels of habitat protection and by active intervention to increase habitat quality, such as bank stabilization projects that would reduce sediment loading to streams used for spawning. In the long term, the Service expects pygmy whitefish to benefit from the different elements of the HCP designed to help restore a naturally functioning complex of aquatic, riparian, and upland forest habitats, so that the ecosystem itself can supply, on a sustained basis, the important habitat elements, such as holding pools, that are important to pygmy whitefish. For example, approximately seven percent of the HCP area resides within the rain-on-snow (ROS) transition zone. Since pygmy whitefish spawning areas are located either within and below the ROS zone, these areas are susceptible to increased frequency and duration of ROS induced flood events in catchments that currently lack mature conifer vegetation.

Short-term and long-term gains in the quality of stream and riparian habitats are expected under the HCP as a result of the natural maturation of younger seral-stage forest in riparian areas. Development of mature and late-successional forest significantly contributes to the re-establishment of a more naturally functioning ecosystem, thus benefitting pygmy whitefish. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of the HCP, "riparian" zones of 300 ft on Type I-III waters, 150 ft on Type IV waters, and 100 ft on Type V waters were established using GIS data, and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase. This increase should help restore more natural ecological functioning in the riparian/aquatic ecosystem as a whole, in part by restoring habitat complexity through natural recruitment of large woody debris, increasing food production for fish, and maintaining cooler water temperatures.

The HCP also includes management actions designed to improve and help restore aquatic and riparian habitats, including stream bank stabilization projects; placement of large woody debris (LWD); a stream bank revegetation program; a program of restoration planting, restoration thinning, and ecological thinning in riparian areas; a program to eliminate, modify, or replace stream-crossing culverts that could impede the passage of pygmy whitefish that may use tributaries, restoring habitat connectivity and continuity; a program to modify, eliminate, or replace stream-crossing culverts that are inadequate for passing peak storm flows, reducing the chance of failure and resulting sediment deposition in downstream habitat; programs to improve problem roads and the maintenance of roads that can affect streams, in both cases to reduce sediment loading to streams associated with erosion and mass wasting; and a program to decommission (remove) about 38 percent of forest roads, further reducing sediment loading to streams.

The comprehensive management plan for the road network should reduce negative impacts to pygmy whitefish and their habitat, by reducing accelerated erosion and sediment loading of streams. Currently, 93% of the City's roads have a very low erosion hazard, 3% were assumed to be low, and 3% were rated as high. High road erosion segments are located in pygmy whitefish drainages of Rack and Boulder Creeks, while low erosion roads are located in the mainstem Cedar River. Roads, which are a major source of management-related sedimentation in streams, will still create negative impacts to stream habitat (even while not actively utilized) until they are stabilized and abandoned. Mean road density within five drainages supporting pygmy whitefish in Chester Morse Reservoir is 1.5 mile mile^2 and these range from 1.1 to 1.8 mile mile^2. It is unknown to what effect road density has on pygmy whitefish, but it is known that roads building and maintance negatively impacts salmonid streams (Furniss et al. 1991). Depending on the site of road construction, riparian buffers may act to sufficiently reduce these negative effects. An indirect effect of the net increase in roads within management areas is the elevated accessibility to rivers and streams containing pygmy whitefish, but this is not expected to occur in the restricted HCP area because the municipal watershed is closed to public entry and patrolled by security. Therefore, poaching and other non-timber harvest activities (such as harvesting special forest products, mining, off-road vehicles, etc.) performed by the public are expected to be minimized to the maximum extent possible.

The management interventions may cause localized, short-term declines in habitat function. Such impacts are expected to include reduced canopy cover that could lead to increased solar heating of stream water or to increased rates of soil erosion, or disturbance of soils that could result in some level of erosion and sediment release into streams or the reservoir. These effects could result in negative effects to habitat of pygmy whitefish. Site evaluations by an interdisciplinary team prior to such activities in riparian areas will help minimize these effects on habitat of pygmy whitefish. In addition, the HCP also includes Watershed Assessment Prescriptions (Appendix 16) and other guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with silvicultural treatments, especially in riparian areas. These prescriptions and guidelines will help reduce the rate of sediment loading to aquatic systems and will help maintain high water quality in potential habitats for pygmy whitefish. One important set of constraints is that, during restoration or ecological thinning activities, no mechanized equipment will be allowed within 50 ft of streams, no tree removal that has the potential to reduce streambank stability will be allowed, and no tree removal will be allowed within 25 ft of any stream.

Because many of the types of habitat rehabilitation and restoration measures included in the HCP are experimental, monitoring within the context of adaptive management is essential to the long-term success of these efforts (Section 4.5.7). The HCP includes two types of monitoring relevant to these efforts (Section 4.5.4): (1) long-term monitoring of stream habitat quality, to detect trends, and (2) monitoring of specific aquatic and riparian restoration projects, to provide feedback on the adequacy of project designs. Interdisciplinary teams will be involved in the design and monitoring of restoration projects.

Disturbance Effects and Injury/Mortality

Potential effects of the HCP on pygmy whitefish are of two types: (1) the effects of land management and (2) the effects of reservoir operation, which is subservient to instream flow management. The primary effects related to reservoir operations are:

1. the potential effects of reservoir drawdown during severe droughts, which could impede passage of adult pygmy whitefish into tributaries to the reservoir during the late fall/early winter spawning season (with timing and duration of impedance varying both within and among years), when relatively steep sections of the face of the delta fans of the Cedar and Rex Rivers may be exposed; and

2. potential entrainment at facilities in the Chester Morse Lake/Masonry Pool complex.

Analysis of reservoir levels for the evaluation of potential drawdown effects was accomplished in two ways:

1. Projected reservoir levels under the IRPP flow regime (the modeled proxy for the current instream flow regime) were compared to projected reservoir levels under the new HCP instream flow regime, using a simplified numerical water balance model of the Cedar River system (see Section 4.5.6); and

2. The frequency of different reservoir elevations under past and current operational regimes were compared with the expected frequency of elevations under the HCP by using analytically derived reservoir elevations for the HCP regime (Section 4.5.6 and Appendix 38), rather than modeled elevations.

Because it allows a consistent comparison of the two flow regimes, the first approach (i.e., modeled weekly elevations) is a reasonable approach to show the *differences* in reservoir elevation under the two operational regimes. Because the modeled elevation method does *not* do a good job of capturing short-term reservoir changes and actual operational decisions that can affect reservoir elevation in the short term, however, the second approach, the comparison of analytically derived reservoir elevations (Appendix 38), is best for evaluating the expected frequency of reservoir conditions under the HCP. This latter analysis looked at two time intervals (periods of record): (1) 1940-1999, representing a long-term record, and (2) 1980-1999, representing a shorter-term record that covers the period during which reservoir operations were most like current operations (the period following promulgation of the 1979 IRPP flows by the WDOE, during which the City voluntarily tried to adhere to the IRPP flows).

As noted in Appendix 38, reservoir elevations are essentially the same under both flow regimes (IRPP and HCP) during for the recent period (1980-99), but some differences exist between the recent period and the longer period of record (1940-99). The recent (20-year) period of record is used to represent the HCP for all comparisons to the longer (60-year) record below, with the exception noted in Appendix 38 that the longer period of record was used to characterize annual changes in reservoir elevations from late November until the end of February to better represent the range of conditions expected during the 50-year HCP.

For the analysis using analytically derived reservoir elevations, five operating zones of reservoir elevation were defined for bull trout (Figure 4, Appendix 38), which is also relevant for pygmy whitefish:

1. Very infrequent high elevations, of concern during spring incubation. Expected frequency of 1 in 50 years with a duration of 1 week, or 1 in 10 years with a duration of less than 1 week.

2. Infrequent high elevations, of concern during spring incubation. Expected frequency of 1 in 10 years with a duration of 1-2 weeks. This zone includes floods, which are short-term events.

3. Normal operating zone, with a 20 percent chance of short excursions outside this zone in any given week. In fall, elevations expected to be below 1540 ft 1 in 4 years, with a duration of 1-3 weeks.

4. Infrequent low elevations, of concern during fall spawning. Expected frequency of 1 in 10 years with a duration of 1-3 weeks, with the possibility of being in this zone for many weeks in the June-September period during droughts.

5. Very infrequent low elevations, of concern during fall spawning. Expected frequency of 1 in 50 years with a duration of 1 to several weeks. This zone includes severe droughts.

Effects Related to Land Management

The primary activities under the HCP that may result in disturbance and direct injury, including death, of pygmy whitefish in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) instream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (8) routine road use.

Disturbance to, direct injury to, or death of pygmy whitefish is expected to result from silvicultural treatments, road management, and other operational activities. However, the effect is expected to be short-term in nature, because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of pygmy whitefish habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which minimizes potential mortality from fishing; and (4) removal of 38 percent of forest roads, which will reduce the negative effects resulting from road maintenance, improvement, and use over the long term.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of disturbance to, direct injury to, or death of individuals as a result of silvicultural treatments, road management, or other operational activities in riparian areas is expected to be very low.

Effects Related to Reservoir Drawdown

Chester Morse Lake pool levels under current reservoir operation range from a normal high pool of 1,563 ft above sea level to a minimum drawdown of 1,532 ft. Under extreme emergency conditions, Chester Morse Lake can be lowered below 1,532 ft to as low as 1,502 ft using the existing emergency pumps, though this has never been done since construction of the Reservoir. Access to tributary streams by fall spawning pygmy whitefish may be impeded or blocked because of the exposure of the steeply sloped faces of delta fans where the Cedar River delta (14 percent slope) and Rex River delta (17 percent slope) meet the main body of Chester Morse Lake. A conservative estimate of 1,540 ft above sea level has been used as the point at which access to the spawning channels would be impeded (see status section above, and HCP section 3.5.6 for rationale).

A comparison of *modeled* reservoir levels projected under the IRPP (current) flow regime to projected reservoir levels under the new HCP instream flow regime was done using historical data sets for the period of record (64-plus years including the annual 3-week pygmy whitefish spawning season, with river spawning assumed to occur from November 26 through December 16) (see Section 4.5.6). Overall, the modeling analysis indicated that differences between current reservoir management and reservoir management under the HCP are small, with reservoir levels in the fall slightly lower under the HCP regime (an average weekly difference of –0.23 ft) as a result of commitments to higher summer streamflows for steelhead in the mainstem Cedar River downstream of Cedar Falls. The difference in reservoir levels was less than 1 ft (higher or lower) 93 percent of the time. The modeling indicated that the IRPP flow regime resulted in reservoir levels below 1,540 ft elevation a total of 6.2 percent of the 843 weeks modeled, whereas the HCP flow regime resulted in reservoir levels below 1,540 ft elevation a total of 6.7 percent of weeks (Table 4.5-2; Section 4.5.6).

As mentioned above, the analysis of reservoir elevations comparing actual past elevations to *analytically derived* elevations under the HCP (Appendix 38), as opposed to the modeled elevations described above, gives a better picture of the likelihood of potential impacts of reservoir drawdown on pygmy whitefish during fall spawning (late-November until mid-December). Inspection of Figure 2 in Appendix 38 indicates that during the period late-November until mid-December reservoir elevations under the same environmental conditions should be essentially the same under the HCP as during the 60-year historic record. As indicated by Figure 4 in Appendix 38, reservoir elevations can be expected to be below 1535 ft at frequencies of 1 in 50 years during the spawning period, and then only for periods of 1-several weeks (within the "very infrequent" operating zone: zone 5 as defined above).

The Service believes that the new HCP flow regime will probably have little additional impact on pygmy whitefish spawning migrations compared to current operations. Although the timing of pygmy whitefish entry into the Rex River and Cedar River potentially might be affected by extraordinary low reservoir levels during the fall, it is highly unlikely that these relatively short and infrequent delays will cause an overall reduction in the number of fish ascending the rivers to spawn or overall spawning success in most years. The potential for blockage or impedance of pygmy whitefish spawning migrations during infrequent periods of low reservoir levels will be studied and analyzed under the HCP Monitoring and Research Program as part of Environmental Evaluation of the Cedar Permanent Dead Storage Project (Section 4.5.6). To date, there is no evidence suggesting existing operations limit the numbers of pygmy whitefish that ascend the Cedar or Rex rivers to spawn.

Restricting public access into the municipal watershed will provide benefits for pygmy whitefish by reducing potential disturbance and direct take from fishing. It is very unlikely that any significant level of disturbance resulting from angling will occur to the whitefish population either when resident within the reservoir or during spawning migrations into tributary streams. Observations indicate that a majority of the whitefish population in the reservoir complex remains consistently in deeper portions of the lake (see HCP section 3.5.7 and R2 Resource Consultants, in preparation) and are virtually inaccessible to trespassers who fish, except during the short period in late fall and early winter when they enter tributaries to spawn. Even during the fall/winter period when they might be potentially most vulnerable to angling pressure in streams, such pressure would come solely from a very low number of trespassers and in all probability be insignificant to the population, especially if lake spawning is included in the life history behavior of this population.

Effects Related to Inundation of Redds

For the reasons described below, it is unlikely that eggs of pygmy whitefish in the Cedar and Rex Rivers, or tributaries, could be adversely affected by inundation during the incubation period in early winter:

1. Pygmy whitefish are broadcast spawners and regularly spawn in lakes, which strongly suggests that their eggs may be relatively impervious to potential effects of inundation. Eggs in the margins of lakes are likely adapted to low water-velocity conditions with some degree of sedimentation. Because the eggs in a river environment are on the surface and not buried, and because eggs likely move around with river currents, velocities of water around eggs would not necessarily decrease with sedimentation that may occur during inundation.

2. Pygmy whitefish spawning observed in the Cedar River has been largely upstream of the zone of spring inundation.

3. Pygmy whitefish spawning in the Cedar and Rex Rivers is believed to be completed in mid-December, and the incubation period of pygmy whitefish is only several weeks at most. Thus, emergence of fry should have occurred long before inundation begins in the lower reaches of the Cedar and Rex Rivers immediately upstream from Chester Morse Lake (Appendix 38).

Effects Related to Entrainment

The Service expects there will be direct mortality to pygmy whitefish in the Chester Morse Lake/Masonry Pool system resulting from entrainment through the intakes of the Cedar Falls Hydroelectric Project at Masonry Dam and through the Overflow Dike into Masonry Pool. A recent study, however, concluded that loss of fish from the Chester Morse Lake/Masonry Pool system is likely having little effect on the reservoir's population. The study estimated that about 1,200 pygmy whitefish per year may be lost to entrainment through Masonry Dam (Knutzen 1997; Appendix 19). An estimate of 1,200 fish lost, or about 2 percent of the estimated 51,000 pygmy whitefish in Chester Morse Lake, is considered to be sustainable because entrainment has continued for most of this century. In other systems, salmonids have been able to maintain stable population levels with annual exploitation rates greater than 20 percent (Nehring and Anderson 1982).

Potential entrainment losses from the Overflow Dike between Chester Morse Lake and Masonry Pool can occur whenever the reservoir level drops near or below 1,550 ft (the top of the modified Overflow Dike spillway), which occurs about 36 percent of a typical year. At these lake levels, the flow from Chester Morse Lake to Masonry Pool is primarily through a 6.5 ft diameter discharge pipe and then onto a concrete energy dissipation block. It appears that some fish may likely be injured or killed from passing through this Overflow Dike pipe, but definite conclusions cannot be drawn from available information (Knutzen 1997). Knutzen postulated that the fish population probably incurs less damage from passing through the Overflow Dike than from entrainment from Masonry Pool.

The health and long-term sustainability of the Chester Morse Lake pygmy whitefish population, in spite of entrainment described above, is further supported by the fact that losses to the population above Cedar Falls have always occurred, even before the first dam was built on the original Cedar Lake in 1901 and Masonry Dam was constructed during World War I. Historically, any whitefish in the upper Cedar River watershed that migrated downstream on its own volition or during storm events would have made a one-way trip over Cedar Falls, which is a natural barrier to upstream passage.

Other Effects

As part of the evaluation of the Cedar Permanent Dead Storage Project, additional studies will focus on the potential impacts of reservoir elevation changes on the fall spawning migration of pygmy whitefish as well as the population ecology of pygmy whitefish.

Summary/Conclusion

The Service believes that the relatively small incremental differences in lake levels projected under the HCP regime will have little influence on spawning migrations and entrainment as compared to current operations. Annual high and low levels in the reservoir are expected to be changed minimally under the HCP as compared to the current regime.

The HCP provides a number of distinct benefits to pygmy whitefish as part of the Watershed Management Mitigation and Conservation Strategies (Section 4.2), including protection of key habitat through reserve status, improvements and substantial decommissioning of forest roads, and measures to help restore stream and riparian habitats over the long term to more natural conditions (see above). Any short-term, local impacts to pygmy whitefish from these restoration activities in streams and riparian areas are expected to be offset by long-term, landscape-level benefits. Increases in the quantity and quality of accessible habitat, in both stream and riparian areas, will benefit the pygmy whitefish population.

The Service believes that the HCP will not jeopardize the watershed's pygmy whitefish population over the long term for the following reasons:

1. The watershed pygmy whitefish population is presently believed to be in good condition;

2. The Permanent Dead Storage Project is not a Covered Activity in the HCP and cannot be proposed by the City for inclusion in the HCP until the studies detailed in section 4.5.6 are completed;

3. Incremental adverse effects of reservoir operations under the HCP on pygmy whitefish are expected to be minimal; and

4. The HCP provides substantial benefits to key habitat for pygmy whitefish.

Under the HCP, a monitoring and research program will be funded to fill critical knowledge gaps for pygmy whitefish (Section 4.5.6), and the HCP pygmy whitefish conservation strategy is designed to avoid, minimize, or mitigate for any incidental take of pygmy whitefish. The Service believes that the potential for negative effects as described in the paragraphs above does not constitute a threat to the pygmy whitefish population in the municipal watershed. The Service also believes, at the time of this writing, that the measures in this HCP for protecting pygmy whitefish and pygmy whitefish habitat, implementing an extensive monitoring and research program, and the incorporation of an adaptive management strategy should ensure the long-term viability of the pygmy whitefish population within the reservoir. Furthermore, effects to whitefish in the reservoir and municipal watershed will not have any effect on populations located elsewhere.

Group #7 - Sockeye Salmon

Not addressed in this Biological and Conference Opinion; see NMFS's Biological Opinion (NMFS 2000).

Group #8 - Chinook, Coho and Steelhead

Not addressed in this Biological and Conference Opinion; see NMFS's Biological Opinion (NMFS 2000).

Group #9 - Bald Eagle

Introduction
Bald eagles are commonly present in the Cedar River Municipal Watershed as transients or as migrants during spring and fall seasons, but no nests have been documented within the watershed, and no communal winter roost sites have been identified. Especially during the spring and fall, both adult and juvenile bald eagles are regularly observed perched in trees adjacent to several of the larger lakes in the watershed, particularly Chester Morse Lake, Masonry Pool, Rattlesnake Lake, and Walsh Lake and along the mainstem channels of the Cedar and Rex Rivers. Potential key nesting habitat for bald eagles typically includes mature, late successional, and old-growth forests with large trees and snags that are typically located within 1 mile of water bodies that support an adequate prey base. Bald eagle winter roost site selection is thought to depend more on protective landforms and availability of coniferous forest than on proximity to water. Key habitat for foraging includes rivers, lakes, and other aquatic habitats.

The bald eagle could be negatively affected by road management or other operational activities in watershed forests, especially in mature to old-growth forest, as well as by silvicultural treatments and restoration activities in younger second-growth forest. Such effects could be direct through destruction of active nests or injury to individuals or indirect, through influences on habitat (e.g., removal of tree canopy or specific nest, roost, or perch trees) or through disturbance. Bald eagles can also be negatively affected by management activities that contribute sediment to streams (e.g., timber harvest, road construction, maintenance and use), thereby reducing water quality and potentially affecting populations of prey fish.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the bald eagle are detailed in Section 4.2.2 of the HCP and summarized below: (1) protection of all existing key habitat in reserve status, including all mature, late successional, and old-growth forests that could be used for nesting, all other forest that could be used for roosting, and all river, lake, and other aquatic habitats that could be used for foraging; (2) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance and the likelihood of disturbing nesting or roosting activities; (3) natural maturation of second-growth forests into mature and late-successional seral stages, increasing the availability of potential nest, roost, and perch sites; (4) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests; (5) retention, creation, and recruitment of large snags and large trees with broken tops during silvicultural treatments, also increasing the availability of potential nest, roost, and perch sites; (6) protection and improvement of water quality and other habitat conditions for prey species through measures to reduce sediment loading to streams; (7) passage of all native anadromous fish species above the Landsburg Diversion Dam, when the fish ladders are constructed; (8) changes in management of instream flows under the HCP and other flow-related measures that will improve conditions for fish that are prey of bald eagles; (9) removal of 38 percent of watershed roads, reducing the potential for disturbance to nesting or roosting eagles; (10) monitoring and research; and (11) protection of nesting pairs and communal roosts from human disturbance.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the municipal watershed, all forest outside limited developed areas is protected through reserve status. As a result, all key forest habitat for the bald eagle within the municipal watershed (i.e. mature to old-growth forest), as well as other potential forest habitat, is protected. All key aquatic habitats are also protected by protection of adjacent forest and by other measures in the HCP.

Major habitat effects on the bald eagle are similar, in general, to those described for other species addressed by the HCP that are associated with late-successional and old-growth forests or with aquatic and riparian habitats. Although old-growth forest, by definition, will not increase in extent under the HCP, substantial increases in the quantity and quality of mature and late-successional coniferous forest habitat for the bald eagle are expected over the 50-year term of the HCP as a result of natural maturation of second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in some areas of second-growth forest. Solely as a result of natural forest maturation, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a fivefold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.2). In addition, by the end of the HCP term, older forest habitat will be more evenly distributed throughout the watershed landscape, including the entire elevation range, than under current conditions.

Short-term and long-term gains in the quality and/or quantity of aquatic and riparian habitats are expected under the HCP as a result of the natural development of mature forest in riparian areas. Development of mature and late-successional forest significantly contributes to the reestablishment of a more naturally functioning ecosystem, with greater overall potential for use by bald eagles. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of the HCP, "riparian" zones of 300 ft on Type I-III waters, 150 ft on Type IV waters, and 100 ft on Type V waters were established using GIS data and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase.

In addition, under the HCP, some potential bald eagle habitat in the municipal watershed is expected to benefit from management actions, such as ecological thinning and restoration, that are intended to produce mature and late-successional forest habitat characteristics in second-growth forests (Section 4.2.2).

The HCP also includes management actions intended to restore and enhance aquatic and riparian habitats. These actions are intended to improve fish habitat, thereby also improving foraging conditions for bald eagles over time. Stream bank stabilization projects, placement of large woody debris, a stream bank revegetation program, and a program of restoration planting, restoration thinning, and ecological thinning in riparian areas is expected to help accelerate (1) the restoration of natural aquatic and riparian ecosystem functioning and (2) the development of mature or late-successional forest characteristics in younger seral-stage forests in riparian areas (Section 4.2.2).

Silvicultural treatments in riparian areas may result in short-term negative impacts on streamside habitat and/or water quality. No commercial timber harvest will occur in the watershed, however, to eliminate or minimize any short-term impacts to bald eagle habitat, interdisciplinary teams will evaluate and plan silvicultural and operational projects in any key habitat, especially within riparian zones. One important set of constraints is that during restoration or ecological thinning activities, no mechanized equipment will be allowed within 50 ft of streams and no tree removal that has the potential to reduce streambank stability will be allowed. In addition, the HCP also includes a comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) and other management guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with silvicultural treatments in riparian areas. Implementing these prescriptions and guidelines is expected to help reduce the rate of sediment loading to aquatic systems, and help maintain and improve water quality.

Road construction, repair, maintenance, and decommissioning can all impact stream and riparian areas. However, the suite of Watershed Assessment Prescriptions and other management guidelines (Section 4.2.2) are intended to minimize the probability of erosion and mass wasting associated with roads. Following these prescriptions and guidelines, along with the program to improve many roads and to decommission about 38 percent of existing roads (Section 4.2.2), will reduce the rate of sediment loading to aquatic systems and maintain high water quality. It is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads are adjacent to streambanks, but improved road maintenance under the HCP will help mitigate those impacts.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance to, and possibly the equivalent of take, of bald eagles that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) riparian and instream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) some types of monitoring and research.

The likelihood of disturbing any actively nesting or roosting bald eagles in the watershed is expected to be low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) protection of known active bald eagle nest sites or roost sites from human disturbance, partly through the use of site evaluations and interdisciplinary teams prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed, reducing the overall levels of habitat disturbance and human activities; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term.

Because disturbance during nesting and foraging can adversely affect bald eagles, the restriction of public access into the Cedar River Municipal Watershed is expected to provide benefits for foraging, nesting, and roosting bald eagles (should eagles eventually nest or communally roost in the watershed). In order to protect eagles that may nest within the municipal watershed or groups of eagles that may use the watershed for foraging, the City will not conduct silvicultural treatments or construct roads within 0.5 mile of a known active bald eagle nest site between January 1 and August 15 or within 0.25 mile of a known active bald eagle nest site at other times of the year, or within 0.25 miles of an active communal roosting site (Section 4.2.2).

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of any bald eagles resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low.

Summary/Conclusion

Population-level effects on the bald eagle are expected to be positive at the local (within the watershed) and regional levels. Protection in reserve status of all key forested habitat will, over time, result in a forested landscape similar to that which would be present naturally. Protection and restoration of aquatic and riparian habitats adjacent to rivers and streams will improve conditions for the dispersal and movement of organisms dependent on aquatic and riparian habitats. The increase in habitat connectivity and maturation of second-growth forest is expected to benefit the bald eagle population by providing potential nesting, roosting, and foraging habitat throughout the landscape of the Cedar River Municipal Watershed and improving conditions for prey. Other measures in the HCP that will improve habitat for fish that are prey of bald eagles or otherwise increase prey populations or availability are described in the bull trout (Group #5) and pygmy whitefish (Group #6) effects sections above.

Two other groups of measures will benefit bald eagles by improving habitat conditions for fish that are prey of bald eagles or by otherwise increasing prey populations. Increased production of anadromous fish will mean increased availability of live prey, increased production of salmon will mean increased availability of carcasses, and construction of fish passage facilities at the Landsburg Diversion Dam will extend the availability of live anadromous fish and salmon carcasses into the municipal watershed. The HCP provides for the passage of all native species of anadromous fish upstream of the Landsburg Diversion Dam into a 12.5-mile reach of the mainstem of the Cedar River and into additional smaller tributaries, substantially adding to spawning and rearing habitat, and increased production of sockeye salmon, downstream of Landsburg, through operation of a hatchery (Section 4.3.2).

Improvements in instream flows under the HCP will increase habitat capacity of the Cedar River, flow downramping protection under the HCP will reduce mortality of juvenile fish, funding for habitat protection and restoration downstream of Landsburg will increase habitat quality and quantity, and funding for improvements at the Ballard Locks will increase survival of smolts passing from Lake Washington to Puget Sound (Section 4.4.2).

Group #10 - Peregrine Falcon

Introduction

No comprehensive surveys to determine the presence or absence of peregrine falcons have been conducted in the Cedar River Municipal Watershed and no incidental observations of this species have been documented to date. However, a nest has recently been documented within a few miles of the northern watershed boundary. Potential key habitat for peregrine falcons in the Cedar River

Municipal Watershed includes cliffs and rock outcrops (potential nesting habitat), as well as natural open habitats (grass-forb meadows and persistent shrub communities) and open wetlands (palustrine emergent and palustrine scrub-shrub) used for foraging.

Certain kinds of human disturbance near nesting peregrines can influence nesting success. Significantly, the types and extent of human activities conducted within the municipal watershed differ substantially from those taking place on many nearby lands, especially those areas open to commercial timber harvest and/or a wide variety of public recreational activities, because the primary function of the Cedar River Watershed is to supply drinking water to the City of Seattle and the surrounding region.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the peregrine falcon are detailed in Section 4.2.2 of the HCP and summarized below: (1) protection through reserve status of all cliff and rock outcrop features that may potentially be used for nesting; (2) protection through reserve status of all natural open habitats used for foraging (e.g., meadows, persistent shrub, and wetlands) in the watershed; (3) elimination of timber harvest for commercial purposes within the watershed, reducing levels of human disturbance associated with log haul; (4) removal of 38 percent of watershed roads, reducing human disturbance related to all types of road use; (5) monitoring and research; and (6) protection of nesting pairs from human disturbance, as well as continued closure of the watershed to unsupervised public access.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All key habitat (cliffs, rock outcrops, natural open habitats, and non-forested [open] wetlands) for the peregrine falcon within the municipal watershed is in reserve status. No changes in acreage of potential key habitat for the peregrine falcon will occur under the HCP, although the overall quality of many open habitats that could be used for foraging should increase as a consequence of placing all surrounding forest in reserve status. In addition, both foraging and nesting habitat quality for the peregrine falcon is expected to improve through the decrease in human activity throughout the watershed.

Disturbance Effects

The primary activities that may result in disturbance, and possibly take, of peregrine falcons in the watershed under the HCP include any operations that involve human activities on roads or in or near suitable foraging or nesting habitat when in use, including the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years, with the potential for more removal later; (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (7) routine road use.

The likelihood of disturbance to any actively nesting peregrine falcon pair in the watershed is expected to be very low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) protection of active peregrine falcon nest sites from human disturbance - if peregrine falcons eventually nest within the municipal watershed, the City will not harvest or cut trees or construct roads within 0.5 mile of a known active peregrine nest site between March 1 and July 31 or within 0.25 mile at other times of the year; (2) elimination of commercial logging activities (including log hauling) from the watershed; (3) the City's policy restricting unsupervised public access to the municipal watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) any watershed operations near any cliffs and rock outcrops require a 200-foot buffer zone, in which activities will be restricted to minimize the potential for habitat impacts or disturbance to peregrine falcons.

Injury/Mortality
Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of, any peregrine falcon resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low.

Other Effects
If peregrine falcon reproductive activity is documented within the Cedar River Municipal Watershed, nests will be monitored to provide information that can be used to develop guidelines to minimize disturbance. The monitoring and research program included in the HCP (Section 4.5) will, through adaptive management (Section 4.5.7), be used to determine if the mitigation and minimization strategies for the peregrine falcon are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

Summary/Conclusion
The HCP protects all potential nesting and foraging habitat for peregrine falcons in the municipal watershed, including all cliffs, rock outcrops, natural open habitats, and open wetlands. The 90,546-acre municipal watershed is also contiguous with other protected lands, especially to the north, that are included within the Federal late-successional reserve system. Apparently-suitable habitat occurs within the watershed, and the Service expects this habitat to be colonized by nesting pairs if the regional population of peregrine falcons continues to expand.

The Service expects that HCP to have a positive influence on local populations of peregrine falcons, and therefore, believes the HCP should contribute to the continued recovery of the peregrine falcon population on a regional level.

Group #11 – Grizzly Bear
Introduction
No comprehensive survey has been conducted to determine the presence or absence of grizzly bears in the Cedar River Municipal Watershed, and no incidental observations have been confirmed to date. In addition, despite the fact that grizzly bears are relatively easy to identify by sight and/or field evidence, the species has not been detected in the watershed, despite extensive field activity.

Therefore, it is unlikely that grizzly bears are presently breeding, foraging or denning in the Cedar River Municipal Watershed on any consistent basis. However, the southernmost portion of the North Cascades Ecosystem Recovery Zone is located approximately 3 linear miles north of the eastern portion of the Cedar River watershed and highly reliable grizzly bear sightings have occurred both north and south of the watershed during the last ten years. Therefore, although no reliable observations of this type of activity have been documented in the watershed, a reasonable possibility exists that individual grizzly bears may occasionally use the municipal watershed as a travel or dispersal corridor.

Grizzly bears typically establish large home ranges that may include up to 1,500 square miles and are also known to disperse over long distances. The relative size of the municipal watershed (141 square miles) compared with potential home range size would suggest that the watershed, in itself, would be unlikely to support resident grizzly bears (might be included in a home range) and might more adequately meet the requirements of dispersing individuals, serving as a dispersal corridor connecting larger blocks of suitable habitat. Both resident and dispersing bears utilize a wide variety of habitats, ranging from open, non-forested types to older, closed canopy forest, on a seasonal basis. Although both resident and dispersing bears might, at times, utilize the majority of forested and non-forested habitat types over the entire elevation range within the watershed, potential key habitats present in the Cedar River Watershed are considered to include upland meadows, talus, persistent shrub communities, emergent wetlands, riparian areas, and closed canopy forest, especially mature to old-growth forest stages. Other habitat types present in the watershed are considered secondary.

Human disturbance (e.g., vehicle traffic, recreational activities) has been identified as a major factor influencing the suitability and use of habitat by grizzly bears. The availability of core areas, comprised of habitat that is more than 0.3 miles from open roads, motorized trails, or high-use hiking trails, and measures of road density have been used recently by federal agencies to evaluate and compare the potential suitability, relative to human disturbance, of habitat for the grizzly bear on a seasonal basis. Significantly, because the primary function of the Cedar River Watershed is to supply drinking water to the City of Seattle and the surrounding region, the types and extent of human activities conducted within the municipal watershed differ substantially from those taking place on many nearby lands, especially those areas open to commercial timber harvest and/or a wide variety of public recreational activities. Mortality of grizzly bears due to human activities such as hunting, hiking or vehicle collisions is the primary factor reducing recovery of grizzly bears in grizzly bear habitat. Closure of the watershed to all hunting, including tribal hunting, and reducing the number of drivable roads which may lead to bear/vehicular travel are two significant aspects of the HCP that will improve habitat for grizzly bears in the HCP area.

Therefore, the most significant factors associated with the Cedar River Municipal Watershed relative to protection of the grizzly bear in the Washington Cascades are 1) the fact that the municipal watershed is located in the central Washington Cascades within a potential dispersal corridor between the Recovery Zone and several areas of protected habitat to the south (e.g., Mt. Rainier National Park) which may play a significant role in linking important areas of grizzly bear habitat within the region; (2) the substantially lower level (and type) of human disturbance occurring within the watershed relative to surrounding areas; this includes a substantially lower risk of grizzly bear mortality due to shooting or vehicle collision, and (3) the protection of all key habitats.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the grizzly bear are detailed in Section 4.2.2 of the HCP and summarized below: (1) elimination of timber harvest for commercial purposes within the watershed, virtually eliminating large scale habitat impacts and substantially reducing disturbance and human-caused grizzly bear mortality resulting from road use; (2) removal of 38 percent of watershed roads, thereby providing additional core habitat and reducing disturbance levels; (3) continued closure of the municipal watershed to unsupervised public access, thus essentially eliminating disturbance and reducing human-caused grizzly bear mortality resulting from recreational activity; (4) protection of all non-forested key habitats; (5) protection of all existing old-growth forest which also serves to protect inclusions of non-forested key habitat; (6) natural maturation of second-growth forests into mature and late-successional seral stages, thus reestablishing more natural ecosystem function; (7) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; (8) protection of denning bears from human disturbance; and (9) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the watershed, all forests outside developed areas, including all 13,889 acres of old-growth forest, are in reserve status,. As a result, all key habitat (upland meadows, talus, persistent shrub communities, emergent wetlands, riparian areas, and closed canopy forest, especially mature to old-growth forest stages), as well as secondary habitat, for the grizzly bear within the municipal watershed is in reserve status.

The HCP protects all forested and non-forested habitat, outside limited developed areas, in the watershed, thereby protecting all potential key habitat, as well as other secondary and potential habitat for the grizzly bear in the Cedar River Municipal Watershed. A majority of this habitat is found within the spotted owl Critical Habitat Unit (CHU) in the higher elevation, eastern portion of the watershed. Protection of key habitat in the CHU is also of primary significance because the CHU is the most remote and least roaded part of the watershed. Also, because of its proximity to the Alpine Lakes Wilderness Area, the CHU is the area of the watershed most likely to be occupied by colonizing grizzly bears or traversed by dispersing or transient individuals.

The HCP also benefits grizzly bears through the restoration and/or development of certain key habitats in the municipal watershed. The HCP is expected to result in short- and long-term benefits to grizzly bears through: (1) natural maturation of second-growth forests into mature and late-successional seral stages, especially in aquatic buffers and riparian areas; (2) management actions designed to restore more-natural functioning in riparian ecosystems; and (3) management actions designed to accelerate the development of mature, late-successional, and old-growth characteristics in second-growth forests.

Grizzly bears are omnivorous and opportunistic foragers, including vegetation, live prey, and carrion in their regular diet. Ungulates, including elk and deer, typically comprise a substantial portion of the grizzly bear diet (either live or as carrion). Both elk and black-tailed deer populations are present in the watershed and, although their habitat use patterns differ, they both utilize a range of open habitats (for foraging) and closed forests (for cover). High levels of commercial timber harvest create an artificially high abundance of herbaceous and shrub forage as compared with more natural systems, and ungulate populations typically respond accordingly. However, because a major focus of the HCP is the protection of old-growth dependent species and the protection and restoration of naturally functioning, late-successional and old-growth dominated ecosystems, ungulate populations favored in early successional stage forests, in general, will not sustain the relatively high numbers of animals present in recent years within the previously harvested areas of the watershed.

Despite a decrease in early seral stage forest habitat, especially in the upper watershed, both elk and deer populations will continue to exist under the HCP management regime and will re-equilibrate with the maturing forest landscape, presumably at some lower population level. This particular aspect of habitat maturation on ungulate populations will not especially favor the grizzly bear, because types of open habitat other than harvest units are limited in the watershed. However, future habitat conditions, and resultant wildlife populations, within the watershed will be more similar to those expected in the unharvested, native coniferous forest ecosystems to which the grizzly bear is adapted. Also, despite the decrease of early- and mid-seral forest habitat within the watershed over time, much of the land adjacent to the watershed, especially to the south and east, will continue, presumably, to be managed as commercial timberland. Under this type of land management regime early- and mid-seral forest habitats, as well as relatively higher numbers of ungulates as a prey base, will be available to grizzly bears well within their potential home range.

Disturbance Effects

Grizzly bears require areas substantially free from human disturbance, especially during denning periods. Areas more than 0.3 mile from a road are termed "core" habitat (see below) and are considered most important for these bears (Interagency Grizzly Bear Committee 1994). Unsupervised public access to the municipal watershed is not allowed except within the Rattlesnake Lake Recreation Area and below the water supply intake at Landsburg on the western administrative boundary. Therefore, recreational activities (e.g., hiking, motor and trail bikes, camping) are restricted within the watershed. Some hiking trails, including a section of the Pacific Crest Trail at the eastern end of the watershed, currently exist or are planned for development along selected sections of the watershed boundary. No recreational trails are currently present or planned within the interior of the municipal watershed. In addition, all road access points to the municipal watershed are gated (locked) at the administrative boundary and access is by permit only.

Since no commercial timber harvest will be conducted within the municipal watershed and virtually all log hauling will be eliminated, road use and traffic levels will be significantly different from that incurred on commercial forest transportation systems and recreational lands. The types of traffic on the watershed transportation system will result primarily from: 1) road maintenance and limited construction activities for road improvements and decommissioning; (2) silivicultural treatment projects (3) surveillance activities related to drinking water protection; (4) research and monitoring projects; and (5) other routine operational activities. With the exception of routine road maintenance, limited road construction and silvicultural projects, and in some cases, operational activities, light vehicle traffic will predominate. Many roads, especially at higher elevations and in more remote areas of the watershed will receive minimum vehicle trips in most years. Most vehicle traffic will, in all probability, be confined to major roads, road systems, and sampling routes most directly associated with operating the water supply system.

A conservative, preliminary analysis estimating the availability of core habitat within the watershed, which considered all watershed roads (not differentiated by activity level) and all habitat types (open water excluded), indicates that a total of 6,554 acres of core habitat, in 51 individual blocks, currently exists within the watershed. The individual blocks of core habitat included in this total range in size from less than one acre to more than 2,000 acres. The four largest individual blocks of contiguous core habitat within the watershed, totaling 5,061 acres (77 percent), are located mostly in the CHU. These four blocks of core habitat contain 2,038, 1,616, 960, and 447 acres and are located in the areas of Mt. Baldy/Abiel Peak/Tinkham Peak on the northern boundary, Findley Lake, Meadow Mountain, and Goat Mountain, respectively. The remaining 1,493 acres (23 percent) of habitat greater than 0.3 miles from a road, contained in 47 smaller blocks, is scattered throughout other areas of the watershed, but no single block is greater than 200 acres in size.

Under the HCP, after projected road removal is completed, a total of 12,975 acres of core habitat (67 individual blocks), representing an increase of 6,421 acres (98 percent increase) from current conditions, will exist by the end of the 50-year HCP term. In fact, most of the substantial increase of core habitat will be realized during the first two decades of the HCP, solely as a result of an aggressive road decommissioning program. The individual blocks of core habitat included in this projected total will range in size from less than one acre to more than 3,000 acres. The five largest individual blocks of contiguous core habitat, totaling 8,353 acres (64 percent of total) will, as before, be mostly located within the CHU. This acreage will consist of large blocks containing 3,001, 2,418, 1,221, 932, and 781 acres. The increases in core habitat will accrue primarily to the large blocks of contiguous core habitat in the same areas as indicated above with the addition of one unit in the upper Taylor Creek Basin. This analysis of projected core habitat indicates that each of the original existing blocks of core habitat will increase in area under the HCP and a fifth block of core habitat greater than 500 acres in size will be created. An additional 4,622 acres of habitat (36 percent of total) greater than 0.3 miles from a road will be present, distributed in other areas of the watershed, including six individual blocks, each greater than 300 acres in size.

The amounts of core habitat potentially available to grizzly bears within the Cedar River Municipal Watershed under current conditions and as expected under the HCP, as presented immediately above, are considered conservative estimates. All roads in the watershed were considered "open" and not differentiated as to type and level of use for the analyses, nor were they classified by seasonal usage. Therefore, since the maximum amount of road was used in the analyses, the area estimates represent the minimum amount of core habitat that would be available to grizzly bears within the watershed during any given season or year. Because many roads, especially at higher elevations and in more remote areas of the watershed, are not driveable or, will in all probability receive a minimum number of vehicle trips in most years, they could be classified as "impassable" or "restricted" and considered as part of core habitat. In such case, the estimates of core habitat for both current and future conditions under the HCP would increase substantially.

Thus, the primary activities under the HCP that may result in disturbance, and possibly of take, of grizzly bears that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat, and include the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later; (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year after year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (7) routine road use; and (8) some types of research and monitoring.

However, the likelihood of disturbance to any actively denning grizzly bears in the watershed is expected to be low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and avoidance of silvicultural treatments, road management, and other operational activities within 1.0 mile of active grizzly bear dens from October 1 to May 30 and within 0.25 mile during the rest of the year; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access (including no access for tribal hunting) to the Cedar River Municipal Watershed, which reduces potential mortality or injury from motor-vehicle collisions and reduces the ability of poachers and trespassers to harass or harm bears; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement and use over the long term. Road removal, particularly in the upper municipal watershed (within the CHU), and closure of roads to public use is important for three reasons – (1) bears are potentially more likely to occur in the upper municipal watershed, (2) the greatest amount of existing core habitat occurs in the upper municipal watershed, and (3) the greatest opportunity to produce additional core habitat through selective road decommissioning also occurs in the upper municipal watershed.

Injury/Mortality

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of injury to or death of any grizzly bear resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low. Further, because of the restriction on public access, and the closure of the watershed to hunting, including tribal hunting, the likelihood of injury or death of grizzly bears through bear/vehicle collisions or shooting, either intentional or accidental, is expected to be very low.

Other Effects

The monitoring and research program included in the HCP (Section 4.5) will, through adaptive management, be used to determine if the mitigation and minimization strategies for the grizzly bear are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives. If grizzly bear dens are discovered within the Cedar River Municipal Watershed, they will be monitored to provide information that can be used to develop guidelines to minimize disturbance.

Summary/Conclusion

The HCP maintains, and over time substantially increases, both the total number and size of many individual, large blocks of core habitat within the watershed, especially within the CHU. Although blocks of core habitat will be distributed throughout the watershed, the largest blocks of contiguous core habitat will be located within the CHU in the eastern section. All elements of grizzly bear key habitat will be available within the CHU and within these larger blocks of core habitat, in particular. In addition, several blocks of contiguous core habitat within the CHU will also be contiguous with other blocks of habitat to the north, east, and south of the watershed, including lands in the federal Late-Successional Reserve (LSR) system. This landscape connectivity may benefit the grizzly bear population on a more regional level by facilitating movement and dispersal of individuals between the municipal watershed and other watersheds to the north, east, and south (especially the Alpine Lakes Wilderness Area to the north).

Furthermore, the lack of human activity in the watershed could be a crucial factor in allowing grizzly bears to establish residency in the watershed. Closure of the watershed to the public eliminates the single greatest threat (human interference) to establishment of a viable grizzly bear population in the WA Cascades. If a bear(s) were to become resident and find adequate food resources in the watershed, that bear(s) is likely to become a source population within the WA Cascades.

Group #12 – Gray Wolf

Introduction

No comprehensive surveys have been conducted to determine the presence or absence of gray wolves in the Cedar River Municipal Watershed, and no incidental observations have been confirmed to date. In addition, because the species is relatively easy to identify by sight and/or by calls, and yet has not been detected despite extensive field activity, it is unlikely that gray wolves are present in the Cedar River Municipal Watershed on any consistent basis. However, this assessment does not negate the possibility that individuals may occasionally use the municipal watershed as a travel or dispersal corridor. Gray wolves typically have large home ranges and utilize a wide variety of habitats ranging from open, non-forested types to older, closed canopy forest, as long as an adequate ungulate prey base is present and human activity is low. Den sites have been observed in sandy soils in river bottom lands, in hollow logs and hollow trees typically present in late-successional and old-growth forests, and in caves. Potential key habitats present in the Cedar River Watershed include rock outcrops, upland meadows, persistent shrub communities, riparian areas, and old-growth forests. Secondary habitats include other forested areas, which could be used for cover or dispersal.

Human disturbance (e.g., vehicle traffic, recreational activities) has been identified as a major factor influencing the suitability and use of habitat by gray wolves. Measures of road density have been used recently by federal agencies to evaluate and compare the potential suitability, relative to human disturbance of habitat for the gray wolf (Mladenoff et al. 1995). Optimal habitat is considered to be areas with a density of open roads less than 1 mi/mi^2. Current road densities for the watershed, by sub-basin, are described by Map 11 of the HCP Map Volume, and the accompanying table.

Significantly, because the primary function of the Cedar River Watershed is to supply drinking water to the City of Seattle and the surrounding region, the types and extent of human activities conducted within the municipal watershed differ substantially from those taking place on many nearby lands, especially those areas open to commercial timber harvest and/or a wide variety of public recreational activities.

The most significant factors associated with the Cedar River Municipal Watershed relative to protection of the gray wolf in the Washington Cascades are 1) the fact that the municipal watershed is located in a potential zone of recolonization, and is a potential dispersal corridor between the population in the North Cascades and several areas of protected habitat to the south (e.g., Mt. Rainier National Park) which may play a significant role in linking important areas of wolf habitat within the region; (2) the substantially lower level (and type) of human disturbance occurring within the watershed relative to surrounding areas; and (3) the protection of all key habitats.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the gray wolf are detailed in Section 4.2.2 of the HCP and summarizedbelow: (1) elimination of timber harvest for commercial purposes within the watershed, virtually eliminating large scale habitat impacts and substantially reducing disturbance resulting from road use; (2) removal of 38 percent of watershed roads, thereby reducing disturbance levels ; (3) continued closure of the municipal watershed to unsupervised public access, thus essentially eliminating disturbance resulting from recreational activity; (4) protection of denning wolves from human disturbance; (5) protection of all non-forested key habitats; (6) protection of all existing old-growth forest, which provides denning sites and also serves to protect inclusions of non-forested key habitat; (7) natural maturation of second-growth forests into mature and late-successional seral stages, thus reestablishing more natural ecosystem function and providing more denning sites; (8) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; and (9) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the watershed, all forests outside developed areas, including all 13,889 acres of old-growth forest, are in reserve status,. As a result, all key habitat for the gray wolf (rock outcrops, upland meadows, persistent shrub communities, riparian areas, and old-growth forest) within the municipal watershed is in reserve status, as well as all secondary habitat outside limited developed areas. The amount of optimal habitat may increase as road densities, thus human activities related to roads, are reduced over time. Current road densities, by sub-basin, are described in Map 11 of the HCP Map Volume, and the accompanying table.

The majority of the key habitat for wolves is found within the spotted owl CHU in the higher elevation, eastern portion of the watershed. Protection of key habitat in the CHU is also of primary significance to the gray wolf because the CHU is the most remote and least roaded part of the watershed (see effects analysis for Group #11, grizzly bear). Also, because of its proximity to the Alpine Lakes Wilderness Area, the CHU is the area of the watershed most likely to be occupied by colonizing gray wolves or traversed by dispersing or transient individuals.

The HCP will also benefit wolves through the restoration and/or development of certain potential key habitats for gray wolves in the municipal watershed. The proposed HCP is expected to result in short- and long-term benefits to gray wolves through: (1) natural maturation of second-growth forests into mature and late-successional seral stages, providing additional den sites and potentially better foraging conditions for ungulates than mid-seral forest; (2) management actions designed to restore a more naturally functioning forest ecosystem; and (3) management actions designed to accelerate the development of mature, late-successional, and old-growth characteristics in second-growth forests.

Gray wolves are carnivorous predators that typically rely on ungulates (elk and deer in this area) as a primary component of their diet and require adequate populations of these species within their range in order to sustain healthy packs and a viable population. Both elk and black-tailed deer populations are present in the watershed. Although patterns of habitat use differ, both species use a range of open habitats for foraging and closed-canopy forest, and/or dense understory vegetation for cover. High levels of commercial timber harvest create an artificially high abundance of herbaceous and shrub forage for deer and elk as compared with more natural systems, and ungulate populations typically respond accordingly.

Because a major focus of the HCP is the protection of old-growth dependent species and the protection and restoration of naturally functioning, late-successional and old-growth dominated ecosystems, however, ungulate populations favored in early-successional stage forests, in general, will not sustain the relatively high numbers of animals present in recent years within the previously harvested areas of the watershed.

Despite a decrease in early-seral stage habitat, especially in the upper watershed, both elk and deer populations will continue to exist under the HCP management regime and will re-equilibrate with the maturing forest landscape, presumably at some lower population level. Because types of open habitat other than harvest units are limited in the watershed, this particular effect of forest habitat maturation on ungulate populations will not especially favor the gray wolf. Several considerations, however counteract this reduction in prey base: (1) that the overall watershed landscape will become, over the term of the HCP, more similar to the natural landscape and prey availability to which wolves in the region were adapted, and (2) considerable early seral forest habitat is being created by commercial timber operations on land adjacent to the watershed, supporting populations of ungulates that are likely larger than those present prior to commercial timber harvest in the region. Considering the large home range of wolf packs and the high availability of ungulate prey in areas adjacent to the watershed, it is possible that the reduction of early seral habitat within the watershed may be less important to future wolf populations than the reduction in road density, decrease in human activity on roads, potential increase in the amount of security habitat, and potential increase in denning sites during the term of the HCP.

Disturbance Effects

Gray wolves require areas away from human disturbance, especially during reproductive (denning) periods. Wolves have a tendency to avoid areas with greater than approximately 1 mi/mi^2 of *open* roads (Mladenoff et al. 1995). Uses of forest roads and trails in this region that could most impact wolves include recreational activities and log haul for commercial timber harvest, and potential impacts on wolves are dependent on the level of these activities. When the levels of these types of human activities are very low, an "open" road may be treated by wolves as a closed road, effectively increasing the potential optimal for habitat in an area. Current road densities for the watershed, by sub-basin, are described by Map 11 of the HCP Map Volume, and the accompanying table.

Unsupervised public access to the municipal watershed is not allowed except within the Rattlesnake Lake Recreation Area and below the water supply intake at Landsburg on the western administrative boundary. Therefore, recreational activities (e.g., hiking, motor and trail bikes, camping, hunting and fishing) are restricted within the watershed. Some hiking trails, including a section of the Pacific Crest Trail at the eastern end of the watershed, currently exist or are planned for development along selected sections of the watershed boundary. No recreational trails are currently present or planned within the interior of the municipal watershed. In addition, all road access points to the municipal watershed are gated (locked) at the administrative boundary and access is by permit only.

Since no commercial timber harvest will be conducted within the municipal watershed under the HCP, and virtually all log hauling will be eliminated, road use and traffic levels will be significantly different from that incurred on commercial forest transportation systems and recreational lands. The types of traffic on the watershed transportation system will result primarily from: 1) road maintenance and limited construction activities for road improvements and decommissioning; (2) silvicultural treatment projects (3) surveillance activities related to drinking water protection; (4) research and monitoring projects; and (5) other routine operational activities. With the exception of routine road maintenance, limited road construction and silvicultural projects, and in some cases, operational activities, light vehicle traffic will predominate. Many roads, especially at higher elevations and in more remote areas of the watershed, will receive very few vehicle trips in most years. Most vehicle traffic will, in all probability, be confined to major roads, road systems, and sampling routes most directly associated with operating the water supply system.

While only a few areas of the watershed may qualify in the future as optimal habitat for wolves when only road density is considered, the relatively minor use of many roads, particularly in the CHU, is likely to allow certain areas to serve as optimal habitat. In addition, large blocks of habitat at least 0.3 miles from roads will increase substantially under the HCP as a result of the road decommissioning program (see the effects analysis for Group #11, grizzly bear).

The primary activities under the HCP that may result in disturbance, and possibly take, of gray wolves that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat, and include the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year after year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (7) routine road use; and (8) some types of research and monitoring.

The likelihood of disturbance to any actively denning gray wolves in the watershed is, however, expected to be very low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and avoidance of silvicultural treatments, road management, and other operational activities within 1.0 mile of active gray wolf dens from March 1 to July 31 and within 0.25 mile during the rest of the year; (2) restriction of activities near any known rendezvous sites and development of a mitigation plan with the Service for any wolves discovered in the watershed; (3) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (4) the City's policy restricting unsupervised public access (including no access for hunting, including tribal hunting) to the Cedar River Municipal Watershed, which reduces potential mortality or injury from motor-vehicle collisions and also reduces the ability of poachers and trespassers to harass or harm wolves; and (5) removal of 38 percent of forest roads, which will reduce road densities and the amount of disturbance related to road maintenance, improvement, and use over the long term. Road removal, particularly in the upper municipal watershed (within the CHU), and closure of roads to public use is important for three reasons – (1) wolves are potentially more likely to occur in the upper municipal watershed, (2) optimal habitat is more likely to be present in the upper watershed, and (3) the greatest opportunity to produce security habitat through selective road decommissioning also occurs in the upper municipal watershed.

Injury/Mortality
Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of, any gray wolf resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low. Accidental and intentional shooting of wolves is one of the primary mortality factors of wolves, especially in areas with high human population densities. The closure of the municipal watershed to hunting of any kind, including tribal hunting, essentially eliminates this serious mortality factor.

Other Effects
The monitoring and research program included in the HCP (Section 4.5) will, through adaptive management (Section 4.5.7), be used to determine if the mitigation and minimization strategies for the gray wolf are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives. If gray wolf dens are discovered within the Cedar River Municipal Watershed, they will be monitored to provide information that can be used to develop guidelines to minimize disturbance.

Summary/Conclusion
The Service believes the HCP will have a net positive effect on gray wolves in the Washington Cascades. The HCP creates a large block of older forest in the CHU. This block is contiguous with lands to the north, east, and south of the watershed at its upper (eastern) end, including lands within the federal Late-successional Reserve system (LSR). This landscape connectivity may benefit the gray wolf population on a more regional level by facilitating movement and dispersal of individuals between the municipal watershed and other watersheds to the north, east, and south (especially the Alpine Lakes Wilderness Area to the north).

Furthermore, the lack of human activity in the watershed could be a crucial factor in allowing gray wolves to establish residency in the watershed. Closure of the watershed to the public eliminates the single greatest threat (human interference) to establishment of a viable wolf population in the WA Cascades. If a wolf(s) were to become resident and find adequate food resources in the watershed, that wolf(s) is likely to become a source population within the WA Cascades.

Group #13 – Harlequin Duck

Introduction
Harlequin ducks are known to be present during breeding season in the Cedar River Municipal Watershed on the mainstem Cedar River to at least an elevation of 2,100 ft, and one major tributary downstream of Cedar Falls, and to successfully breed occasionally. Harlequins winter on salt water and nest along fast-moving streams and rivers, placing their nests on the ground in dense vegetation, in piles of woody debris, in undercut stream banks, between rocks, and in hollow trees or tree cavities (Section 3.6). Potential key habitat for the harlequin duck during the breeding season, used for nesting and rearing of young birds, are fast-flowing rivers and streams and associated bank-side vegetation, especially within mature, late-successional, and old-growth forests.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for harlequin ducks are described in Section 4.2.2 and summarized below: (1) protection of all key habitat (streams and associated riparian habitat); (2) elimination of timber harvest for commercial purposes within the watershed reducing the overall level of habitat disturbance and the likelihood of disturbing nesting or foraging activities; (3) protection of all existing forested habitat in reserve forest status, allowing the restoration of natural function in riparian areas; (4) natural maturation of second-growth forests into mature and late-successional seral stages, potentially recruiting increased amounts of large woody debris that may serve as loafing and nesting sites and improving stream habitat function; (5) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas, potentially hastening the development of large woody debris in riparian areas; (6) retention, creation, and recruitment of logs and large snags during silvicultural treatments, supplying large woody debris which may serve as loafing sites in streams and nesting sites on banks; (7) stream restoration and bank stabilization projects; (8) road improvements and improved road maintenance, reducing sediment loading to streams; (9) guidelines and prescriptions designed to reduce sediment production during watershed management activities; (10) removal of 38 percent of watershed roads, reducing the risk of disturbance to nesting ducks and reducing sediment loading to streams; and (11) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All lands outside limited developed areas, including all aquatic and riparian ecosystem elements, are in reserve status. As a result, all key habitat for the harlequin duck within the municipal watershed (fast-flowing streams, especially where associated with mature, late-successional and old-growth forests, and streamside habitat) is in reserve status. In addition, silvicultural activities are restricted within 50 feet of streams to minimize the potential for habitat impacts or disturbance to key wildlife species, including harlequin ducks.

The HCP includes management actions designed to help restore and enhance aquatic and riparian habitats. Stream bank stabilization projects, placement of large woody debris (LWD), a stream bank revegetation program, and a program of restoration planting, restoration thinning, and ecological thinning in riparian areas are expected to help (1) restore natural aquatic and riparian ecosystem functioning and (2) accelerate the development of mature or late-successional characteristics in younger second-growth forests in riparian areas. Other provisions in the HCP, including, road decommissioning (removal), road improvements, improved road maintenance, and limitations on activities near streams, will also foster reestablishment of naturally functioning hydrologic regimes within the landscape of the Cedar River Watershed. Restoration of a naturally functioning aquatic ecosystem will benefit the harlequin duck over the long term. However, over the short term, these management interventions may cause some localized decline in habitat function. Site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions in the watershed to ensure that habitat for harlequin ducks will be minimally impacted.

Silvicultural treatments in riparian areas may result in negative impacts on streamside habitat and/or water quality. Such impacts may occur if vegetation canopy cover is reduced to an extent that leads to increased rates of soil erosion or increased solar heating of stream water. No commercial timber harvest will occur in the watershed, however, and, in order to eliminate or minimize any short-term impacts to harlequin duck habitat, mechanical equipment and cutting of trees are restricted within 50 feet of streams, and interdisciplinary teams will evaluate and plan silvicultural and operational projects in any key habitat, especially within riparian zones. One important set of constraints is that, during restoration or ecological thinning activities, no mechanized equipment will be allowed within 50 ft of streams, no tree removal that has the potential to reduce streambank stability will be allowed, and no tree removal will be allowed within 25 ft of any stream. In addition, the HCP also includes a comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) and other management guidelines (Section 4.2.2) intended to minimize the potential for erosion and mass wasting associated with silvicultural treatments in riparian areas. Implementing these prescriptions and guidelines will reduce the rate of sediment loading to aquatic systems, and help maintain and improve water quality.

Road construction, repair, maintenance, and decommissioning can all affect stream and riparian areas. The Watershed Assessment Prescriptions (Appendix 16) and other management guidelines (Section 4.2.2) are intended to minimize the probability of erosion and mass wasting associated with roads. Following these prescriptions and guidelines, along with implementing the program to improve and decommission roads (Section 4.2.2), will reduce the rate of sediment loading to aquatic systems and help maintain high water quality. It is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads come near streambanks, but improved road maintenance under the HCP will help mitigate those impacts.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of harlequin ducks in the watershed include any operations that involve human activities on roads or in suitable habitat. Such activities include the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) riparian and instream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) some types of monitoring and research.

The likelihood of disturbing any actively nesting harlequin duck pairs in the watershed is expected to be low because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of harlequin duck habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed, reducing the overall level of disturbance;

(3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, reducing potential disturbance during nesting; and (4) removal of 38 percent of forest roads, which will reduce the potential for negative effects resulting from road maintenance, improvement, and use over the long term.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of disturbance to, direct injury to, or death of any harlequin ducks as a result of silvicultural treatments, road management, or other operational activities is expected to be very low. An occasional harlequin duck nest might be destroyed inadvertently as a result of management actions in streamside habitats, but such events are expected to be very rare.

Summary/Conclusion

Overall, the population effects on the harlequin duck population are expected to be positive. Key stream and adjacent riparian habitat will be protected and improve in quality over the term of the HCP. Continued low levels of human activity in the watershed will minimize the potential for disturbance to nesting pairs. In addition, the landscape connectivity afforded both fish and wildlife using the aquatic and riparian ecosystem in the municipal watershed will also benefit harlequin ducks by increasing potential foraging habitat and food availability, as well as by providing restored and more mature streamside vegetation that should increase the availability of nest sites. The increase of potential foraging, nesting, and brooding habitat in the Cedar River Municipal Watershed provided by the HCP will substantially augment the efforts of state and federal agencies and other organizations to conserve stream, riparian, and forested habitat in the region and especially in the vicinity of the Cedar River watershed. Such efforts are of particular significance in view of the consistently increasing pressure from urbanization and other types of development that is expanding eastward from the Seattle/Tacoma metropolitan areas.

Group #14 – Great Blue Heron

Introduction

The great blue heron is 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 large coniferous or deciduous trees, typically near water, and feed along the edges of lakes, ponds, streams, and wetlands (Section 3.5.6). Great blue herons typically use habitats below the Pacific silver fir zone, at lower elevations, and may sometimes forage many miles from their nesting areas. Potential key habitat for this species in the municipal watershed includes aquatic and riparian habitats, and secondary habitat includes older seral upland forest, which may be used for nesting.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for great blue herons are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All lands outside limited developed areas, including all aquatic and riparian ecosystem elements, are in reserve status. As a result, all key habitat for the great blue heron within the municipal watershed (aquatic and riparian habitats) is in reserve status. In addition, protection in reserve status of all forested areas of the watershed will result in increased availability of nesting trees for this species.

Protection of, and improvements in, water quality and streamside habitat are of particular importance for foraging and reproduction in this species. Also important are (1) elimination of timber harvest for commercial purposes within the watershed, (2) stream and riparian restoration projects, (3) reduction of sediment loading to streams and wetlands, and (4) gradual development of mature, functional riparian forests.

Short-term and long-term gains in the quality and/or quantity of aquatic and riparian habitats are expected under the HCP as a result of the natural development of mature and late-successional forest in riparian areas. Development of mature and late-successional forest significantly contributes to the reestablishment of a more naturally functioning ecosystem, thus potentially benefitting great blue herons through population increases of fish and amphibian prey species. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of the HCP, "riparian" zones of 300 ft on Type I-III waters, 150 ft on Type IV waters, and 100 ft on Type V waters were established using GIS data, and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase.

The HCP also includes management actions designed to help restore and/or enhance aquatic and riparian habitats. Stream bank stabilization, placement of large woody debris, stream bank revegetation, restoration planting and thinning, and ecological thinning in riparian areas are all expected to contribute to accelerated reestablishment of more natural aquatic and riparian ecosystem functions. The reestablishment of more natural aquatic ecosystem function, combined with the development of additional mature and late-successional characteristics in younger second-growth forests, especially in streamside riparian areas, will reestablish a more naturally functioning forest ecosystem throughout the watershed landscape, thereby improving habitat quality and availability for prey species. In addition, more potential great blue heron nest sites will become available as tall trees persist and continue to develop near aquatic habitats.

Some silvicultural treatments in riparian areas are expected to result in short-term negative impacts on streamside habitat and/or water quality, and thus, may be detrimental to herons. Such impacts may occur, for example, if reduced canopy cover leads to increased solar heating of stream water, or to increased rates of soil erosion. The following measures included in the HCP, however, should eliminate or minimize any short-term impacts of such management activities on habitat for great blue herons or their aquatic prey: (1) no harvest for commercial purposes in riparian or other areas, (2) restriction of the use of mechanical equipment and cutting of trees within 50 feet of streams, and (3) the use of interdisciplinary teams to evaluate and plan silvicultural and operational projects in any key habitat, especially within riparian zones. As a result, potential impacts to habitat or water quality resulting from removal of vegetative cover will be virtually eliminated. One important set of constraints is that, during restoration or ecological thinning activities, no mechanized equipment will be allowed within 50 ft of streams, and no tree removal that has the potential to reduce streambank stability will be allowed. Also, the Watershed Assessment Prescriptions (Appendix 16) and other management guidelines (Section 4.2.2) are intended to minimize erosion and mass wasting associated with silvicultural treatments in riparian areas. Following these prescriptions will reduce the rate of sediment loading to aquatic systems, and help maintain high water quality.

Road repair, maintenance, and decommissioning and new construction, if any occurs, can all be expected to have short-term negative effects upon streams, wetlands and riparian areas. Again, however, the Watershed Assessment Prescriptions (appendix 16) and other management guidelines (Section 4.2.2), however, are also intended to minimize the probability of erosion and mass wasting associated with roads. It is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads come near streambanks, but improved road maintenance and a lower level of use under the HCP than what occurred historically with commercial timber harvest will help mitigate those impacts.

Both the hydrologic regimes of, and habitat conditions within, many wetlands and other aquatic habitats in the municipal watershed have likely been affected to some degree by past timber harvest, especially removal of all trees near wetlands. This observation indicates that an opportunity exists to improve hydrologic and other habitat conditions, contributing to restoration of the more natural conditions that existed prior to harvest. By placing all lands outside of limited developed areas in reserve status, the HCP includes provisions that will serve to protect and/or reestablish forest vegetation adjacent to open wetland systems, retain forested wetlands, and protect hydrologic recharge areas. Conservation measures of this type will allow wetland communities to maintain and/or reestablish, over time, more naturally functioning hydrologic regimes as part of a naturally functioning forest ecosystem similar to what existed in the watershed before the twentieth century. Any changes in the hydrologic regimes of wetland communities affected by the HCP will be the result of natural processes of forest succession.

Silvicultural treatments including (1) restoration planting of about 1,400 acres, (2) restoration thinning of about 11,000 acres, and (3) ecological thinning of about 2,000 acres, are expected to make habitat conditions more suitable in some second-growth forest by increasing the number of suitable nest trees and by maintaining or improving stream temperatures through better shade conditions over the long term. In addition, by the end of the HCP term, older forest habitat will be more evenly distributed throughout the watershed landscape, including the entire elevation range and all stream corridors, than under current conditions.

As described for the common loon (Group #4) and in Section 4.5.6, operation of the reservoir over the last decade or two, which has entailed higher operating elevations in the spring and summer, has affected and is continuing to affect wetlands of the Rex and Cedar River deltas. This kind of effect on wetlands and adjacent forest is characteristic of reservoirs in general, because of large fluctuations in water levels that can vary from year to year. The Service does not expect, although it is possible, that significantly more reduction in the total area of sedge wetlands around Chester Morse Lake will occur, but changes in forest and other vegetation (including willow thickets) around the reservoir, especially in the deltas, can be expected to continue to change as effects on these habitats lag the changes in reservoir operation that initiated the most recent, ongoing shift of vegetative communities. In the near term, further loss of mature trees along the reservoir margin would potentially reduce the availability of nesting sites, although no great blue herons have been known to nest in this area. Operation of Chester Morse Lake and the Masonry Pool during the term of the HCP will be similar to that which occurred in recent years, however, the wetlands and lakeside forests are probably on the way to reaching a new dynamic equilibrium with the current reservoir operating regime over the long term. Natural maturation of riparian forest and silvicultural intervention to accelerate development of natural riparian forest functions should, over the long term, lead to an overall improvement of conditions for potential nesting around the reservoir compared to current and near-term future conditions.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of great blue herons that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) instream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) some types of monitoring and research.

The likelihood of disturbance to any actively nesting great blue herons in the watershed, however, is expected to be low and short-term in nature, if it does occur, because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of great blue heron habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed, reducing the overall levels of habitat disturbance and human activities; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term. In addition, the Service expects the City to manage operational activities in a manner that minimizes disturbance in the vicinity of active rookeries.

The Service anticipates that disturbance of non-nesting great blue herons within the watershed will occur. However, these effects will be short-term in nature, and as the result of implementing restoration efforts that are expected to have long-term benefits to great blue herons. Because of specific mitigation and minimization measures committed to in the HCP, the Service believes the likelihood of direct injury to, or death of any great blue herons as a result of silvicultural treatments, road management, or other operational activities to be very low.

Summary/Conclusion
Population-level effects on the great blue heron are expected to be positive. Under the HCP, all key aquatic and riparian habitat will be protected and, overall, is expected to improve in quality over time. Water quality will also improve over time as a result of a reduction of sediment input to aquatic habitats through habitat restoration, improved road maintenance, road improvement projects, substantial road decommissioning, and a reduced level of heavy road use under a policy of no commercial timber harvest. Improvements in water quality and aquatic habitat will likely result in population increases of prey populations of great blue heron (fish and amphibians). Any short-term, local impacts to great blue herons resulting from restoration activities in aquatic and riparian areas will be offset by long-term, landscape-level benefits. In addition, measures in the HCP which reduce human activity levels will protect nests in the watershed from human disturbance, increasing the potential for nesting success.

Protection in reserve status of all aquatic and riparian habitats, as well as upland forest, will also improve habitat connectivity, thereby facilitating dispersal and movement of species dependent on aquatic and riparian habitats, including prey of the great blue heron. The substantial degree of habitat protection and water quality and habitat improvement provided under the HCP should thus benefit any nesting great blue herons that may occur in the Cedar River Municipal Watershed. In addition, increases in mature and late-successional forest habitat, especially where closely associated with aquatic systems, should increase the availability of potential nesting areas (with large trees) within the watershed landscape.

Group #15 – Osprey

Introduction
Ospreys have been documented to be present and breeding on a consistent basis in the Cedar River Municipal Watershed for at least the past three decades and were likely present prior to this period. Successfully breeding pairs have been documented at several different nest sites within the watershed during recent years. Potential key nesting habitat for ospreys in the watershed includes mature, late successional, and old-growth forests, especially stands providing snags and large trees within a short distance of water bodies that support an adequate prey base (fish). Snags within the reservoir drawdown zone also provide a limited number of potential nesting and perching sites. Potential key foraging habitat includes lakes, the reservoir, and larger rivers and streams.

Pertinent Mitigation and Minimization Measures
Mitigation and minimization measures for the osprey are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial and Detrimental Effects of the HCP
Habitat Effects
All forests outside limited developed areas are in reserve status. As a result, all key habitat (lakes and streams for foraging and mature to old-growth forest for nesting), as well as potential habitat, for the osprey within the municipal watershed is protected. Although old-growth forest (by definition) will not increase in extent under the HCP, substantial increases in the quantity of mature and late-successional coniferous forest habitat for the osprey are expected. Solely as a result of natural forest maturation, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a fivefold increase (Section 4.2.2). In addition, by the end of the HCP term, older forest habitat will be more evenly distributed throughout the watershed landscape than under current conditions.

Short-term and long-term gains in the quality and/or quantity of aquatic and riparian habitats are expected under the HCP as a result of the natural development of mature forest in riparian areas. Development of mature and late-successional forest significantly contributes to the reestablishment of a more naturally functioning ecosystem, with greater overall potential for utilization by ospreys. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of the HCP, "riparian" zones of 300 ft on Type I-III waters, 150 ft on Type IV waters, and 100 ft on Type V waters were established using GIS data and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase. In addition, under the HCP, some potential osprey habitat in the municipal watershed is expected to benefit from management actions (ecological thinning and restoration) intended to produce mature and late-successional forest habitat characteristics in second-growth forests (Section 4.2.2).

The HCP also includes management actions intended to restore and enhance aquatic and riparian habitats. These actions are intended to improve fish habitat, thereby also improving foraging conditions for ospreys over time. Stream bank stabilization projects, placement of large woody debris, a stream bank revegetation program, and a program of restoration planting, restoration thinning, and ecological thinning in riparian areas is expected to help accelerate (1) the restoration of natural aquatic and riparian ecosystem functioning and (2) the development of mature or late-successional forest characteristics in younger seral-stage forests in riparian areas (Section 4.2.2).

Silvicultural treatments in riparian areas may result in short-term negative effects on streamside habitat and/or water quality. No commercial timber harvest will occur in the watershed, however, to eliminate or minimize any short-term impacts to osprey habitat, interdisciplinary teams will evaluate and plan silvicultural and operational projects in any key habitat, especially within riparian zones. One important set of constraints is that during restoration or ecological thinning activities, no mechanized equipment will be allowed within 50 ft of streams and no tree removal with the potential to reduce streambank stability will be allowed.

Road construction, repair, maintenance, and decommissioning can all impact stream and riparian areas. However, the HCP includes a comprehensive suite of Watershed Assessment Prescriptions and other management guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with roads. Following these prescriptions and guidelines, along with the program to improve many roads and to decommission about 38 percent of existing roads (Section 4.2.2), will reduce the rate of sediment loading to aquatic systems and maintain high water quality. It is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads are adjacent to streambanks, but improved road maintenance under the HCP will help mitigate those impacts.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance to, and possibly the equivalent of take, of ospreys that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) riparian and instream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) some types of monitoring and research.

The likelihood of disturbing any actively nesting ospreys in the watershed is expected to be low and short-term in nature when it does occur because of the specific mitigation and minimization measures committed to in the HCP: (1) protection of known active osprey nest sites from human disturbance, partly through the use of site evaluations and interdisciplinary teams prior to silvicultural or road management activities, and through management of operational activities to minimize disturbance in the vicinity of active osprey nest trees; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed, reducing the overall levels of habitat disturbance and human activities, and thus the chance of disturbance of nesting pairs; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term. If identified, no active or historically active nest trees will be cut, except in unique circumstances when human safety considerations or the protection of facilities in limited developed areas are of substantial or regulatory concern. The Service does not expect this circumstance to arise more that a couple times, at most, over the term of the HCP.

The Service anticipates that disturbance of non-nesting ospreys within the watershed will occur. However, these effects will be short-term in nature, and as the result of implementing restoration efforts that are expected to have long-term benefits to ospreys. Because of specific mitigation and minimization measures committed to in the HCP, the Service believes the likelihood of direct injury to, or death of any ospreys as a result of silvicultural treatments, road management, or other operational activities to be very low.

Summary/Conclusion

Population-level effects on the osprey are expected to be positive. Under the HCP, all key forested and aquatic habitat will be protected and improved in quality over time. In addition, the current substantial amount of watershed forest in fragmented condition will mostly be replaced by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early or mid-seral forest habitat less than 50 years old will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early seral stages as a result of recent commercial logging will mature over the term of the HCP, as no additional commercial harvest will be conducted. The total amount of late-seral forest habitat (over 80 years old) is expected to increase by a factor of nearly five. Protection in reserve status of all key riparian, aquatic, and forested habitat will create a system of forested corridors adjacent to rivers and streams for the dispersal and movement of organisms dependent on aquatic and riparian habitats, as well as large areas of older forest in uplands interspersed between stream systems. The increase in habitat connectivity and maturation of second-growth forest is expected to benefit the osprey population by providing potential nesting and foraging habitat throughout the landscape of the Cedar River Municipal Watershed.

Two groups of measures will benefit osprey by improving habitat conditions for fish (prey of osprey) or by otherwise increasing prey populations. Increased production of anadromous fish will mean increased availability of prey, and construction of fish passage facilities at the Landsburg Diversion Dam will extend the availability of live anadromous fish into the municipal watershed. The HCP provides for the passage of all native species of anadromous fish upstream of the Landsburg Diversion Dam into a 12.5-mile reach of the mainstem of the Cedar River and into additional smaller tributaries, substantially adding to spawning and rearing habitat, and increased production of sockeye salmon downstream of Landsburg through operation of a hatchery (Section 4.3.2).

Improvements in instream flows under the HCP will increase habitat capacity of the Cedar River, flow downramping protection under the HCP will reduce mortality of juvenile fish, funding for habitat protection and restoration downstream of Landsburg will increase habitat quality and quantity, and funding for improvements at the Ballard Locks will increase survival of smolts passing from Lake Washington to Puget Sound (Section 4.4.2).

If fish populations in the reservoir were to be affected by the changed instream flow regime under the HCP, the prey base for ospreys using the reservoir could be affected. However, such changes are expected to be minor and offset by improvements in rearing and spawning habitats in tributaries to the reservoir (see bull trout and pygmy whitefish effects analyses above).

Group #16 – Willow Flycatcher

Introduction

The willow flycatcher is present and is known to breed in the Cedar River Municipal Watershed. Potential key habitat for the willow flycatcher in the municipal watershed includes ponds, wetlands, riparian areas, willow thickets, persistent shrub communities, natural forest openings, and meadow complexes, primarily within the western hemlock zone, at lower elevations. Throughout their range, willow flycatchers use a variety of open, brushy habitats and are commonly associated with willow thickets (Sedgwick and Knopf 1992). Sedgwick and Knopf (1992) report that willow flycatchers were consistently associated with abundance, density, and coverage of willows.

Flycatchers will use very small wetlands or wet shrubby areas included in conifer forests, but mid- to late-seral forests themselves provide only "adequate" habitat (Smith et al. 1997). They also use the grass-forb and open canopy stages of forest succession, including clearcuts (Smith et al. 1997).The willow flycatcher could be negatively affected by silvicultural treatments, road management, or other operational activities in or near key habitat (e.g., wetlands and riparian areas). Such effects could be direct (e.g., through destruction of active nests or injury to individuals) or indirect, through influences on habitat (e.g., removal of overstory) or disturbance. The loss of early seral, brushy habitat created artificially by commercial timber harvest will likely reduce the carrying capacity of the watershed for willow flycatchers, although the future landscape will develop into one more similar to the natural landscape to which this species is adapted.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the willow flycatcher are described in Section 4.2.2 and summarized as follows: (1) protection through reserve status of all key stream, pond, and wetland habitat, all wetland complexes (includes forested area), all persistent shrub communities not associated with Chester Morse Reservoir, and all riparian habitat; (2) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance and the likelihood of disturbing nesting activities; (3) restoration and enhancement of aquatic and riparian habitats (restoration planting, restoration thinning, and ecological thinning in riparian areas) designed to help accelerate the development of a naturally functioning aquatic and riparian ecosystem; (4) removal of 38 percent of watershed roads, reducing the level of human disturbance; (5) monitoring and research; (6) protection of known nesting pairs from human disturbance; and (7) closure of the watershed to unsupervised public access, reducing potential disturbance near nests.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the watershed, all lands outside limited developed areas are in reserve status. As a result, most key habitat for the willow flycatcher within the municipal watershed is protected through reserve status, with the exception being the willow thickets around the perimeter of the reservoir. The City is not able to predict future habitat quality and quantity next to the reservoir due to changing water levels and vegetation response to those changes. No substantial changes in acreage of potential key habitat for willow is expected under the HCP. In addition, overall habitat quality for the willow flycatcher is expected to improve through the protection of naturally open habitats whenever watershed operations are conducted nearby, and through active intervention to help restore natural habitat function and quality. The decrease in human activity should also be beneficial for flycatchers. Some short-term and long-term gains in the quality of wetlands and some other types of open habitats are expected under the HCP as a result of the natural maturation of younger seral-stage forest adjacent to these habitats, and silvicultural intervention. Silvicultural treatments designed to help restore natural riparian habitat functions could result in an increased diversity, and possibly abundance, of insect prey for willow flycatchers.

Willow flycatchers also forage in some early seral forest habitats. As a consequence of eliminating timber harvest for commercial purposes, however, the overall amount of early seral forest habitat in the watershed is expected to decrease over the term of the HCP. Early seral forest habitat will be created largely by natural processes, such as windstorms and disease, and several decades from now is likely to be in patches smaller than those present today. The overall landscape in the municipal watershed, however, will be more similar to the natural landscape to which the willow flycatcher is adapted within this region. It should be noted also that considerable amounts of early seral forest habitat created by commercial timber harvest will likely be available in many areas adjacent to the watershed.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance to, and possibly injury or mortality, of willow flycatchers in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (7) routine road use.

The likelihood of disturbing any actively nesting willow flycatcher pairs in the watershed is expected to be low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) protection of known active willow flycatcher nest sites from human disturbance, partly through the use of site evaluations and interdisciplinary teams prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed, reducing the overall levels of habitat disturbance and human activities; and (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (5) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of, any willow flycatchers resulting from silvicultural treatments, road management, or other operational activities is expected to be low in any given year. However, the Service does expect that injury or mortality will occur, likely via destruction of nests during restoration activities, during the 50-year permit.

Summary/Conclusion
It is possible that the projected decrease in the acreage of open, brushy habitats, particularly willow patches, in the municipal watershed over the 50-year HCP term will reduce the carrying capacity of the watershed for the willow flycatcher. Availability of key habitat (wetlands, riparian areas, persistent shrub communities, and meadow complexes) will not change appreciably, although habitat quality should increase. Because considerable areas of clearcuts can be expected to be available on nearby private timberlands (some of which may be suitable flycatcher habitat), it is unlikely that the elimination of commercial timber harvest in the watershed will have a negative effect on regional populations of this species, particularly in view of the measures in the HCP to reduce human disturbance levels and the development of a more natural landscape.

Group #17 Three-Toed Woodpecker

Introduction
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 key habitat for the three-toed woodpecker in the municipal watershed includes high-elevation mature, late-successional, and old-growth forests, especially those specific habitats containing large snags.

The three-toed woodpecker could be negatively affected by silvicultural treatments, road management, or other operational activities, especially in mature to old-growth forests. Such effects could be direct through destruction of active nests or injury to individuals or indirect, through influences on habitat (e.g., removal of large snags, tree canopy, or specific nest trees) or disturbance.

Pertinent Mitigation and Minimization Measures
Mitigation and minimization measures for the three-toed woodpecker are described in Section 4.2.2 and summarized below: (1) protection of all existing old-growth forest; (2) elimination of timber

harvest for commercial purposes within the watershed; (3) natural maturation of second-growth forests into mature and late-successional seral stages; (4) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; (5) retention, creation, and recruitment of large snags during silvicultural treatments; (6) removal of 38 percent of watershed roads; (7) monitoring and research; and (8) protection of nesting pairs from human disturbance.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All forests outside developed areas, including all 13,889 acres of old-growth forest, are in reserve status. As a result, all key habitat (high-elevation mature, late-successional, and old-growth forest) for the three-toed woodpecker within the municipal watershed is in reserve status. Of the 13,889 acres of old-growth forest, 11,323 acres (82 percent) are above 3,000 ft elevation and 4,201 acres (30 percent) are above 4,000 ft elevation.

Major habitat effects on the three-toed woodpecker are generally as described for the northern goshawk. Although old growth (by definition) will not increase in area under the HCP, substantial increases in the quantity of mature and late-successional coniferous forest habitat for the three-toed woodpecker are expected over the 50-year term of the HCP as a result of natural maturation of second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in some areas of second growth forest. Solely as a result of natural forest maturation, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a five-fold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.5).

Based on the threee-toed woodpecker's apparent preference for higher elevation mature, late-successional , and old-growth forest habitats and its current range distribution, it is probable that the species will benefit most from protection of old growth (particularly above 3,000 ft) and maturation of second growth forest, mainly at higher elevations, within the watershed. Although much of the increase in mature and late-successional forest habitat, especially during the first two decades under HCP, will occur at elevations below 3,000 ft, a substantial increase in the amount of mature coniferous forest (approximately 10,000 acres) is also expected at elevations above 3,000 ft during the last three decades of the HCP. The combination of old growth within the watershed being concentrated at higher elevations (82 percent above 3,000 ft) and the maturation, over time, of second growth to mature stages within the same elevation zone, will thereby provide a net habitat benefit for the three-toed woodpecker within the municipal watershed on both a short- and long-term basis. Similarly, as was the case for the northern goshawk, the 22,845-acre CHU, including the upper Rex River Basin will form a large, contiguous block of interspersed old growth and mature forest, over time, that will be of particular, potential value to the three-toed woodpecker.

Under the HCP, some potential three-toed woodpecker habitat in the municipal watershed is expected to improve as a result of ecological and restoration thinning projects. Ecological and restoration thinning in second-growth forests in the CHU, as well as other parts of the watershed, is expected to hasten the development of mature, late-successional, and old-growth characteristics in those forests, thereby effectively connecting all extant patches of old-growth forest within the term of the HCP. Under the HCP, approximately 11,000 acres are projected to be treated by restoration thinning and approximately 2,000 acres are projected to be treated by ecological thinning in the watershed.

There may be some short-term loss of large snags important to these species, especially in ecological thinning areas, because state worker safety laws require the removal of dangerous snags during restoration and ecological thinning operations. Loss of large snags during restoration thinning will be minimal because this silvicultural treatment will be conducted primarily in regenerating stands in early seral stages (less than 30 years old) that typically contain few, if any, large snags. Snag densities are variable, although typically low, in most young second-growth forest (40-60 years old) in which ecological thinning may be conducted, and in some cases selected snags may need to be removed. In the long term, however, the overall density of large snags is expected to increase significantly in the watershed, because of overall objectives to retain, create, and recruit large snags during restoration and ecological thinning (Section 4.2.2).

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of three-toed woodpeckers that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (7) routine road use.

The likelihood of disturbing any actively nesting three-toed woodpecker pair in the watershed is expected to be very low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of active three-toed woodpecker nest sites from human disturbance prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of, any three-toed woodpeckers resulting from silvicultural treatments, road management, or other operational activities is expected to be low.

Summary/Conclusion

Population-level effects on the three-toed woodpecker are generally as described for the northern goshawk. Under the HCP, the current substantial amount of watershed forest in fragmented condition will mostly be replaced by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early or mid-seral forest habitat (less than 50 years old) will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early seral stages as a result of recent commercial logging will mature over the term of the HCP and no additional commercial harvest will be conducted. The total amount of late seral habitat (over 80 years) is expected to increase by a factor of nearly five. The improved landscape connectivity and increased acreage of preferred forest habitat within the municipal watershed should benefit the three-toed woodpecker population in the vicinity by providing improved forest habitat conditions that facilitate movement and/or dispersal of individuals throughout the watershed and by providing critical older forest habitat for nesting and foraging.

In particular, the large block of older forest at higher elevations in the CHU will benefit a three-toed woodpecker population by providing connectivity with lands in the federal LSR system in the Cascades. This landscape connectivity may further benefit three-toed woodpecker populations on a more regional level by facilitating movement and dispersal of individuals between the municipal watershed and other watersheds to the north, east, and south.

Group #18 – Pileated Woodpecker, Vaux's Swift

Introduction

The pileated woodpecker and Vaux's swift commonly occur and are known to breed in the Cedar River Municipal Watershed. Key habitats for the pileated woodpecker and Vaux's swift in the watershed are mature, late-successional, and old-growth forests, especially those areas with abundant snags, and, for swifts, large, hollow trees.

Pileated woodpeckers and Vaux's swifts could be negatively affected by silvicultural treatments, road management, or other operational activities in mature to old-growth forests. Such effects could be direct through destruction of active nests or injury to individuals or indirect, through influences on habitat, e.g., removal of large snags, tree canopy, or specific nest trees, or disturbance.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the pileated woodpecker and Vaux's swift are described in Section 4.2.2 and summarized below: (1) protection of all existing old-growth forest; (2) elimination of timber harvest for commercial purposes within the watershed; (3) natural maturation of second-growth forests into mature and late-successional seral stages; (4) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; (5) removal of 38 percent of watershed roads; (6) retention, creation, and recruitment of large snags; (7) monitoring and research; and (8) protection of nesting pairs from human disturbance.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All forests outside limited developed areas, including all 13,889 acres of old-growth forest, are in reserve status. As a result, all key habitat (mature, late-successional, and old-growth forest with abundant snags and large hollow trees) for the pileated woodpecker and Vaux's swift within the municipal watershed is protected.

Coniferous forest in older age classes is the most likely to have developed the structural characteristics, in particular, large snags for pileated woodpeckers and large hollow trees for Vaux's swifts, that these species prefer for nest and roost sites. A relatively small amount of mature (1,074 acres) and late-successional forest (91 acres) totaling 1,165 acres is currently present in the western portion of the lower watershed, distributed entirely in small patches. In contrast, most of the 13,889 acres of old-growth forest, with the exception of a few, relatively small, isolated patches, is concentrated in the eastern portions of the watershed within the CHU.

Although Vaux's swifts, and especially pileated woodpeckers, have been observed in association with both old-growth and several age classes of second growth forest in widely separated areas of the watershed, two areas in particular, the CHU/Rex River Basin and the Chester Morse and Taylor Creek basins, are especially important to the pileated woodpecker and Vaux's swift on both a short- and long-term basis. The CHU, including the upper Rex River Basin, currently contains the majority of remaining old-growth forest, interspersed with large areas of younger seral stage regenerating forest, remaining in the watershed. Both habitat distribution and habitat quality are expected to improve, particularly in this area, primarily as a result of maturation of younger forest (a long-term gain). Although a much smaller amount of old-growth forest currently exists within the Chester Morse and Taylor Creek basins, a substantial area of these basins is currently in older young and mature forest stages that will continue to mature over the term of the HCP and provide considerably more mature and late-successional habitat for pileated woodpeckers and Vaux's swifts. In addition, maturation of the forest in these basins, as well as throughout the watershed landscape, will decrease the existing level of fragmentation of old growth and create larger contiguous blocks of potentially suitable habitat for these species on a long-term basis during the 50-year term of the HCP. Such large blocks of suitable habitat are important to the long-term viability of the pileated woodpecker and Vaux's swift populations within the municipal watershed.

Major habitat effects on the pileated woodpecker and Vaux's swift are generally as described for the three-toed woodpecker. However, in contrast, these species utilize low- and mid-elevation forest, as well as high-elevation mature, late-successional, and old-growth forest. Substantial increases in the quantity of mature and late-successional coniferous forest habitat for these species are expected over the 50-year term of the HCP primarily because of natural maturation of all second-growth forests (a long-term habitat gain), but also because of silvicultural intervention designed to accelerate development of older forest characteristics in second growth forest in some areas. In the near term, there will be more than a 30-fold increase in the amount of mature (80-119 year old) conifer forest present in the watershed during the first two decades of the HCP, totaling 34,745 acres by the year 2020. And, over the long term, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a five-fold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (HCP section 4.2.5). As was the case for the other late-successional and old-growth associate species discussed, the 22,845-acre CHU and associated old growth in the Rex River Basin will form a large, contiguous block of mixed old growth and mature forest over time that will be of particular value to these species over the long term.

Under the HCP, some pileated woodpecker and Vaux's swift habitat in the watershed is expected to benefit from ecological and restoration thinning that is intended to produce mature and late-successional forest habitat characteristics in second-growth forests. Ecological thinning and restoration thinning in second-growth forests in the CHU and other parts of the watershed is expected to hasten the development of mature, late-successional, and old-growth characteristics in those forests, thereby effectively connecting all extant patches of old-growth forest within the term of the HCP. Under the HCP, approximately 11,000 acres are projected to be treated by restoration thinning and approximately 2,000 acres are projected to be treated by ecological thinning in the watershed.

There may be some short-term loss of large snags important to these species, especially in ecological thinning areas, because state worker safety laws require the removal of dangerous snags during restoration and ecological thinning operations. Loss of large snags during restoration thinning will be minimal because this silvicultural treatment will be conducted primarily in regenerating stands in early seral stages (less than 30 years old) that typically contain few, if any, large snags. Snag densities are variable, although typically low, in most young second-growth forest (40-60 years old) in which ecological thinning may be conducted, and in some cases selected snags may need to be removed. In the long term, however, the overall density of large snags is expected to increase significantly in the watershed, because of overall objectives to retain, create, and recruit large snags during restoration and ecological thinning (Section 4.2.2).

The combined effects of natural maturation and silvicultural treatment of selected forest lands in the CHU, Rex River, Chester Morse, and Taylor Creek basins, as well as throughout the entire watershed landscape, will not only decrease the existing level of old growth fragmentation and increase the total amount of potentially suitable habitat, but will also result in an improved distribution of key habitat throughout the municipal watershed. The combination of these factors will thereby create larger, more contiguous blocks of potentially suitable habitat for pileated woodpeckers and Vaux's swifts on a long-term basis during the 50-year term of the HCP. Such large blocks of suitable habitat will be important to the long-term viability of pileated woodpecker and Vaux's swift nesting populations within the municipal watershed.

Disturbance Effects and Injury/Mortality
As was the case for the three-toed woodpecker, the primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of these species in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occassionally more in some years); and (7) routine road use.

The likelihood of disturbing any actively nesting pileated woodpecker or Vaux's swift pair in the watershed is expected to be very low and only short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of active pileated woodpecker and Vaux's swift nest sites from human disturbance prior to silvicultural or road management activities; (2) elimination of commercial logging activities from the watershed; (3) the City's policy restricting all unsupervised public and tribal access to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of, any pileated woodpeckers or Vaux's swifts resulting from silvicultural treatments, road management, or other operational activities is expected to be low.

Summary/Conclusion
Population-level effects on pileated woodpeckers and Vaux's swifts are generally as described for the three-toed woodpecker.In addition to increasing the habitat carrying capacity of the municipal watershed over time for this species, the large block of older forest at higher elevations in the CHU will provide connectivity with lands in the federal LSR system in the Cascades. This large scale landscape connectivity may benefit pileated woodpecker and Vaux's swift populations on a more regional level by facilitating movement and dispersal of individuals between the municipal watershed and other watersheds to the north, east, and south.

Group #19 – Olive-Sided Flycatcher

Introduction
The olive-sided flycatcher is present and likely breeding in the Cedar River Municipal Watershed. Although the olive-sided flycatcher is known to utilize a variety of habitat types including early to

late seral stages of coniferous forest, as well as open habitats. Potential key habitats for this flycatcher in the municipal watershed are considered to be mature, late-successional, and old-growth forests (especially those with relatively high snag density), forested wetlands, and natural open habitats (e.g., meadows, persistent shrub). Other seral stage forest habitat and other open canopy habitat types are considered secondary.

The olive-sided flycatcher may be negatively affected by silvicultural treatments, road management, or other operational activities, particularly in mature to old-growth forests, forested wetlands, or near natural open habitats in the watershed. Such effects could be direct (e.g., through destruction of active nests or injury to individuals) or indirect, through influences on habitat (e.g., removal of large snags, tree canopy, or specific nest trees) or disturbance.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the olive-sided flycatcher are described in Section 4.2.2 and summarized below: (1) protection of all existing old-growth forest; (2) protection of forested wetlands; (3) protection of all non-forested, natural open habitats; (4) elimination of timber harvest for commercial purposes within the watershed; (5) natural maturation of second-growth forests to mature and late-successional seral stages; (6) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; (7) removal of 38 percent of watershed roads; (8) monitoring and research; and (9) protection of known nesting pairs from human disturbance.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All forests outside limited developed areas are in reserve status. As a result, all key habitat (mature, late-successional, and old-growth forest, forested wetlands, and natural open habitats) for the olive-sided flycatcher within the municipal watershed is protected.

Major habitat effects on the olive-sided flycatcher are generally as described for other species groups presented that are associated with late-successional and old-growth forests, especially avian species (e.g., spotted owl, marbled murrelet, 3-toed woodpecker, pileated woodpecker, Vaux's swift), and particularly the northern goshawk. The olive-sided flycatcher, similarly to the pileated woodpecker (Group #18), utilizes high-elevation, as well as low- and mid-elevation mature, late-successional, and old-growth forest. However, in contrast, this species also uses forested wetlands and natural open habitats (e.g., meadows and persistent shrub). Increases in the quantity of mature to late-successional coniferous forest habitat for the olive-sided flycatcher are expected over the 50-year term of the HCP as a result of natural maturation of all second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in second growth in some areas. In the near term, and solely as a result of second-growth forest maturation, there will be more than a 30-fold increase in the amount of mature (80-119 year old) conifer forest present in the watershed during the first two decades of the HCP, totaling 34,745 acres by the year 2020. And, over the long term, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a five-fold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.5).

In addition to the reserve status of watershed forests (includes forested wetlands), the non-forested, open habitats that are utilized by olive-sided flycatchers, and described as Special Habitats in the HCP (e.g., meadows, persistent shrub), are also protected by management guidelines. Watershed operations, including silvicultural activities, near any Special Habitats will be regulated within 200 feet of the specific habitat element. Also, any proposed road construction in or near Special Habitats will be evaluated by an interdisciplinary team and designed to avoid or minimize impacts or disturbance to olive-sided flycatchers.

Under the HCP, some olive-sided flycatcher habitat in the municipal watershed is expected to benefit from ecological and restoration thinning intended to produce mature and late-successional forest habitat characteristics in second-growth forests in some areas. These thinning activities in the CHU, and other parts of the watershed, are expected to hasten the development of late-successional and old-growth forest characteristics in treated forests, thereby effectively connecting all extant patches of old-growth forest within the term of the HCP. Under the HCP, approximately 11,000 acres are projected to be treated by restoration thinning and approximately 2,000 acres are projected to be treated by ecological thinning in the watershed.

The combined effects of natural maturation and silvicultural treatment of selected forest lands in the CHU, Rex River, Chester Morse, and Taylor Creek basins, as well as throughout the entire watershed landscape, will not only decrease the existing level of old growth fragmentation and increase the amount of potentially suitable habitat, but will also result in an improved distribution of key habitat throughout the municipal watershed. The combination of these factors will thereby create larger, more-contiguous blocks of potentially suitable habitat for olive-sided flycatchers on a long-term basis during the 50-year term of the HCP. Such large blocks of suitable habitat will be important to the long-term viability of an olive-sided flycatcher nesting population within the municipal watershed.

Because no commercial timber harvest will be conducted outside of limited developed areas within the watershed, all forests, as well as all natural open habitats (e.g., meadows, persistent shrub, wetlands) constituting key habitat, are also in reserve status and therefore protected. Virtually all of these natural open habitats are expected to persist throughout the 50-year term of the HCP and provide foraging habitat for olive-sided flycatchers. Also, certain open habitats associated with operational activities (e.g., road edges, right-of-ways), constituting secondary habitat, are also expected to persist. However, because commercial timber harvest will not be conducted, early seral stage forest habitats (e.g., grass-forb, forb-shrub, shrub, etc.) previously maintained within the watershed through timber harvest, will substantially decrease under the HCP. In the future, such early seral stage forest habitat will be created and/or maintained solely by natural events (e.g., windthrow, disease, fire). Therefore, this type of secondary habitat for olive-sided flycatchers is expected to substantially decrease relative to current conditions under the HCP.

The amount of grass-forb-shrub habitat (13,673 acres) and open canopy, early regeneration stage, habitat (1,937 acres) currently existing in the watershed is projected to decrease to 1,164 acres of grass-forb-shrub habitat (92 percent decrease) and zero open canopy habitat (100 percent decrease) by the year 2020. With the exception of open habitats created by natural events, no grass-forb-shrub or open canopy habitat is projected to be present in the municipal watershed by the year 2050. However, a more natural level of occurrence of these habitat types will be reestablished in the watershed by the end of the 50-year term of the HCP. Although early seral stage forest openings offer some foraging opportunities for the olive-sided flycatcher, net long-term benefits are expected to accrue for this species from the protection of old growth forest, protection of natural open habitats, and the recruitment of substantial amounts of mature and late-successional forests over time.

Disturbance Effects and Injury/Mortality

The primary activities that may result in disturbance, injury, potentially even including death, of olive-sided flycatchers in the watershed under the HCP include operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) riparian forest habitat restoration; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (8) routine road use.

Disturbance to, injury of, or death of olive-sided flycatchers in the watershed is expected to occur as a result of the actions described above. However, the effects on habitat are expected to be short-term in nature, and not significant to the population of olive-sided flycatchers in the watershed because of the specific mitigation and minimization measures committed to in the HCP: (1) protection of known active olive-sided flycatcher nest sites from human disturbance; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; (4) removal of 38 percent of forest roads which will reduce the amount of disturbance related to road maintenance, improvement and use over the long term; and (5) management guidelines limiting silvicultural and operational activities in and/or near Special Habitats.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of any olive-sided flycatchers resulting from silvicultural treatments, road management, or other operational activities is expected to be very low.

Summary/Conclusion

Population-level effects of the HCP on olive-sided flycatchers are expected to be positive. Under the HCP, the current substantial amount of watershed forest in fragmented condition will be replaced mostly by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early or mid-seral stage forest habitat (less than 50 years old) will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation), because forest now in early seral stages as a result of recent commercial logging will mature over the term of the HCP and no additional commercial harvest will be conducted. The total amount of key, late seral, habitat (over 80 years) is expected to increase by a factor of nearly five. The improved landscape connectivity and increased acreage of preferred forest habitat within the municipal watershed should benefit the olive-sided flycatcher population in the vicinity by providing improved forest habitat conditions that facilitate movement and/or dispersal of individuals throughout the watershed and by providing critical older forest habitat for nesting and foraging.

The HCP also promotes the development, over time, of a large block of older forest in the CHU, and throughout the watershed landscape. The CHU block is contiguous with lands to the north, east, and south of the watershed at its upper (eastern) end, including lands within the federal late-successional reserve (LSR). This landscape connectivity may benefit olive-sided flycatcher populations on a more regional level by facilitating movement and dispersal of individuals between the Cedar River Municipal Watershed and other watersheds to the north, east, and south.

Group #20 – Brown Creeper

Introduction

Brown creepers are present and known to breed in the Cedar River Municipal Watershed. Potential key habitats for the brown creeper in the municipal watershed are mature, late-successional, and old-growth forests, including forested wetlands.

The brown creeper may be negatively affected by silvicultural treatments, road management, or other operational activities particularly in mature to old-growth forests in the watershed. Such effects could be direct through destruction of active nests or injury to individuals or indirect, through influences on habitat (e.g., removal of large snags, tree canopy, or specific nest trees) or disturbance.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the brown creeper are described in Section 4.2.2 and summarized below: (1) protection of all existing old-growth forest and forested wetlands; (2) elimination of timber harvest for commercial purposes within the watershed; (3) natural maturation of second-growth forests into mature and late-successional seral stages; (4) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; (5) retention, creation, and recruitment of large snags during silvicultural treatments; (6) removal of 38 percent of watershed roads; (7) monitoring and research; and (8) protection of known nesting pairs from human disturbance.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All forests outside limited developed areas, including the 13,889 acres of old growth and all forested wetlands, are in reserve status. As a result, all key habitat (mature to old-growth forest and forested wetlands) for the brown creeper in the municipal watershed is protected.

Increases in the quantity of mature and late-successional coniferous forest habitat for the brown creeper are expected over the 50-year term of the HCP as a result of natural maturation of all second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in second growth in some areas. In the near term, and solely as a result of second-growth forest maturation, there will be more than a 30-fold increase in the amount of mature (80-119 year old) conifer forest present in the watershed during the first two decades of the HCP, totaling 34,745 acres by the year 2020. And, over the long term, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a five-fold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.5).

Under the HCP, some brown creeper habitat in the municipal watershed is expected to benefit from ecological and restoration thinning intended to produce mature and late-successional forest habitat characteristics in selected second-growth forests. These thinning activities in selected second-growth forests within the CHU, and other areas of the watershed, are expected to hasten development of late-successional and old-growth characteristics in treated forests, as well as accelerate the development of very large trees with rugose (rough) bark that the brown creeper prefers as foraging substrate. Such thinning activities, in combination with natural forest maturation, are expected to effectively connect all extant patches of old-growth forest within the term of the HCP. Under the HCP, approximately 11,000 acres are projected to be treated by restoration thinning and approximately 2,000 acres are projected to be treated by ecological thinning in the watershed.

The combined effects of natural maturation and silvicultural treatment of selected forest lands in the CHU, Rex River, Chester Morse, and Taylor Creek basins, as well as throughout the entire watershed landscape, will not only decrease the existing level of old growth fragmentation and increase the amount of potentially suitable habitat, but will also result in an improved distribution of key habitat throughout the municipal watershed. The combination of these factors will thereby create larger, more-contiguous blocks of potentially suitable habitat for brown creepers on a long-term basis during the 50-year term of the HCP. Such large blocks of suitable habitat will be important to the long-term viability of a brown creeper nesting population within the municipal watershed.

Disturbance Effects and Injury/Mortality

The primary activities that may result in disturbance, injury, potentially even including death, of brown creepers in the watershed under the HCP include operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2)

restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) riparian forest habitat restoration; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (8) routine road use. Some nests could be inadvertently destroyed during planting, thinning, or road management operations, however, site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions in order to minimize direct impacts.

Disturbance to, injury of, or death of brown creepers is expected to occur as a result of the actions described above. However, the effects on habitat are expected to be short-term in nature, and not significant to the population of brown creepers in the watershed because of the specific mitigation and minimization measures committed to in the HCP: (1) protection of known active brown creeper nest sites from human disturbance; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term.

Summary/Conclusion

Population-level effects on the brown creeper are expected to be positive. The amount of key habitat within will increase substantially over time, as should the habitat carrying capacity of the watershed for this species. In addition, improved landscape connectivity may benefit the brown creeper population on a more regional level by facilitating movement and dispersal of individuals between the municipal watershed and other watersheds to the north, east, and south.

Group #21 – Band-tailed Pigeon

Introduction

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. Detailed knowledge of habitats essential for maintenance of stable breeding populations of band-tailed pigeons is limited. The major components of pigeon habitat appear to be suitable and secure forested nesting areas, foraging sites (including mineral sites), and escape/roosting habitats (Braun 1994). During the breeding season, band-tails are most common in forests with interspersion of seral stages and openings, abundant food resources and mineral springs (WDFW, 1991). Studies of radio-marked band-tailed pigeons in Colorado indicated that most marked adults feed within 15 km of their nesting sites (Curtis and Braun 1983).

The band-tailed pigeon could be negatively affected by silvicultural treatments, road management, or other operational activities, especially in low- to mid-elevation forests in the watershed. Such effects could be both direct (e.g., through destruction of an active nest caused by silvicultural treatment activities) or indirect, through influences on habitat (e.g., removal of overstory) or disturbance. Reductions in early seral habitats anticipated under the HCP may also reduce foraging opportunities for band-tailed pigeons within the watershed.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for band-tailed pigeons are described in Section 4.2.2 and summarized below: (1) protection of any mineral springs, if discovered; (2) protection through reserve status of all natural open habitat used for foraging (e.g., meadows, persistent shrub, and wetlands) in the watershed; (3) elimination of timber harvest for commercial purposes in the watershed, reducing the level of habitat disturbance and the likelihood of disturbance of nesting activities; (4) silvicultural treatments in riparian and upland second-growth forests, insofar as such treatments result in the increased production of fruits used by band-tailed pigeons; (5) development, through forest maturation and natural disturbances, of a landscape more similar to the natural landscape to which the band-tailed pigeon is adapted; (6) monitoring and research; and (7) closure of the watershed to unsupervised public access, reducing potential disturbance near nests or direct mortality as a result of hunting.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All forests outside limited developed areas are in reserve status. As a result, all key habitat (mineral springs, if any exist, and low-elevation coniferous and mixed forests) for the band-tailed pigeon within the municipal watershed is in reserve status.

Although no mineral springs (a key habitat type) have been identified in the watershed, the HCP calls for the protection of any mineral spring discovered during the term of the HCP. All natural open habitat used for foraging (e.g., meadows, persistent shrub, and mapped wetlands) in the watershed is protected through reserve status. Silvicultural treatments in riparian and upland second-growth forests will be designed to develop more extensive shrub layers, and should, in some cases, result in the increased production of fruits used by band-tailed pigeons, including red elderberry, *Sambucus racemosa,* and huckleberry (*Vaccinium*) species.

Band-tailed pigeons also forage in habitats affected by human activities, including early-seral forest that is in small patches near forest edges. As a consequence of the elimination of timber harvest for commercial purposes, however, the overall amount of early-seral forest habitat in the watershed is expected to decrease over the term of the HCP. Early-seral forest habitat will be created largely by natural processes, such as windstorms, stream bank erosion, and disease, and several decades from now is likely to be in patches smaller than those present today.

It is not clear what effect the change in forest age distribution in the municipal watershed during the term of the HCP will have on band-tailed pigeons, but considerable early-seral forest habitat is being created by commercial timber operations on land adjacent to the watershed. In Colorado, Curtis and Braun (1983) reported that most band-tailed pigeons feed within 15 km of nesting sites. Therefore, pigeons nesting within the municipal watershed may be capable of foraging in adjacent ownerships that are more likely to be in early seral stages. In addition, the overall landscape in the municipal watershed will be more similar to the natural landscape to which band-tailed pigeons in the region are adapted.

Disturbance Effects and Injury/Mortality

The primary activities that may result in disturbance, direct injury, potentially even including death, of band-tailed pigeons under the HCP include operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (7) routine road use.

Disturbance to, injury of, or death of band-tailed pigeons is expected to occur as a result of the actions described above. However, the effects on habitat are expected to be short-term in nature, and not significant to the population of band-tailed pigeons in the watershed because of the specific mitigation and minimization measures committed to in the HCP: (1) elimination of timber harvest for commercial purposes in the watershed, reducing overall habitat disturbance and log hauling on roads; (2) interdisciplinary team site evaluations and protection of known, active band-tailed pigeon nest sites and mineral springs from human disturbance prior to silvicultural or road management activities; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term.

Disturbance to, direct injury to, or death of band-tailed pigeons resulting from silvicultural treatments, road management, or other operational activities in the watershed is expected to occur. However, the likelihood is considered low because of the specific mitigation and minimization measures committed to in the HCP. Nonetheless, occasional nests might be unintentionally eliminated as a result of silvicultural treatments or other management actions.

Summary/Conclusion

The net effect of forest habitat changes on band-tailed pigeons is not known, however, no significant population-level effects are expected. Braun (1994) suggests that research is needed to determine preferred habitats and also whether pigeons prefer continuous forests or forests interspersed with openings. Reductions of early-seral habitat within the watershed, which are thought to be critical as foraging areas, may be offset to some extent by silvicultural treatments that increase shrubs that produce fruit eaten by band-tailed pigeons. Because nests are hard to find, some nesting pairs could be disturbed or eliminated during silvicultural treatments, despite site evaluations by interdisciplinary teams. This relatively minor risk of disturbance, or minimal chance of nest elimination, should be more than countered, however, by protection of any mineral springs and known nests, and, most significantly, by elimination of the major source of potential nesting disturbance in the area, that being commercial timber harvest.

Group #22 – Rufous Hummingbird, Western Bluebird

Introduction

The rufous hummingbird is common throughout the Cedar River Municipal Watershed. The western bluebird is known to occur only occasionally in the watershed, and no breeding activity has been observed. Potential key habitat for the rufous hummingbird in the municipal watershed is natural open habitat (meadows, persistent shrub communities, and meadow complexes), some open wetlands (palustrine emergent and scrub-shrub), open riparian habitats, old-growth forest, and other areas where nectar-producing flowers of preferred species are available. Forest openings in old-growth allow suitable flower species to re-establish that hummingbirds can use (Calder 1993). Rufous hummingbirds nest in second growth forests (16 –120 yrs of age) and mature forest of >120 years (Meslow and Wight 1975). Rufous hummingbirds also use early seral-stage forest (grass-forb-shrub and open canopy stages) and secondarily use some other types of conifer forest where forage plants are present.

Potential key habitat for the insectivorous western bluebird in the municipal watershed is natural open habitat (meadows and persistent shrub communities), open wetlands (palustrine emergent and scrub-shrub), open riparian habitats, and natural forest openings and other forest clearings, particularly where snags are present. Western bluebirds nest in cavities in trees, using abandoned woodpecker holes in snags in burned areas or nest boxes placed at forest edges or in other open areas. Western bluebirds also use some early seral-stage forest (grass-forb-shrub and open canopy stages).

Rufous hummingbirds and western bluebirds could be negatively affected by silvicultural treatments, road management, or other operational activities in or near habitats used by either species. Such effects could be direct (e.g., destruction of active nests) or indirect, through influences on habitat (e.g., removal of vegetation) or disturbance.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for rufous hummingbirds and western bluebirds are described in Section 4.2.2 and summarized below: (1) protection through reserve status of all natural open habitats used for foraging (e.g., meadows, persistent shrub, and wetlands) in the watershed; (2) silvicultural treatments in riparian and upland second-growth forests, insofar as these treatments result in creation and recruitment of snags that could provide nest sites for western bluebirds and development of shrub layers that could provide foraging opportunities for hummingbirds; (3) protection of known nesting pairs from human disturbance; (4) removal of 38 percent of watershed roads, reducing the level of human disturbance; (5) monitoring and research; and (6) closure of the watershed to unsupervised public access, reducing potential disturbance near nests; and (7) protection of all existing old-growth forests.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Both rufous hummingbirds and western bluebirds are primarily associated with forest edges and openings with a diversity of flowering plants and insects for feeding upon and open space for aerial displays of courtship behavior. This most frequently occurs in early-seral habitats which are open and shrub-dominated, and in late succesional habitats which have a highly developed and diverse understory of herbaceous plants and shrubs (Partners in Flight 1999). Forest openings in old-growth allow suitable flower species to re-establish that hummingbirds can use (Calder 1993).

The loss of early seral habitat created artificially by commercial timber harvest could reduce the carrying capacity of the watershed for the western bluebird and possibly for the rufous hummingbird. For hummingbirds, this reduction in carrying capacity would be via reduction in flowering plants used for foraging and potentially some nesting habitat. Acreage of grass-forb and early-seral open-canopy habitats are presently about 1,937 ac and 13,673 ac, respectively, within the watershed. According to the growth models used by the City, at year 2050, it is expected that there will be little if any acreage of these habitat types in the watershed (see Map #23 in the HCP Map Volume, December, 1998). Some acreage will likely still be present, however, due to natural events such as windthrow, fire and insects/disease. However, it must be noted that the overall future landscape expected to develop under the HCP will more closely resemble the natural ecological potential of the region. Further, considerable amounts of early seral forest habitat created by commercial timber harvest will likely be available in many areas adjacent to the watershed, and that the amount of early seral forest habitat available in the region has not been a major factor in recent declines of these species, nor is it likely to be in the future.

Because no commercial timber harvest will be conducted in the watershed, almost the entire watershed of 90,000 acres is in reserve status, except for those few areas that are in development, such as Cedar Falls operations complex. As a result, all key habitat (natural open habitats) for the rufous hummingbird and western bluebird within the municipal watershed is protected through reserve status. Silvicultural treatments in riparian and upland second-growth forests will be designed to develop a more extensive shrub layer and to create and recruit snags. In some cases, these treatments should result in increased numbers of flower-producing plants that hummingbirds may use for foraging and snags near open areas that western bluebirds may use for nesting.

Disturbance Effects and Injury/Mortality

The primary activities that may result in disturbance, injury, potentially even including death, of rufous hummingbirds and western bluebirds under the HCP include operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (7) routine road use.

Disturbance to, injury of, or death of rufous hummingbirds and western bluebirds is expected to occur as a result of the actions described above. However, the effects on habitat are expected to be short-term in nature, and not significant to the populations of rufous hummingbirds and western bluebirds in the watershed because of the specific mitigation and minimization measures committed to in the HCP: (1) protection of known active rufous hummingbird and western bluebird nest sites from human disturbance, when located (note that discovery of nests may occur during site evaluations by interdisciplinary teams prior to silvicultural activities near potential nesting areas); (2) eliminating commercial logging activities (including virtually all log hauling) from the watershed, reducing the overall levels of habitat disturbance and human activities; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term.

Summary/Conclusion
The net effect of the HCP upon populations of rufous hummingbirds and western bluebirds cannot be stated for certain. The Service believes, for reasons described below, that the HCP will produce a landscape that is very similar to the ecological potential of the region, and therefore, more akin to the einvironment in which these species evolved in western WA. The current abundance of early seral stages, and hence higher-than-expected populations of both bird species, in the watershed is a consequence of widespread commercial timber harvesting.

It is possible that the projected decrease in the acreage of early seral-stage habitats in the municipal watershed over the 50-year HCP term may reduce the carrying capacity of the watershed for one or both of these species. Several measures included in the HCP, however, may offset some of the potential effect of reduced foraging habitats for rufous hummingbirds and western bluebirds.

Because loss of snags is known to be one factor that has reduced regional populations of western bluebirds, efforts to create and recruit snags near open areas may offset the reduction in early seral forest habitat. Likewise, efforts to increase development of understory shrubs in second-growth conifer forest may offset, at least to some extent, loss of early seral forest habitat for rufous hummingbirds. Because considerable areas of clearcuts can be expected to be available on nearby private timberlands, it is unlikely that the elimination of commercial timber harvest in the watershed will have a negative effect on regional populations of either species, particularly in view of the measures in the HCP to reduce human disturbance levels and the development of a more natural landscape.

Group #23 – Golden Eagle, Merlin

Introduction
Golden eagles are present in the Cedar River Municipal Watershed only intermittently as transients and migrants, most often observed above high-elevation ridges. Merlins are present in the watershed, but no comprehensive surveys have been conducted, and no nests or breeding activity

have been documented to date. Both species forage in open areas and nest on cliffs and in trees near forest openings. Golden eagles nest in large trees in old-growth forests; merlins nest in old crow nests and natural cavities. Merlins in the Cascade Mountains are found at higher elevations, from the Pacific silver fir zone and higher, using forest edges and meadows along the Cascade crest (Smith et al. 1997). No merlin nests have been verified in the Cascades in Washington, though (Smith 1997) cliffs and rock outcrops, natural open upland habitats (grass-forb meadows and persistent shrub communities), open wetlands (palustrine emergent and palustrine scrub-shrub wetlands), and large trees are potential key habitats for these species in the Cedar River Municipal Watershed, with high-elevation forests also representing key habitat for merlins. The golden eagle also forages in early seral forest habitats The merlin prefers open to semi open areas for hunting (Sodhi et. al. 1993). On the Olympic Peninsula, merlins have been observed nesting in old growth forest and foraging in nearby pastures and lacustrine habitat (Mark Ostwald, USFWS biologist, personal communication).

Golden eagles and merlins could be negatively affected by silvicultural treatments, road management, or other operational activities in or near habitats used by either species. Such effects could be direct (e.g., destruction of active nests) or indirect, through influences on habitat (e.g., removal of vegetation or snags) or disturbance. The loss of early seral habitat created artificially by commercial timber harvest will reduce foraging habitat for both species

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for golden eagles and merlins are described in Section 4.2.2 and summarized below: (1) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance and the likelihood of disturbing nesting activities; (2) protection through reserve status of all cliffs and rock outcrops potentially used for nesting; (3) protection through reserve status of all existing old-growth forest that may be used for nesting, or, at higher elevation, for foraging by merlins; (4) protection through reserve status of all natural open habitats used by either species for foraging (e.g., meadows, persistent shrub, and wetlands) in the watershed; (5) natural maturation of second-growth forests into mature and late-successional seral stages that could provide trees used for nesting or improve habit for foraging merlins; (5) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas, potentially increasing the number and quality of nesting trees for both species; (6) protection of known nesting pairs from human disturbance with no removal of young for falconry purposes; (7) removal of 38 percent of watershed roads, reducing the level of human disturbance; (8) closure of the watershed to unsupervised public access, reducing potential disturbance near nests; and (9) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All key habitat (cliffs, rock outcrops, natural open habitats, and mature to old-growth forest) for golden eagles and merlins in the municipal watershed is in reserve status. The acreage of mature, late-successional, and old-growth forest will increase by nearly a factor of five under the HCP, and the quality of some open habitats may improve and develop more natural characteristics as forest adjacent to open habitats matures. Golden eagles and merlins will benefit through the decrease in human activity throughout the watershed, through the protection of natural open habitats whenever watershed operations are conducted nearby, and through active intervention to help restore natural habitat function and quality. Silvicultural treatments in second-growth forests near open habitats will be designed to foster development of larger trees and snags, which could be used for nesting by either species.

Golden eagles and merlins also forage in some open, early seral forest, with merlins potentially using such habitats primarily near forest edges. As a consequence of eliminating timber harvest for commercial purposes, however, the overall amount of early seral forest habitat in the watershed is expected to decrease over the term of the HCP. Early seral forest habitat will be created largely by natural processes, such as windstorms and disease, and several decades from now is likely to be in patches smaller than those present today. The overall landscape in the municipal watershed, however, will be more similar to the natural landscape to which these species adapted within this region. It should be noted that considerable amounts of early seral forest habitat created by commercial timber harvest will likely occur in many areas adjacent to the watershed, which would be available to such wide-ranging foragers as golden eagles and merlins.

Disturbance Effects and Injury/Mortality

The primary activities that may result in disturbance, and possibly the equivalent of take of, golden eagles and merlins in the watershed under the HCP include any operations that involve human activities on roads or in or near suitable habitat including the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (7) routine road use.

The likelihood of disturbance to any actively nesting golden eagles or merlins in the watershed, however, is expected to be very low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) protection of known active golden eagle and merlin nest sites from human disturbance (including no removal of young birds for falconry purposes), partly through the use of site evaluations and interdisciplinary teams prior to silvicultural activities near potential nesting areas; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed, reducing the overall levels of habitat disturbance and human activities; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of, any golden eagles or merlins resulting from silvicultural treatments, road management, or other operational activities is expected to be very low.

Summary/Conclusion

The protection of all forest outside limited developed areas in reserve status, the protection and potential improvement of all key open habitats, silvicultural activities designed to develop large trees and snags (for nesting), and the overall level of protection from human disturbance afforded by the HCP should all provide population benefits for the golden eagle and the merlin. It is possible that the projected decrease in the acreage of early seral-stage habitats in the municipal watershed over the 50-year term may reduce foraging habitat in the watershed for golden eagles and merlins.

This loss of early seral forest habitat, however, would be partially mitigated by the measures described above and the development of a more natural landscape habitat distribution under the HCP, one more similar to that for which both species are adapted. In addition, considerable areas of clearcuts can be expected to occur on nearby private timberlands available to such wide-ranging foragers. Thus, it is unlikely that the elimination of commercial timber harvest in the watershed will have a negative effect on regional populations of either species and the mitigation and conservation measures in the HCP, taken as a whole, may provide an overall positive population effect.

Group #24 – Black Swift

Introduction

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 key habitat for black swifts in the municipal watershed includes cliffs, rock outcrops, headwalls and inner gorges, waterfalls on streams, and mature, late-successional, and old-growth forests, especially in riparian areas. Black swifts commonly nest on steep cliffs or behind waterfalls, in caves, in deep gorges, sea cliffs and in sea caves (Marrin 1997). Moisture, inaccessibility by terrestrial predators, and darkness or deep shade during most of the day seem to be required at nesting sites (Marrin 1997). They are aerial feeders that forage widely above the forest canopy or over open areas, such as wetlands and meadows.

Black swifts could be negatively affected by silvicultural treatments, road management, or other operational activities in or near key habitat (e.g., riparian areas, waterfalls, large trees, and cliffs). Such effects could be direct (e.g., through injury to individuals) or indirect, through influences on habitat or disturbance.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for black swifts are described in Section 4.2.2 and summarized below: (1) protection in reserve status of known cliffs and rock outcrops that may be used for nesting in the watershed; (2) restoration and enhancement of aquatic and riparian habitats (restoration planting, restoration and ecological thinning in riparian areas) designed to help accelerate the development of a naturally functioning aquatic and riparian ecosystem and the development of mature or late-successional forest characteristics in riparian areas; (3) protection of all natural open habitats (e.g., meadows, persistent shrub, and wetlands) used for foraging in the watershed, primarily through protection by inclusion in surrounding forest that is in reserve status; (4) protection of all existing old-growth forest; (5) natural maturation of second-growth forests into mature and late-successional seral stages; (6) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; (7) removal of 38 percent of watershed roads, reducing potential disturbance near any nesting areas; (8) elimination of timber harvest for commercial purposes within the watershed, reducing the level of human activity potentially near nesting areas; (9) monitoring and research; and (10) protection of nesting pairs and colonies from human disturbance.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All lands outside limited developed areas are in reserve status. As a result, all key habitat (cliffs, rock outcrops, headwalls and inner gorges, waterfalls on streams, and mature to old-growth forests) for the black swift within the municipal watershed is in reserve status.

Besides the protection of all potential key habitats listed, the silvicultural treatments and road management activities committed to in the HCP are expected to significantly restore and enhance potential key habitat in riparian areas and in mature to late-successional forest. Increases in the quantity and quality of mature and late-successional coniferous forest habitat are expected over the 50-year term of the HCP as a result of natural maturation of all second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in second-growth in some areas, both potentially increasing the abundance and diversity of insects on which swifts may feed. Measures to protect and restore stream, wetland, and riparian habitats should similarly improve the ability of such areas to produce insect prey for swifts.

Disturbance Effects and Injury/Mortality

The primary activities that may result in disturbance, injury, potentially even including death, of black swifts under the HCP include operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (7) routine road use.

Disturbance to, injury of, or death of black swifts is expected to occur as a result of the actions described above. However, the effects on habitat are expected to be short-term in nature, and not significant to the population of black swifts in the watershed because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations prior to undertaking management activities in key habitat to ensure that habitat for black swifts is not degraded, to minimize direct impacts to individual black swifts that may be present, and to ensure that any breeding swifts are not disturbed; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed, reducing the overall level of human disturbance that could potentially affect nesting or foraging; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to nesting pairs and other resident or transient birds; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term.

Summary/Conclusion

Black swifts will benefit from any habitat improvements that increase the availability of insect prey, but the population-level effects of any such change cannot be predicted. Protection of any nesting pairs and colonies from human disturbance could have a positive population effect on black swift populations in the watershed. The net effect of the HCP on both local and regional populations is unclear, but is not expected to be detrimental.

Group #25 – Northern Water Shrew, Masked Shrew

Introduction

Both the northern water shrew and masked shrew are present in the Cedar River Municipal Watershed. The masked shrew occurs at all elevations in the Cascades in riparian and other forest types, as well as alder and willow thickets, and prefers moist conditions with abundant plant cover, thick leaf litter, and decaying logs (Kurta 1995; Johnson and Cassidy 1997). The northern water shrew is associated with cold, clear water in small streams, ponds, and forested wetlands with abundant cover (Johnson and Cassidy 1997). Potential key habitat for both species in the municipal watershed is considered to include streams, ponds, wetlands, and riparian areas, and in addition for the masked shrew, mature, late-successional, and old-growth forest.

Group #25 species are susceptible to impacts from silvicultural treatments, road management, or and other activities in riparian areas, and operations that deliver sediment to streams. Such impacts could be direct through direct injury to, or death of, individuals or indirect, through influences on habitat (e.g., removal of overstory). Group #25 species could also be negatively affected by management activities that contribute sediment to streams (stream habitat restoration projects, silvicultural treatments in riparian areas, road construction, maintenance, use, and decommissioning), thereby reducing water quality.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the northern water shrew and masked shrew are described in Section 4.2.2 and summarized below: (1) protection of all key streamside and wetland habitat; (2) protection of all existing forested habitat in reserve forest status, facilitating dispersal of individuals of both species, providing key habitat for masked shrews, and serving to protect all streams, ponds, and wetlands; (3) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance and the likelihood of disturbing individuals during breeding and non-breeding seasons; (4) natural maturation of second-growth forests into mature and late-successional seral stages, potentially promoting conditions which would facilitate dispersal for both species and improving habitat for masked shrew; (5) stream restoration and bank stabilization projects, improving streamside cover and potentially improving water quality; (6) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams; (7) guidelines and prescriptions designed to reduce sediment production during watershed management activities; (8) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas, also improving habitat conditions on the forest floor (long term) and facilitating dispersal; (9) retention, creation, and recruitment of logs and large snags during silvicultural treatments, supplying organic debris to the forest floor on both a short- and long-term basis; (10) removal of 38 percent of watershed roads, reducing the risk of direct injury or death as a result of road use; and (11) monitoring and research, with monitoring of benthic invertebrates of particular relevance for northern water shrew.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All forest outside limited developed areas, is in reserve status. As a result, all key habitat for the Group #25 shrews within the municipal watershed (streams, ponds, wetlands, riparian habitat, and mature, late-successional and old-growth forests) is in reserve status. In addition, silvicultural activities are restricted within 50 feet of streams to minimize the potential for habitat impacts or disturbance to key wildlife species. Protection of, and improvements in, water quality and aquatic habitat are of particular importance for the northern water shrew. Protection in reserve status of all forested areas of the watershed, including riparian corridors, will facilitate dispersal for both of these species.

Short-term and long-term gains in the quality and/or quantity of aquatic and riparian habitats are expected under the HCP as a result of the natural development of mature forest in riparian areas. Development of mature and late-successional forest significantly contributes to the reestablishment of a more naturally functioning ecosystem, with greater overall potential for utilization by these shrews. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of the HCP, "riparian" zones of 300 ft on Type I-III waters, 150 ft on Type IV waters, and 100 ft on Type V waters were established using GIS data and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase.

The HCP also includes management actions designed to help restore and enhance aquatic and riparian habitats, including measures that will improve habitat conditions for invertebrate prey of these shrews. Stream bank stabilization projects, placement of large woody debris (LWD), a stream bank revegetation program, and a program of restoration planting, restoration thinning, and ecological thinning in riparian areas are expected to help (1) restore natural aquatic and riparian ecosystem functioning and (2) accelerate the development of mature or late-successional characteristics in younger second-growth forests in riparian areas. Other provisions in the HCP, including, road decommissioning (removal), road improvements, improved road maintenance, and limitations on activities near streams, will also foster reestablishment of naturally functioning hydrologic regimes within the landscape of the Cedar River Watershed. Restoration of a naturally functioning aquatic ecosystem will benefit the Group #25 shrews over the long term. However, over the short term, these management interventions may cause some localized decline in habitat function. Site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions in the watershed to ensure that habitat for Group #25 shrews will be minimally impacted.

Silvicultural treatments in riparian areas may result in negative impacts on streamside habitat and/or water quality. Such impacts may occur if vegetation canopy cover is reduced to an extent that leads to increased rates of soil erosion or increased solar heating of stream water. No commercial timber harvest will occur in the watershed, however, and, in order to eliminate or minimize any short-term impacts to habitat of Group #25 shrews, mechanical equipment and cutting of trees are restricted within 50 feet of streams, and interdisciplinary teams will evaluate and plan silvicultural and operational projects in any key habitat, especially within riparian zones. One important set of constraints is that during restoration or ecological thinning activities, no mechanized equipment will be allowed within 50 ft of streams and no tree removal that has the potential to reduce streambank stability will be allowe. In addition, the HCP also includes Watershed Assessment Prescriptions (Appendix 16) and other management guidelines (Section 4.2.2) intended to minimize the potential for erosion and mass wasting associated with silvicultural treatments in riparian areas. Implementing these prescriptions and guidelines will reduce the rate of sediment loading to aquatic systems, and help maintain and improve water quality.

Road construction, repair, maintenance, and decommissioning can all affect stream and riparian areas. The Watershed Assessment Prescriptions (Appendix 16) and other management guidelines (Section 4.2.2) are intended to minimize the probability of erosion and mass wasting associated with roads. Following these prescriptions and guidelines, along with the program to improve and decommission roads (Section 4.2.2), will reduce the rate of sediment loading to aquatic systems and help maintain high water quality. It is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads are adjacent to streambanks, but improved road maintenance under the HCP will help mitigate those impacts.

Although old-growth forest, by definition, will not increase in extent under the HCP, substantial increases in the quantity and quality of mature and late-successional coniferous forest that is key habitat for the masked shrew and dispersal habitat for the northern water shrew are expected over the 50-year term of the HCP as a result of natural maturation of second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in some areas of second-growth forest. Solely as a result of natural forest maturation, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a fivefold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.2). In addition, by the end of the HCP term, older forest habitat will be more evenly distributed throughout the watershed landscape, including the entire elevation range, than under current conditions.

In addition, under the HCP, some potential key habitat for masked shrew and dispersal habitat for the water shrew in the municipal watershed is expected to benefit from management actions, such as ecological thinning and restoration, that are intended to produce mature and late-successional forest habitat characteristics in second-growth forests (Section 4.2.2). To minimize local, short-term habitat impacts of silvicultural activities in upland forests, the HCP also includes management guidelines (Section 4.2.2).

Disturbance Effects and Injury/Mortality

The primary activities that may result in disturbance, injury, potentially even including death, of shrews under the HCP include operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) riparian and instream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) some types of monitoring and research. Occasionally, dispersing individuals of these shrew species might be injured or killed inadvertently by management activities in upland or riparian areas, or by vehicles on watershed roads.

Disturbance to, injury of, or death of shrews is expected to occur as a result of the actions described above. However, the effects on habitat are expected to be short-term in nature, and not significant to the populations of shrews in the watershed because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of Group #25 species habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which further minimizes the risk of injury or death of dispersing shrews; and (4) removal of 38 percent of forest roads, which will reduce the potential for negative effects resulting from road construction, maintenance, improvement, and use over the long term.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of disturbance to, direct injury to, or death of individuals as a result of silvicultural treatments, road management, or other operational activities in riparian areas is expected to be low in any given year. Occasionally, dispersing individuals of these shrew species might be injured or killed inadvertently by management activities in upland or riparian areas, or by vehicles on watershed roads. Masked shrews, which occur in more upland forest habitats than do northern water shrews, might occasionally be injured or killed by management actions in the upland parts of the watershed, but such impacts would be more than offset by long-term habitat improvements.

Summary/Conclusion

Population-level effects on the masked shrew and northern water shrew populations are expected to be positive. Key stream, wetland, pond, riparian, and upland forest habitat will be protected and improved in quality. Any short-term, local impacts to these species from restoration activities in riparian or other areas will be more than offset by long-term, landscape-level benefits. Increases in mature and late-successional forest habitat will facilitate dispersal of these species within the watershed, and allow the watershed to serve as a population source for Group #25 species in the region.

Group #26 – Hoary Bat, Silver-Haired Bat, Big Brown Bat, Long-Eared Myotis, Long-Legged Myotis, California Myotis, Little Brown Myotis, Keen's Myotis, Yuma Myotis, Fringed Myotis, Pacific Townsend's Big-Eared Bat

Introduction

The long-legged myotis and little brown myotis are present in the Cedar River Municipal Watershed, but no comprehensive surveys have been conducted, and it is unknown whether any of the other bat species in Group #26 are present. Because the long-legged myotis and little brown myotis are present, it is likely that the other bat species in Group #26 are also present and breeding, because many of these Group #26 bats use similar types of forest structures as solitary and maternity roosts, and use similar habitats for foraging.

Although each bat species in Group #26 has slightly different habitat requirements, key habitats for the group in the municipal watershed are considered to be mature, late-successional, and old-growth forests, forested riparian areas, open wetlands, stream corridors, open water bodies, natural open habitats (meadows and persistent shrub communities), and cliffs, rock outcrops, and caves. Bats roost and hibernate in hollow trees and snags in late-successional and old-growth forests, in caves and cracks in cliffs and rock outcrops, and also in and under artificial structures such as bridges (Barbour and Davis 1969, Maser et al. 1981, and van Zyll de Jong 1985, all in Christy and West 1993). Bats forage over open water bodies (e.g., lakes, ponds, reservoir, open wetlands, large streams) and over meadows and persistent shrub communities.

Bat species in Group #26 may be negatively affected by silvicultural treatments, road management, or other operational activities in the watershed. Such effects can be both direct (e.g., through direct injury or mortality of individuals in roost trees or hibernacula), or indirect, through effects on habitat (e.g., destruction of roost trees or hibernacula) or disturbance (e.g., arousal of hibernating individuals).

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the bat species are described in Section 4.2.2 and summarized below: (1) protection of all existing old-growth forest; (2) protection of natural, non-forested habitats (open wetlands, streams, lakes, cliffs, rock outcrops, and caves); (3) elimination of timber harvest for commercial purposes within the watershed; (4) natural maturation of second-growth forests into mature and late-successional seral stages; (5) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; (6) retention, creation, and recruitment of large snags during silvicultural treatments; (7) removal of 38 percent of watershed roads; (8) monitoring and research; and (9) protection of known breeding and roosting sites or hibernacula from human disturbance.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All forests and wetlands, outside developed areas, including all 13,889 acres of old growth, are in reserve status. As a result, all key habitat for bat species in Group #26 including mature to old growth forest, riparian areas, wetlands, open water bodies, natural open habitats, cliffs, and caves, within the municipal watershed is in reserve status.

Increases in the quantity of mature and late-successional coniferous forest habitat for these species of bats are expected over the 50-year term of the HCP as a result of natural maturation of all second-growth forests (a long term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in second-growth in some areas. As a result, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a five-fold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.5). Long-term benefits are also expected to accrue to these species of bats as a result of recruitment of large snags in watershed forests.

Relative to most other species groups discussed that are closely associated with mature to old-growth forest, bats in Group #26 generally use a broader range of habitats, including riparian areas, open wetlands, lakes, ponds, natural open habitats (meadows and persistent shrub communities), caves, cliffs, and rock outcrops. Bats in this species group are therefore expected to also benefit from management actions designed to protect, enhance, or restore these habitats. For instance, the HCP includes management actions designed to help restore and enhance aquatic and riparian habitats as well as special habitat types such as cliffs and caves, used by bats.

Programs for restoration planting and ecological and restoration thinning are focused on accelerating the development of mature and late-successional forest structural characteristics in younger second-growth forest in selected riparian areas. In addition, other programs to stabilize stream banks and replace large woody debris in streams are directed at improving stream habitat conditions. The combination of these restoration programs is expected foster the reestablishment of more natural aquatic and riparian ecosystem function in these habitat communities within the municipal watershed.

Restoration of more naturally functioning aquatic and riparian ecosystems will benefit species of bats in Group #26 over the long term. In addition, many stream crossing structures (culverts and log stringer bridges) will be replaced with concrete bridges during the term of the HCP as part of a comprehensive program to improve forest road standards and restore fish passage in certain stream systems within the municipal watershed. It is believed that modern concrete bridges are not expected to provide as many roost sites for bats as older wooden stringer bridges but, nevertheless, they will provide some potential roost structures. Also, it is thought that bats can use large culverts as roost sites. At this time, it appears that 3 wood stringer bridges will be removed and not replaced at all (a result of the road abandonment commitments) and 4 wood stringer bridges will be replaced with concrete bridges. It is believed that these efforts could reduce roosting opportunities for bats within the Watershed. It is important to realize, in doing the effects analysis, however, that these are all artificial roost sites, and if roost sites are limiting to bats in the Watershed, increase the carrying capacity of the watershed over what it would be absent these facilities. We do not have any information on the number of culverts that will be replaced by concrete bridges, nor on the relative value of culverts versus concrete bridges as roost sites. Finally, if bats do use round culverts in the watershed, the City will be increasing the size and absolute number of cross-drain culverts on many roads within the watershed as part of the road improvement program in the HCP, thus increasing the number of potential culvert roosts for bats.

In addition to the reserve status of watershed forests, which serves to protect the aquatic system (wetlands, streams, lakes, ponds), both aquatic habitats and Special Habitats (e.g., meadows, persistent shrub, cliffs, caves) utilized by species of bats in Group #26 are also protected by management guidelines. Cutting of trees near streams and other aquatic habitats will be limited to restoration and ecological thinning with no ground-based equipment used within 50 feet and cutting further restricted within 25 feet. Silvicultural activities, including any necessary road construction, conducted near streams and other aquatic habitats will be designed by an interdisciplinary team to minimize and mitigate any impacts on or disturbance to species of bats in Group #26. Watershed operations near any Special Habitats will be regulated within 200 feet of the specific habitat element. Also, any proposed road construction in or near Special Habitats will be evaluated by an interdisciplinary team and designed to avoid or minimize impacts or disturbance to species of bats in Group #26.

Under the HCP, some key habitat for bats in Group #26, outside aquatic systems and riparian forests, within the municipal watershed is also expected to benefit from ecological and restoration thinning intended to produce mature and late-successional forest habitat characteristics in second-growth forests. Ecological and restoration thinning in second-growth forests in the CHU, and in other selected areas of the watershed, are expected to hasten the development of mature, late-successional, and old-growth characteristics in treated forests, thereby effectively connecting all extant patches of old-growth forest within the term of the HCP. In addition, restoration and ecological thinning in the watershed will benefit the species of bats in Group #26 over the long term as a result of retention, creation, and increased recruitment of large snags. Over the 50-year term of the HCP, approximately 11,000 acres are projected to be treated by restoration thinning and approximately 2,000 acres are projected to be treated by ecological thinning in the watershed.

It is notable that certain species of bats are likely to forage, at least to some degree, over early seral habitats. Because no commercial timber harvest will be conducted, outside limited developed areas, early seral stage habitat (grass-forb-shrub and open canopy) is expected to decrease substantially over the term of the HCP. This reduction in early seral stage habitat may result in some negative effects on certain species of bats in Group #26. The amount of grass-forb-shrub habitat (13,673 acres) and open canopy, early regeneration stage, habitat (1,937 acres) currently existing in the watershed is projected to decrease to 1,164 acres of grass-forb-shrub habitat (92 percent decrease) and zero open canopy habitat (100 percent decrease) by the year 2020. With the exception of open habitats created by natural events, no grass-forb-shrub or open canopy habitat is projected to be present in the municipal watershed by the year 2050. However, a more natural level of occurrence of these habitat types will be reestablished in the watershed by the end of the 50-year term of the HCP. Although early seral stage forest openings offer some foraging opportunities for bats in Group #26, net long-term benefits are expected to accrue for these species because of the protection of old growth forest, riparian forest, aquatic systems, including wetlands, natural open habitats, and the recruitment of substantial amounts of mature and late-successional forests over time.

In addition, some HCP management actions (e.g., ecological and restoration thinning) may cause some localized decline in habitat function and/or loss of snags in the short-term because state worker safety laws require removal of dangerous snags. However, site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions to avoid disturbance or destruction of breeding, roosting, or hibernation sites. In addition, the overall density of large snags and hollow trees should increase significantly in the watershed over the long term, because of overall objectives to retain, create, and recruit large snags and trees with defects during thinning activities (Section 4.2.2).

Disturbance Effects and Injury/Mortality

The primary activities that may result in disturbance, injury, potentially even including death, of bats in Group #26 include operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) riparian forest habitat restoration; (5) removal of approximately 240 miles of road, and associated culverts and bridges, over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (8) routine road use.

Management activities near roost and hibernation sites may have negative impacts on species of bats and some roost sites could be destroyed inadvertently during planting, thinning, or road management operations. However, site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions in order to minimize direct impacts on bat species in the watershed.

Disturbance to, injury of, or death of bats in Group #26 is expected to occur as a result of the actions described above. However, the effects on habitat are expected to be short-term in nature, and not significant to the populations of bats in Group #26 in the watershed because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of known active roost sites or hibernacula from human disturbance prior to silvicultural treatment or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to roosting, hibernating, or foraging bats; (4) removal of 38 percent of forest roads which will reduce the amount of disturbance related to road maintenance, improvement and use over the long term; and (5) management guidelines limiting silvicultural and operational activities in and/or near both aquatic habitats and Special Habitats.

Summary/Conclusion

Population-level effects on the species of bats in Group #26 are expected to be positive. Under the HCP, the current substantial amount of watershed forest in fragmented condition will be replaced mostly by large blocks of older forest habitat, interrupted only by natural openings, roads, right-of-ways, and limited areas of development. By HCP year 50, no early- or mid-seral forest habitat (less than 50 years old) will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early seral stages as a result of recent commercial logging will mature over the term of the HCP and no additional commercial harvest will be conducted. The total amount of late-seral habitat (over 80 years old) is expected to increase by a factor of nearly five.

Mitigation and minimization measures in the HCP protect aquatic and associated riparian habitats that facilitate the dispersal and movement of organisms dependent on riparian habitats such as the species of bats in Group #26, as well as protect large areas of older forest in upland areas between stream systems. The increased acreage of preferred forest habitat and landscape connectivity should benefit populations of bats within the municipal watershed by providing critical older forest habitat for nesting and foraging and by facilitating the daily and/or seasonal movement of individuals throughout the watershed. In particular, the large block of older forest in the CHU will benefit populations of bats in Group #26 by providing connectivity with lands in the federal LSR system in the Cascades. This landscape connectivity should benefit populations of bats on a more regional level by facilitating daily and/or seasonal movement of individuals between the municipal watershed and other watersheds to the north, east, and south.

Group #27 – Fisher, American Marten, Wolverine

Introduction

No comprehensive surveys to determine the presence or absence of the fisher, American marten, and wolverine have been conducted in the Cedar River Municipal Watershed, and no incidental observations of these species have been documented to date.

Although the fisher, American marten, and wolverine each have somewhat different habitat requirements, potential key habitat in the municipal watershed for the species as a group, is considered to be mature, late-successional, and old-growth forests, forested wetlands, and forested riparian areas. Younger forest seral stages and some other habitat types are secondary habitat for all three species, and may be used at variable levels for foraging, dispersal, and other travel.

Fishers are found primarily below about 3,300 ft elevation, in the western hemlock and Pacific silver fir zones, and prefer forest with large trees and abundant large woody debris, using cavities as resting and denning sites. In this region, American marten are typically found at higher elevations than fisher. American martens also prefer older forest with complex structure, including large woody debris, which is used for resting and denning. Wolverines also are found at higher elevations, in remote montane areas, and are known to use talus slopes, tree root complexes, and coarse woody debris as denning sites. Both wolverine and fisher are sensitive to human disturbance, and wolverines are believed to avoid areas altered or inhabited by humans.

Human disturbance (e.g., vehicle traffic, recreational activities) likely influences the suitability and use of habitat by wolverines and fisher, and the availability of habitat away from forest roads, motorized trails, or high-use hiking trails is likely an important factor influencing the distribution of these two species in this region. Significantly, because the primary function of the Cedar River Watershed is to supply drinking water to the City of Seattle and the surrounding region, the types and extent of human activities conducted within the municipal watershed differ substantially from those taking place on many nearby lands, especially those areas open to commercial timber harvest and/or a wide variety of public recreational activities.

Fisher, American marten, and wolverine may be negatively affected by silvicultural treatments, road management, or other operational activities in mature to old-growth forests. Such effects could be direct (e.g., through injury or mortality of individuals resulting from collision with vehicles), or indirect, through influences on habitat or disturbance.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for fisher, American marten, and wolverine are described in Section 4.2.2 and summarized below: (1) elimination of timber harvest for commercial purposes within the watershed, virtually eliminating large scale habitat impacts and substantially reducing disturbance resulting from road use; (2) removal of 38 percent of watershed roads, thereby providing additional undisturbed habitat and reducing overall disturbance levels; (3) continued closure of the municipal watershed to unsupervised public access, thus essentially eliminating disturbance resulting from recreational activity; (4) protection of all existing old-growth forest; (5) natural maturation of second-growth forests into mature and late-successional seral stages, thus reestablishing more natural ecosystem function; (6) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; (7) protection of known breeding sites from human disturbance; and (8) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All forests outside limited developed areas, including all 13,889 acres of old-growth forest, are protected in reserve status under the HCP. As a result, all key habitat for fisher, American marten, and wolverine (mature to old-growth forest stages), as well as secondary habitat, within the municipal watershed is in reserve status. A majority of older seral habitat is currently found within the spotted owl CHU in the higher elevation, eastern portion of the watershed. Protection of key habitat in the CHU is also of primary significance because the CHU is the most remote and least roaded part of the watershed. Also, because of its proximity to the Alpine Lakes Wilderness Area, the CHU is the area of the watershed most likely to be occupied by colonizing wolverine and American marten or traversed by dispersing or transient individuals of these species. Over the 50-year term of the HCP the commitment not to harvest timber for commercial purposes will also result in substantial recruitment of mature and late-successional forest as a result of natural maturation. In addition, silvicultural treatments designed to accelerate the development of mature and late-successional forest characteristics in second-growth forests will also increase the availability and/or quality of potential habitat for these three species.

Overall, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by year 2050, a near fivefold increase over current conditions for these three seral stages in total and a fiftyfold increase in mature and late-successional forest (HCP Section 4.2.2). However, not all of the mature, late-successional, or even old-growth forest that currently exists or will mature in the watershed during the term of the HCP, is expected to provide habitat of equal quality for fisher, American marten, and wolverine. This is because forest characteristics (e.g., species composition, canopy closure, snags, average tree diameter, branching structure) not only vary naturally in unharvested forest as a result of different site conditions, aspect, and elevation, but also vary in second-growth forest as a result of historic harvest practices and recent forest management regimes.

Because the vast majority of the lower-elevation forest in the watershed was harvested in the early twentieth century, most of the mature and late-successional forest habitat, by the year 2050, will develop at low elevations, where the second-growth is currently older than in most other parts of the watershed (HCP Section 4.2.2). At elevations below 3,000 ft elevation, mature and late-successional forest is projected to total 47,988 acres by year 2050, a forty-one fold increase over current conditions, and mature, late-successional, and old-growth forest is projected to total 50,563 acres. This increase will be especially important for fisher, because they are known to prefer this habitat at lower elevation.

In addition, the HCP will benefit fisher, American marten, and wolverine through the management actions designed to accelerate the development of mature, late-successional, and old-growth characteristics in second-growth forests. Ecological thinning, restoration thinning, and restoration planting in second-growth forests in the CHU and other parts of the watershed is expected to hasten the development of late-successional and old-growth characteristics in those forests, thereby effectively connecting all extant patches of old-growth forest within the term of the HCP. Under the

HCP, approximately 11,000 acres are projected to be treated by restoration thinning, approximately 2,000 acres by ecological thinning, and 1,400 acres by restoration planting, especially in riparian corridors, within the watershed.

The HCP also includes management actions designed to help restore and enhance riparian habitats used by the fisher, American marten, and wolverine. Short- and long-terms gains in the quality and/or quantity of riparian habitats for these species are expected under the HCP as a result of the natural maturation of younger seral stage forest in riparian areas, as well as restoration planting, restoration thinning, and ecological thinning in riparian areas designed to accelerate the reestablishment of naturally functioning riparian ecosystems.

Because American martens and, especially, wolverines and fishers require areas away from human disturbance during reproductive periods, restrictions on unsupervised public entry into the watershed (Section 4.2.2), road removal, and elimination of commercial timber harvest activities in the watershed in particular are expected to benefit each of these three species. Restriction of public access on watershed roads reduces potential mortality or injury from motor-vehicle collisions and reduces the ability of poachers and trespassers to harass or harm these species.

Unsupervised public access to the municipal watershed is not allowed except within the Rattlesnake Lake Recreation Area and below the water supply intake at Landsburg on the western administrative boundary. Therefore, recreational activities (e.g., hiking, motor and trail bikes, camping) are restricted within the watershed. Some hiking trails, including a section of the Pacific Crest Trail at the eastern end of the watershed, currently exist or are planned for development along selected sections of the watershed boundary. No recreational trails are currently present or planned within the interior of the municipal watershed. In addition, all road access points to the municipal watershed are gated (locked) at the administrative boundary and access is by permit only. In order to provide a relative measure of the potential disturbance level that might be incurred by these three species within the municipal watershed a general comparison can be inferred from an analysis of "security" or "core" habitat (areas more than 0.3 mile from a road) as applied for the grizzly bear (see effects analysis for Group #11; see below).

Since no commercial timber harvest will be conducted within the municipal watershed and virtually all log hauling will be eliminated, road use and traffic levels will be significantly different from those incurred on commercial forest transportation systems and recreational lands. The types of traffic on the watershed transportation system will result primarily from: 1) road maintenance and limited construction activities for road improvements and decommissioning; (2) silvicultural treatment projects; (3) surveillance activities related to drinking water protection; (4) research and monitoring projects; and (5) other routine operational activities. With the exception of routine road maintenance, limited road construction and silvicultural projects, and in some cases, operational activities, light vehicle traffic will predominate. Many roads, especially at higher elevations and in more remote areas of the watershed, will receive minimum vehicle trips in most years. Most vehicle traffic will, in all probability, be confined to major roads, road systems, and sampling routes most directly associated with operating the water supply system or conducting some types of monitoring and research. Current road densities for the watershed, by sub-basin, are described by Map 11 of the HCP Map Volume, and the accompanying table.

A conservative, preliminary analysis estimating the availability of core habitat available for grizzly bear (see effects analysis for Group #11), which should have applicability for fisher, American marten, and wolverine, indicates that a total of 6,554 acres of core habitat, in 51 individual blocks, currently exists within the watershed. The individual blocks of core habitat included in this total range in size from less than one acre to more than 2,000 acres. The four largest individual blocks of contiguous core habitat within the watershed, totaling 5,061 acres (77 percent), are located mostly in the CHU. These four blocks of core habitat contain 2,038, 1,616, 960, and 447 acres and are located in the areas of Mt. Baldy/Abiel Peak/Tinkham Peak on the northern boundary, Findley Lake, Meadow Mountain, and Goat Mountain, respectively. The remaining 1,493 acres (23 percent) of habitat greater than 0.3 miles from a road, contained in 47 smaller blocks, is scattered throughout other areas of the watershed, but no single block is greater than 200 acres in size.

Under the HCP, after projected road removal is completed, a total of 12,975 acres of core habitat (67 individual blocks), representing an increase of 6,421 acres (98 percent increase) from current conditions, will exist by the end of the 50-year HCP term. In fact, most of the substantial increase of core habitat will be realized during the first two decades of the HCP, solely as a result of an aggressive road decommissioning program. The individual blocks of core habitat included in this projected total range in size from less than one acre to more than 3,000 acres. The five largest individual blocks of contiguous core habitat, totaling 8,353 acres (64 percent of total) are, as before, located mostly within the CHU. This acreage consists of large blocks containing 3,001, 2,418, 1,221, 932, and 781 acres. The increases in core habitat will accrue primarily to the large blocks of contiguous core habitat in the same areas as indicated above with the addition of one unit in the upper Taylor Creek Basin. This analysis of projected core habitat indicates that each of the original existing blocks of core habitat will increase in area under the HCP and a fifth block of core habitat greater than 500 acres in size will be created. An additional 4,622 acres of habitat (36 percent of total) greater than 0.3 miles from a road is present, distributed in other areas of the watershed, including six individual blocks, each greater than 300 acres in size.

The amounts of core habitat potentially available within the Cedar River Municipal Watershed, as described above, are considered conservative estimates. All roads in the watershed were considered "open" and not differentiated as to type and level of use for the analyses, nor were they classified by seasonal usage. Therefore, since the maximum amount of road was used in the analyses, the area estimates represent the minimum amount of core habitat that would be available within the watershed during any given season or year. Because many roads, especially at higher elevations and in more remote areas of the watershed, are not driveable or will, in all probability, receive a minimum number of vehicle trips in most years, they could be classified as "impassable" or "restricted" and considered as part of core habitat. In such case, the estimates of core habitat for both current and future conditions under the HCP would increase substantially.

In contrast to the fisher and American marten, wolverines utilize elk and black-tailed deer carrion as a principal food item. Elk and black-tailed deer populations require a mix of open habitats and closed forests to provide an adequate combination of foraging areas and cover. The elimination of commercial timber harvest called for in the HCP is expected to reduce the amount of early seral habitat in the watershed, and thus may negatively affect prey populations for wolverines. Despite a decrease in early seral-stage habitat, especially in the upper watershed, both elk and deer populations will continue to exist under the HCP management regime and will re-equilibrate with the maturing forest landscape, presumably at some lower population level. Because types and relative amounts of open habitat other than harvest units are limited in the watershed, this particular effect of forest habitat maturation on ungulate populations will not especially favor the wolverine.

Several other considerations, however, may counteract this expected reduction in prey base for wolverine: (1) that both the overall watershed landscape and relative abundance of prey will become, over the term of the HCP, more similar to the natural condition that preceded commercial harvest, and to which wolverines in the region were adapted, and (2) considerable early seral-forest habitat is being, and presumably will continue to be, created by commercial timber operations on land adjacent to the watershed, supporting populations of ungulates that are likely larger than those present prior to commercial timber harvest in the region. Considering the large home range of wolverines and the high availability of ungulate prey in areas adjacent to the watershed, it is possible that the reduction of early seral habitat within the watershed may be less important to future wolverine populations than the combination of planned reduction in road density, decrease in human activity on roads, potential increase in the amount of security habitat, and potential increase in denning sites during the term of the HCP.

Disturbance Effects and Injury/Mortality

Injury/Mortality: These 3 species are susceptible to trapping and shooting, which can be significant mortality factors for these species in other areas. Due to the closure of the watershed to hunting and trapping by the public and tribes, the Service believes the likelihood of direct mortality to these species during the term of the HCP will be very low. Furthermore, the Service believes the likelihood of direct injury or mortality from watershed operations will be very low due to the minimization measures contained in the HCP (see summary above).

Disturbance Effects: Wolverines and fishers, in particular, are known to be sensitive to disturbances caused by human activities. The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of fishers, American martens, or wolverines that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat, including the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (7) routine road use; and (8) some types of research and monitoring.

The likelihood of disturbance or Injury/Mortality occurring at a level which may compromise the viability of any Group #27 species that may occur in the watershed is expected to be low because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of known active den sites from human disturbance prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to breeding pairs and other resident or transient individuals; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement and use over the long term.

Summary/Conclusion

The effect of the HCP upon Group #27 species is expected to be positive. Three very significant factors associated with the Cedar River Municipal Watershed relative to protection of all three species in the Washington Cascades are (1) the substantially lower level (and type) of human disturbance occurring within the watershed relative to surrounding areas; (2) the protection of all key habitats, including all old-growth forest; (3) recruitment of a significant amount of mature and late-successional forest, with efforts intended to develop complex forest structure. Given the extreme rarity of older seral forest at low elevations in the Puget Sound region, the recruitment of large areas of mature and late-successional forest below 3,300 ft elevation in the municipal watershed is also a very important factor for fisher. Of importance to both wolverine and American marten is the fact that the municipal watershed, particularly the CHU in the easternmost portion, serves as an important link in the federal late-successional reserve system, helping to connect the Alpine Lakes Wilderness Area to the north and Mt. Rainier National Park to the south.

Under the HCP, the current substantial amount of watershed forest in fragmented condition will be replaced mostly by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early or mid-seral forest habitat less than 50 years old will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early seral stages as a result of recent commercial logging will mature over the term of the HCP, and no additional commercial harvest will be conducted. The total amount of late-seral habitat (over 80 years) is expected to increase by a factor of nearly five. The improved landscape connectivity and increased acreage of preferred forest habitat within the municipal watershed should benefit the populations of fishers, American martens, or wolverines that may exist in the vicinity by providing improved forest habitat conditions that facilitate movement and/or dispersal of individuals throughout the watershed, and by providing critical older forest habitat for breeding and foraging.

Group #28 – Canada Lynx

Introduction

No comprehensive surveys to determine the presence or absence of the Canada lynx have been conducted in the Cedar River Municipal Watershed and no incidental observations of the species have been confirmed to date. In addition, because the species is relatively easy to identify by sight and/or by tracks, and yet has not been detected despite extensive field activity, it is unlikely that lynx are present in the Cedar River Municipal Watershed on any consistent basis. This evaluation is consistent with the fact that the Cedar River watershed is situated at the western and southern extent (south of I-90) of the recently documented primary range of the Canada lynx within the Washington Cascades. In addition, the small size of the municipal watershed relative to lynx home range requirements (up to 115 mi^2) make it likely that only a few resident lynx would use the municipal watershed as a portion of their home range. Although no lynx observations have been documented in the municipal watershed, the occurrence of reliable sightings south of the municipal watershed within the past 10 years suggests that an individual lynx may occasionally travel through the watershed.

Canada lynx are most common from Canada southward into the North Cascades, eastward through the Okanogan region and into northern Idaho. Until recently, Canada lynx have been found on the west side of the Cascades Crest only in the northern section of the North Cascades (Ruggiero et al. 1994). As a result, it is significant to note that much of the information regarding habitat use by lynx, including use of early successional to mature coniferous and deciduous forest habitat, as well as non-forested types such as rock outcrops, bogs, and thickets (McCord and Cardoza 1990; Ruggiero et al. 1994), has been gathered via research in ecosystems that are substantially different from those present within the municipal watershed.

Very recent work by Weaver and Amato (1999) indicates that lynx inhabit portions of Washington where they were not thought to exist. Surveys to identify lynx from hair samples were implemented on National Forest lands in Washington and Oregon during 1998. Results indicate that a minimum of nine lynx were encountered in Washington State, on the Mount Baker-Snoqualmie, Wenatchee, and Gifford Pinchot National Forests. Based on the presence of lynx sightings well south of the municipal watershed, it should not be discounted that lynx may use habitat within the watershed, although, the number of lynx capable of utilizing the watershed would be small.

In addition, the apparent lack of a strong cyclical relationship between lynx populations and snowshoe hare abundance in the southern portions of the range of the Canada lynx (Koehler 1990), as typically exhibited by northern populations, may indicate a lesser reliance on snowshoe hare as a prey species. Therefore, lynx may rely less on early seral-stage forests as foraging habitat in marginal areas of its range. The relatively lower densities of snowshoe hares in west slope Cascade forests compared to forests in the lynx's northern range may also be an indication that west side forests are not optimal habitat for Canada lynx and that comparable populations should not be expected to exist throughout the region. Thus, it may be presumptuous to think that predictions of habitat use within the Cedar River watershed can be made with any certainty.

Assuming that Canada lynx would utilize habitat on the west side of the central Cascades in a manner similar to that used in other regions and ecosystems of Washington, potential key habitat in the municipal watershed is considered to be higher elevation, mature, late-successional, and old-growth forest (especially above 4,000 ft elevation, with abundant logs, and relatively undisturbed) for denning. Results from Weaver and Amato (1999) have confirmed that lynx use habitat in Washington ranging from 3400 - 5600 feet elevation, with the average elevation equal to 4889 feet.

In east side forests, early and mid-seral stage, closed-canopy forest (e.g., sapling/pole stage) is used as foraging habitat by lynx, and riparian forest and ridge line habitats are used as travel corridors. Habitat conditions in closed-canopy early and mid-seral forests on the west side of the Cascades, however, are very different from conditions in such forests on the east side. Young, closed-canopy forest on the west side typically has much less capacity to support potential prey for lynx, particularly when such habitat has been artificially created by commercial timber harvest, where habitat complexity, diversity, and understory development are relatively poor on most sites. In view of these observations, the City considers early seral, closed-canopy forests created only by *natural* processes to be secondary habitat for lynx, along with riparian forest and ridge line habitats.

Other habitat types may receive variable levels of use for foraging and travel by lynx, including open non-forested habitats (rock outcrops, talus/felsenmeer, bogs, persistent shrub, thickets, forest openings created by natural processes). Relative habitat quality and levels of lynx use in these habitats may depend substantially upon prey availability (including snowshoe hares), habitat patch size, and proximity to denning sites.

Similar to the case for grizzly bear (Group #11) and gray wolf (Group #12), human disturbance (e.g., vehicle traffic, recreational activities) has been identified as a major factor influencing the suitability and use of habitat by Canada lynx, especially during the denning season. Excessive trapping has also in some cases, been a substantial mortality factor affecting population levels. Significantly, because the primary function of the Cedar River Municipal Watershed is to supply drinking water to the City of Seattle and the surrounding region, the types and extent of human activities conducted within the municipal watershed differ substantially from those taking place on many nearby lands, especially those areas open to commercial timber harvest and/or a wide variety of public recreational activities.

Although the overall density of "open" roads is now 4.2 mi/mi^2 and will be reduced to about 2.7 mi/mi^2 once the road decommissioning plan has been completed after about HCP year 20, the relatively low level of human use of most municipal watershed roads compared to other watersheds may result in many areas of the municipal watershed effectively providing suitable habitat for lynx with respect to levels of human disturbance. This condition may particularly be the case in the CHU, in the easternmost portion of the watershed, in larger blocks of native old-growth forest, and at higher elevations where road density will be lowest and road use will likely be the least.

The most significant factors associated with the Cedar River Municipal Watershed relative to protection of the Canada lynx in the Washington Cascades are 1) the fact that the municipal watershed is located in a potential zone of re-colonization, and is a potential dispersal corridor between the population in the North Cascades and several areas of protected habitat to the south (e.g., Mt. Rainier National Park) that may play a significant role in linking important areas of potential lynx habitat within the region; (2) the substantially lower level (and different type) of human disturbance occurring within the watershed relative to surrounding areas; and (3) the protection of all key and secondary habitats.

Direct and indirect effects of operational activities on, and the long-term benefits to, the Canada lynx are generally as described for other species addressed by the HCP that are closely associated with mature, late-successional, and old-growth forest, especially those that require relatively low levels of human disturbance (e.g., Group #11, grizzly bear; Group #12, gray wolf). Both immediate and long-term benefits are expected to accrue to lynx through protection of old-growth forest and recruitment of mature and late-successional forest in the watershed, and through protection of other forested (secondary) habitats used for foraging or travel. A net overall gain of potential habitat (breeding, foraging, and dispersal) for the lynx is expected over the 50-year term of the HCP, assuming that early seral forest created by commercial timber harvest is not important to lynx on the west slope of the Cascades.

As a consequence of eliminating timber harvest for commercial purposes, however, the snowshoe hare populations in the watershed may be expected to decrease over the term of the HCP. As no early seral-stage forest habitat will be created by other than natural processes, the amount of early seral habitat, and the concurrent herbaceous/shrub forage supply for snowshoe hares, is likely to decrease in many areas of the watershed. Insofar as Canada lynx depend on a snowshoe hare prey base on the west slope of the central Cascades, the capacity of the watershed to support lynx may diminish in this respect over time, unless the reduced level of human disturbance, increased level of habitat development, and key habitat protection is more important than the reduced prey base in this geographic region. Two additional considerations are (1) that the overall watershed landscape will be more similar to the natural landscape to which lynx previously inhabiting the region were adapted, and (2) considerable early seral forest habitat is being created by commercial timber operations on land adjacent to the watershed, supporting populations of snowshoe hare that are likely larger than those present prior to commercial timber harvest in the region.

The lynx could also be negatively affected by silvicultural treatments, road management, or other operational activities. Such effects could be direct (e.g., direct injury or mortality of individuals as a result of vehicle collision), or indirect, through effects on habitat or disturbance.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for Canada lynx are described in Section 4.2.2 and summarized as follows: (1) elimination of timber harvest for commercial purposes within the watershed, virtually eliminating large scale habitat impacts and substantially reducing disturbance resulting from road use; (2) removal of 38 percent of watershed roads, thereby providing additional habitat with reduced disturbance levels; (3) continued closure of the municipal watershed to unsupervised public access, thus essentially eliminating disturbance and/or mortality resulting from recreational/sport activities; (4) protection of denning lynx from human disturbance; (5) protection of all existing old-growth forest, which provides denning sites and also serves to protect inclusions of non-forested habitat (secondary); (6) protection of all riparian areas and ridge line travel corridors; (7) natural maturation of second-growth forests into mature and late-successional seral stages, thus reestablishing more natural ecosystem function and providing more denning sites; (8) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; and (9) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Major habitat effects on the Canada lynx are generally as described for the other species groups addressed by the HCP that are most closely associated with late-successional and old-growth forest. In contrast to several of these species which utilize habitats over a broad range of elevations, however, in other portions of its range, at least, the Canada lynx typically exhibits a preference for high-elevation, rather than mid- and low-elevation, mature, late-successional, and old-growth forest, especially such forest habitat above 4,000 ft. Although early and mid-seral stage, closed-canopy forest (e.g., sapling/pole stage) has been identified as receiving variable levels of foraging and travel use by lynx in other areas of the species' range, these habitats, although also protected in reserve status, are of unknown importance as foraging habitat for any lynx that may occur within the watershed. Other habitat types used at some level by lynx in other areas for foraging and travel include open non-forested habitats (rock outcrops, talus/felsenmeer, bogs, persistent shrub, thickets, forest openings created by natural disturbances), all of which are present in the municipal watershed.

Because no commercial timber harvest will be conducted in the watershed, all forests outside limited developed areas, including all 13,889 acres of old-growth forest, are in reserve status. As a result, all key habitat is protected in reserve status, as well as all forest outside limited developed areas, all secondary habitats, and all other habitat types that could be used potentially as foraging habitat and/or travel corridors by Canada lynx within the municipal watershed. In addition, the amount of habitat available to lynx within the watershed receiving substantially lower levels of human disturbance than in the past is expected to increase over time, because no commercial logging will take place and road densities will be decreased through decommissioning. Open road densities are expected to decrease from 4.2 mi/mi^2. However, because the watershed is closed to the public most remaining roads will essentially function as closed roads.

Of the 13,889 acres of old-growth forest currently present in the watershed, 11,323 acres (82 percent) is located above 3,000 ft elevation, including 4,201 acres (30 percent of total) that is located above 4,000 ft elevation. No mature or late-successional forest presently exists within the watershed at these elevations. A majority of key old-growth forest habitat that may be suitable for denning Canada lynx is located in a few large contiguous blocks within the spotted owl CHU in the eastern portion of the watershed near the Cascade Crest, and in smaller scattered blocks and along high ridges (travel corridors) to the west, all mostly at relatively high elevations. Relatively little old-growth forest, however, is located west of Chester Morse Lake. Protection of key old-growth habitat for lynx is of primary importance, especially in the CHU, because the CHU is the most remote and least roaded part of the watershed (see effects analysis for Group #11, grizzly bear). Also, because of its proximity to the Alpine Lakes Wilderness Area, the CHU is the area of the watershed most likely to be occupied by colonizing lynx or traversed by dispersing or transient individuals.

Although the structure and ecological function of all forests with the watershed will continue to develop over time, the amount of old-growth forest available to lynx, 13,889 acres on a watershed wide basis and 11,323 acres above 3,000 ft, will remain the same and in reserve status under the HCP, barring severe natural disturbances. The HCP is also expected to benefit Canada lynx, however, through the restoration and/or development of certain potential key habitats for lynx in the municipal watershed. The proposed HCP is expected to result in short- and long-term benefits to lynx through: (1) natural maturation of second-growth forests into mature and late-successional seral stages, providing additional den sites in close proximity to foraging areas and travel corridors; (2) management actions designed to restore a more naturally functioning forest ecosystem; and (3) management actions designed to accelerate the development of mature, late-successional, and old-growth characteristics in second-growth forests.

Although only 165 acres of mature forest occur above 3,000 ft elevation, key habitat for Canada lynx, will be created during the first two decades of the HCP. A substantial increase will accrue during the last thirty years. During the last three decades of the HCP, a 10,690-acre increase in the total amount of late-successional forest (30 acres) and mature forest (10,660 acres) will be created in areas of the watershed above 3,000 ft elevation. Most of this habitat will develop in areas between 3,000 and 4,000 ft elevation, thereby improving both the horizontal and vertical distribution of potential key habitat and connectivity with secondary habitats, including riparian and ridge line travel corridors, for lynx within the municipal watershed. In addition, solely as a result of forest maturation on a watershed wide basis (i.e., at all elevations), approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a fivefold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.2). The combination of natural forest maturation and proposed silvicultural treatments in selected areas of the watershed will result in an overall increase in suitable potential habitat for lynx throughout the entire elevation range of the watershed landscape, with the possible exception of reduced amounts of early seral forest created artificially by timber harvest.

By year 2050, there will be no early seral-stage forest (0-29 years of age) that is created by commercial timber harvest, a reduction from 15,610 acres in 1997. The extent of early seral habitat at year 2050, however, would be more typical of levels existing in a mature coniferous forest ecosystem than those that have developed under historic harvest management regimes. Any additional early seral-stage habitats would result solely from natural disturbance events such as fire, landslide, insect infestation, or other disease. On average over the last millennium, about 280 acres of forest per year have been removed by forest fires in this region, but such fires are episodic and not periodic (Henderson 1990, 1993).

Only 7 percent (6,104 acres) of the land within the watershed that is classified as forested is located above an elevation of 4,000 ft. Approximately 30,444 acres (36 percent) of the forested land is located at elevations above 3,000 ft, and the remaining 54,786 acres (64 percent) falls below that level. Canada lynx appear to demonstrate a habitat preference for forested lands located above 4,000 ft, but all forested, as well as non-forested, lands within the municipal watershed are well within the overall elevation range of habitat used by Canada lynx. Although lower elevation forest may not be used as preferred or key habitat, it may function adequately at some level as secondary foraging or dispersal habitat. Below 3,000 ft, the amount of old-growth (2,565 acres) and non-forest habitat will remain constant over the term of the HCP, barring severe natural disturbances. However, there will be a substantial increase in the amount of mature and late-successional forest habitat in this elevation range, from 1,165 acres in 1997 to 47,997acres in 2050. These changes in total amounts of habitat and their relative landscape distribution, resulting both from natural maturation processes and restoration activities (see below), will result in habitat potential for Canada lynx more typical of an older, naturally functioning coniferous forest ecosystem.

Canada lynx are carnivorous predators that typically rely on snowshoe hares as a primary component of their diet, especially in more northern portions of their range. In northern regions lynx tend to display cyclic population fluctuations closely linked to snowshoe hare densities (also cyclic) and to require adequate populations of hares within their range in order to sustain viable populations. However, this cyclic relationship does not appear to be as strongly exhibited by lynx populations on the periphery of its geographical range, especially on the southern and western boundaries of its range (i.e., the west slope of the central Washington Cascades), where hare densities typically are relatively low in un-managed forests. High levels of commercial timber harvest, however, create an artificially high abundance of herbaceous and small shrub forage for snowshoe hares as compared with more natural systems, and hare population densities typically are high in these areas.

Snowshoe hares are present in the watershed. While populations appear to be consistent in density with those in other areas of the west slope of the Washington Cascades, no numeric estimates are available. Snowshoe hares use a wide variety of habitats, including dense, second-growth forests, old growth, forested wetlands, and edge habitats over a wide range of elevation. All forest that could be habitat for snowshoe hares within the watershed, including old growth, second growth, forested wetlands, and riparian forest, is protected in reserve status. As a result, all non-forested habitat (e.g., wetlands, persistent shrub), present as inclusions surrounded by forest cover, are also protected. Many natural edge habitats (e.g., the transition zone between persistent shrub, rock outcrop, or talus/felsenmeer habitats and old-growth forest) utilized by hares are also protected. Also, early and mid-seral stage forest that supports populations of snowshoe hare will, in all probability, continue to be available to any lynx that might inhabit the municipal watershed on the many adjacent lands managed for commercial timber production on a typically short harvest rotation that fall within the characteristically large home range of Canada lynx.

In addition, the restoration and ecological thinning included in the HCP will result in the production of a certain amount of herbaceous and shrub forage in thousands of acres of treated forests, somewhat offsetting the lack of availability in commercial timber harvest units, as well as creating some additional edge habitat as small forest openings are made. Although provisions of the HCP will reduce the amount of early seral forest habitat at elevations above 3,000 ft, presumably reducing prey for lynx in that zone, the overall landscape distribution and connectivity of all seral stages of forest succession fostered by the HCP conservation policies will more closely approach conditions of habitat availability and prey densities characteristic of a naturally functioning coniferous forest ecosystem on the west slope of the Cascade Mountain. This change in conditions is important and intentional because a primary purpose of the Act is to conserve the ecosystems on which threatened or endangered species depend. Within the Cascadian coniferous forest ecosystem, lynx and hare populations, as well as other populations of lynx prey, will fluctuate relative to a more natural ecological balance with only limited influence of timber harvest.

Short-term and long-terms gains in the quality and/or quantity of aquatic and riparian habitats are expected under the HCP as a result of the natural maturation of younger seral-stage forest in buffer areas, and as a result of management actions designed to help restore and enhance riparian habitats (e.g., restoration planting, restoration thinning, and ecological thinning in buffer and riparian areas). Development into mature and late-successional forest and restoration of a more naturally functioning riparian ecosystem may potentially benefit the lynx through the creation of more favorable travel corridors and better habitat for its prey.

Restoration of more natural riparian ecosystem function (development of mature forest canopy) through silvicultural intervention would benefit the lynx over the long term by providing a more preferred habitat type, especially for denning, with a broader distribution over the watershed landscape. However, restoration activities (e.g., restoration thinning) might also have temporary, short-term effects in terms of behavioral disturbance that would cease at the time of project completion. Site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions in aquatic buffers to ensure that habitat for lynx is minimally impacted.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance and possibly injury or mortality, of lynx that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat including the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (7) routine road use.

If Canada lynx were eventually to occur in the watershed, however, the likelihood of disturbance to any actively breeding Canada lynx denning in the watershed is expected to be very low and short-term in nature because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of known active den sites from human disturbance prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to breeding pairs and other resident or transient individuals; and (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance to lynx resulting from road maintenance, improvement and use over the long term.

Because lynx require areas away from human disturbance during reproductive periods, restrictions on unsupervised public entry into the watershed (Section 4.2.2), road removal, and elimination of commercial timber harvest activities in the watershed in particular are expected to benefit this species. Road decommissioning and restricted public access in the upper municipal watershed within the CHU are especially important to the lynx for three reasons: (1) lynx are more likely to occur in the upper portion of the municipal watershed; (2) the greatest amount of existing lynx core habitat (away from roads) occurs in the upper municipal watershed; and (3) the greatest opportunity to produce additional core habitat through selective road removal also occurs in the upper municipal watershed. Reductions in road density as well as restrictions of public access on watershed roads will reduce potential mortality or injury from motor-vehicle collisions and reduce the ability of poachers and trespassers to harass or harm this species.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of any Canada lynx resulting from silvicultural treatments, road management, or other operational activities is expected to be very low. Rarely, however, an individual Canada lynx crossing or utilizing watershed roads as travel corridors may be injured or killed inadvertently by vehicles. Accidental and intentional shooting and trapping of lynx is one of the primary mortality factors of lynx, especially in areas with high human population densities. The closure of the municipal watershed to hunting or trapping of any kind, including tribal hunting or trapping, essentially eliminates this serious mortality factor

Summary/Conclusion

Population-level effects on the Canada lynx are, generally, as described for the other species addressed by the HCP that are closely associated with late-successional and old-growth forest, especially those that require relatively low levels of human disturbance (e.g., Group #11, grizzly bear; Group #12, gray wolf). Under the HCP the substantial amount of watershed forest currently in fragmented condition will mostly be replaced by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. The Service expects that the habitat carrying capacity of the watershed for the lynx should remain the same as present, and may even increase over time and that the HCP will have an overall net positive effect on the lynx population in the Cascades.

By HCP year 50, no early or mid-seral forest habitat less than 50 years old will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early seral stages as a result of recent commercial logging will have matured over the term of the HCP, as no additional commercial harvest will have been conducted. The total amount of late-seral forest habitat (over 80 years) is expected to increase by a factor of nearly five. The improved landscape connectivity and increased acreage of preferred forest habitat within the municipal watershed should benefit the populations of Canada lynx that may exist in the vicinity by providing improved forest habitat conditions that facilitate movement and/or dispersal of individuals throughout the watershed and by providing older forest habitat for breeding and foraging.

The development of a large block of older forest at higher elevations in the CHU will benefit the lynx by providing connectivity with lands in the federal LSR (late-successional forest reserve) system in the Cascades. This block is also located in the portion of the municipal watershed closest to the Alpine Lakes Wilderness Area and the Cascade Crest. As mentioned above, the CHU is the area most likely to be occupied by colonizing lynx or traversed by dispersing/transient lynx. Thus, this landscape connectivity may further benefit populations of Canada lynx on a more regional level by facilitating movement and dispersal of individuals between the Cedar River Municipal Watershed and other watersheds to the north, east, and south (especially the Alpine Lakes Wilderness Area to the north).

Group #29 – Pacific Lamprey, River Lamprey

Introduction

Pacific and river lampreys are widely distributed along the Pacific Coast. While these species are generally considered to be anadromous, some landlocked populations of Pacific lampreys are known to exist (Wydoski and Whitney 1979; ODFW 1996). The life cycles of the anadromous river and Pacific lampreys involve spawning in coastal rivers or streams and extended rearing in freshwater habitat prior to migration to sea.

Both of these lamprey species enter coastal rivers and streams to spawn. Adults may spend extended time in freshwater prior to spawning without feeding. Juvenile lampreys, called amocoetes, live in depositional areas containing fine material for extended periods prior to migrating to the ocean. The quality of stream habitat for spawning lampreys depends on water temperature, water quality, and habitat complexity, which in turn depends, in part, on the condition of riparian vegetation. Potential key habitat for these species includes low- to moderate-gradient streams with small-sized gravel for spawning and sandy or muddy bottom depositional areas with slow to moderate velocities for rearing, along with riparian areas associated with these streams within the municipal watershed.

For the purposes of this effects analysis, the City assumes that both lamprey species are in the Cedar River system and will pass above Landsburg when the fish ladders are in place. However, the number of lamprey, if any, that will pass above Landsburg is uncertain.

Either lamprey species could be negatively affected by impingement on water intake screens at Landsburg, cleaning of the forebay at the Landsburg water supply intake, silvicultural treatments, road management, or other operational activities in riparian or upland areas that could affect streams in the lower municipal watershed. Such effects could be direct through direct injury to, or death of, individuals or indirect, through influences on habitat (e.g., removal of overstory riparian vegetation). Lamprey could also be negatively affected by management actions that may contribute sediment to aquatic habitats on a short- or long-term basis (e.g., stream habitat restoration projects, silvicultural treatments in riparian areas, road maintenance, use, and road decommissioning).

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for Pacific and river lamprey are detailed in the sections 4.2.2, 4.3.2, 4.4.2, and Section 4.5.6. In brief the mitigation and minimization measures committed to in the HCP are expected to maintain the natural processes important for creating and maintaining habitat for lamprey in the watershed by implementing or providing:

1. construction of fish passage and protection facilities at the Landsburg Diversion Dam;
2. implementation of guaranteed and supplemental instream flows, protecting and providing habitat in the Cedar River below the Masonry Dam;
3. funding for habitat protection and restoration downstream of Landsburg;
4. funding to improve survival of adults passing through the Ballard Locks to Puget Sound;
5. adaptive management of river flows, though the Cedar River Instream Flow Oversight Commission;
6. protection of key habitat in the municipal watershed (streams and associated riparian habitat between lower Cedar Falls and Landsburg);
7. elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance;
8. protection of all riparian forest, as well as upland forest, with recruitment of substantial mature and late-successional forest over time in riparian and upland areas, improving the habitat quality of forests associated with streams and helping to restore natural ecological functions in riparian forests;
9. silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests;
10. stream restoration projects, which are expected to improve microhabitat conditions in many reaches;
11. road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams and other aquatic habitats;
12. guidelines and prescriptions designed to reduce anthropogenic sediment production during watershed management activities, such as forebay cleaning at Landsburg; and
13. monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Passage above the Landsburg Diversion Dam will provide improved access for Pacific and river lampreys to approximately 17 miles of stream habitat (mainstem and tributary) that will be protected and restored under the Watershed Management Mitigation and Conservation Strategies (Section 4.2.2). Several tributary streams enter the Cedar River between Lower Cedar Falls and Landsburg that provide low-gradient habitat conducive to lamprey spawning and larval rearing. Improved access is expected to provide the opportunity for increased long-term natural production of these species in the municipal watershed and result in an overall net increase in habitat available to anadromous lampreys. While it is presently possible that some individuals ascend the diversion dam, the installation of fish passage facilities is expected to improve access and increase the number of lamprey that may reach habitat as far up the Cedar River as lower Cedar Falls. Lampreys are known to ascend fish ladders built for salmon in the Columbia River (Fitzpatrick et al. 1996).

The HCP includes additional provisions that will enhance conditions in the Cedar River for Pacific and river lamprey. These provisions include: (1) proposed guaranteed flows and change of flow compliance point (Section 4.4.2); (2) flow downramping standards to protect juvenile fish from stranding (Section 4.4.2); (3) funding for habitat restoration projects, potentially including construction of groundwater-fed spawning channels and/or the purchase or protection of lands near the river downstream of Landsburg (Section 4.4.2); (4) construction of fish passage and protection facilities at the Landsburg Diversion Dam; and (5) watershed management mitigation and conservation measures that would benefit Pacific and river lamprey once fish passage is restored. These measures are expected to provide immediate protection of Pacific and river lamprey habitat and provide opportunity for increased production in the basin.

Habitat Effects Related to Instream Flow Management

Instream flow regimes under the HCP will further protect Pacific and river lamprey by providing assurances that flows throughout the majority of the reach between Lake Washington and Lower Cedar Falls would be equal to or greater than the levels provided by the existing Washington Department of Ecology IRPP recommended flows for most of the year (Section 4.4). Because Pacific or river lamprey spawn in winter and spring, the elements of the instream flow regime designed to protect the redds of salmon and steelhead that spawn in shallower areas near the river margin from dewatering will also afford protection to any lamprey eggs and larvae that may occur in these areas.

In addition, as part of the proposed instream flow management regime, the compliance point of stream flow will be moved approximately 20 miles upstream near the Landsburg Diversion Dam (Section 4.4). Because of this change, flows will remain higher downstream of Landsburg as a result of groundwater and surface water inputs that occur downstream of the measurement point. The change in the location of the measurement point will also allow flows to fluctuate in a more natural manner in the lower river.

The City is anticipating no alterations in its flood management practices as a result of the HCP. Consequently, the City anticipates little or no change in the magnitude, frequency, duration, or timing of peak flow events. Channel forming processes associated with these peak flows serve to maintain silt and sand laden backwaters and quiet eddies near the stream margins or in off-channel areas, habitat typically used by larval lampreys of both species for rearing (Wydoski and Whitney 1979).

Larval Pacific lamprey remain in the stream environment for from 4 to 6 or 7 years before beginning their transformation to the parasitic adult stage (Close et al. 1995). The length of the river lamprey larval period is unknown (Scott and Crossman 1979). This long freshwater larval period is of particular concern with regard to instream flows and facility operations. During the larval phase, lamprey may move from place to place within the same mud habitat or migrate downstream to another area of the stream (Close et al. 1995). The mechanisms that cue larvae to relocate and the rate at which they can respond to these cues are poorly understood, but larvae are known to respond to low oxygen levels by leaving their burrows (Potter 1980; Hardistry and Potter 1971).

Habitat Effects Related to Funding for Downstream Habitat

The lower Cedar River downstream of the Municipal Watershed has been severely impacted by urbanization and other development, channel modifications, and riparian zone disturbance (King County 1998). It is likely that the confined nature of much of this reach has resulted in a significant loss of backwaters and quiet eddies with areas of mud and silt substrate suitable for lamprey larvae rearing. Mainstem and side-channel habitat quantity and quality have been reduced substantially compared to original conditions in the lower river, largely by land management actions beyond the control and responsibility of the City.

The HCP provides $4.6 million for habitat protection and improvement downstream of Landsburg, which could include construction of groundwater-fed spawning channels and the protection and/or purchase of lands adjacent to the river or its tributaries. New groundwater-fed channels and connected ponds would result in benefits to both Pacific lamprey and river lamprey. These areas would provide perennial habitat protected from channel scour associated with peak flows in the main channel of the Cedar River.

Habitat Effects Related to Mitigation for the Landsburg Diversion Dam

Insofar as Pacific or river lampreys have difficulty crossing the Landsburg Diversion Dam when migrating upstream, construction of fish passage facilities at Landsburg will substantially increase the availability of protected, high quality habitat for spawning adults and larvae. Passage over the Landsburg Diversion Dam would increase river miles of mainstem habitat available to lamprey by 55 percent, and, according to the Washington stream catalog, an additional 17 stream miles of habitat (mainstem and tributary) would become available overall. Given the ability of lampreys to ascend barriers, it is possible that more than 17 stream miles may be accessible to Pacific and river lampreys.

Habitat Effects Related to Land Management in the Municipal Watershed

The effects of past land management in the municipal watershed have included (1) removal of riparian forest during timber harvest, reducing shading, the supply of food (invertebrates) to streams, and recruitment of large woody debris; and (2) construction and use of hundreds of miles of forest roads, which has increased sediment loading to streams through erosion and mass wasting (landslides). The current, disturbed condition of the majority of aquatic and riparian habitats in the municipal watershed presents opportunities for habitat rehabilitation and, over the long term, restoration of the natural ecological functions of the aquatic/riparian ecosystem.

Because no commercial timber harvest will be conducted in the watershed, all lands outside limited developed areas, including all aquatic and riparian ecosystem elements, are in reserve status. As a result, all key habitat for Pacific or river lamprey within the municipal watershed (i.e., streams and associated riparian habitat in the lower watershed) is protected through reserve status. In addition, protection in reserve status of *all* forested areas of the watershed will decrease the likelihood of land management activities adversely affecting Pacific or river lamprey. In the short term, these species will benefit by increased levels of habitat protection and by active intervention to increase habitat complexity, such as through projects to add large woody debris to streams deficient in habitat structure, which would create pools that could be used by larvae. In the long term, Pacific and river lamprey will benefit from the different elements of the HCP designed to help restore a naturally functioning complex of aquatic, riparian, and upland forest habitats, so that the ecosystem itself can supply, on a sustained basis, the important habitat elements, such as pools, that are important to these species.

While reduction of anthropogenic sediment input to streams could reduce the amount of artificially created habitat for lamprey larvae, which use mud and fine sediment, actions to bring these inputs to more natural levels would help restore an aquatic/riparian ecosystem more similar to that to which Pacific and river lamprey are adapted. Furthermore, such restoration efforts should serve to improve the quality of habitat for spawning adults.

Short-term and long-term gains in the quality of stream and riparian habitats are expected under the HCP as a result of the natural maturation of younger seral-stage forest in riparian areas. By placing all lands outside of limited developed areas in reserve status, the HCP includes provisions that will serve to protect and/or reestablish forest vegetation adjacent to streams in the lower municipal watershed, as well as protecting all wetlands, and their recharge areas, associated with streams. Maturation of protected forest in riparian forests near streams will help restore more natural ecological functioning in the riparian/aquatic ecosystem as a whole, in part by restoring habitat complexity through natural recruitment of large woody debris, creation of more pools, increases in food production for fish, and cooler water temperatures.

The HCP also includes active intervention designed to improve and help restore aquatic and riparian habitats, including stream bank stabilization projects; placement of large woody debris (LWD); a stream bank revegetation program; a program of restoration planting, restoration thinning, and ecological thinning in riparian areas; a program to eliminate, modify, or replace stream-crossing culverts that could impede the passage of lamprey using tributaries, restoring habitat connectivity and continuity; a program to eliminate, modify, or replace stream-crossing culverts that are inadequate for passing peak storm flows, reducing the chance of failure and resulting excessive sediment deposition in downstream habitat; programs to improve problem roads and the maintenance of roads that can affect streams, in both cases to reduce sediment loading to streams associated with erosion and mass wasting; and a program to decommission (remove) about 38 percent of forest roads, further reducing sediment loading to streams.

Collectively, these conservation and mitigation measures should (1) help restore natural aquatic and riparian ecosystem functioning and (2) accelerate the development of mature or late-successional characteristics in younger second-growth forests in riparian areas. Although restoration of a more naturally functioning aquatic ecosystem will benefit Pacific and river lamprey over the long term, some of these management interventions may cause some localized, short-term decline in habitat function. Such impacts might include reduced canopy cover that could lead to increased solar heating of stream water or to increased rates of soil erosion, or disturbance of soils that could result in erosion and sediment release into streams.

Because no harvest for commercial purposes will occur in riparian areas, however, any impacts associated with the removal of vegetative cover will be largely eliminated. Site evaluations by an interdisciplinary team prior to undertaking such activities in riparian areas will also help minimize any such impacts on Pacific and river lamprey. In addition, the HCP also includes a comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) and other guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with silvicultural treatments in riparian areas. Implementing these prescriptions and guidelines will help reduce the rate of sediment loading to aquatic systems and will help maintain high water quality in potential habitat for Pacific and river lamprey.

Because many of the types of habitat rehabilitation and restoration measures included in the HCP are experimental, monitoring within the context of adaptive management is essential to the long term success of these efforts (Section 4.5.7). The HCP includes two types of monitoring relevant to these efforts (Section 4.5.4): (1) long-term monitoring of stream habitat quality, to detect trends, and (2) monitoring of specific aquatic and riparian restoration projects, to provide feedback on the adequacy of project designs. Interdisciplinary teams will be involved in the design and monitoring of restoration projects.

Disturbance Effects and Injury/Mortality

Operation of facilities has inherent potential to injure or kill lamprey that may pass near such facilities or use nearby habitats. The City acknowledges that limited information exists on specific habitats used by larval lamprey in the Cedar River Basin and the rate at which larval lamprey can adjust to changes in river stage. Maintaining stream flows over silt and sand deposits associated with backwaters and off-channel areas could minimize the need of larvae to relocate. To provide additional flexibility in managing stream flows for the benefit of fish, including lamprey, the Instream Flow Agreement (Appendix 27) provides the opportunity for the Service, via the Cedar River Instream Flow Oversight Commission, to advise the City in managing available flows that are over and above guaranteed levels. The Service has a voting seat on this Commission.

Disturbance effects and direct injury or death could thus occur under the HCP in three ways: (1) through operation of the Landsburg diversion facilities, (2) through management of instream flow levels, and (3) through land management in the municipal watershed. These effects are addressed below.

Effects Related to Operation of Landsburg Diversion Facilities

Fine sediments accumulate in the concrete-lined forebay adjacent to the Landsburg Diversion Dam that is associated with the water intake, and this material must be removed annually in order to maintain proper facility operation and ensure drinking water quality. The process of removing this material requires lowering the water elevation at Landsburg Dam, and thus the level of the ponded inundation zone upstream, and draining the forebay. This is done at a maximum rate of stage change in river flow during both the forebay draining and refill operations of +/-0.25 feet per hour. The entire operation is normally completed in 48 hours. During cleaning operations, accumulated sediment is mechanically removed and any larval lampreys that have not left the forebay before draining would be destroyed. Losses, if any, would be influenced by the number and behavior of larval lamprey using the forebay area. It should be noted, however, that any lampreys using sediments in the forebay would be using artificially created habitat that would not be present were the facilities absent.

Also, during normal operation, inundation from the Landsburg Dam typically extends upriver for approximately 3000 ft, the reach within which silt and other fine materials settle out on the channel bottom, creating habitat for larval lamprey. The portion of this reach still retaining run-of-the-river flow (during and after downramping) may provide refuge for larval lamprey displaced from substrates exposed along the river margin during the forebay cleaning process, and this habitat may also add to the amount of fine sediment habitat available naturally for Pacific and river lamprey. Should lamprey larvae be present within this reach during cleaning, the Service believes that losses from desiccation may be minimal, because of the short period of time and the time of year the substrate would be subject to exposure and the season of the year (typically mid-winter) when the operation is done. Forebay cleaning typically occurs in February or March, when air and water temperatures are relatively cool and precipitation is frequent. Since juvenile lamprey may be present year around, forebay cleaning in late winter reduces the risk to juvenile lamprey, compared to forebay cleaning done in warmer and drier periods of the year.

Some lamprey larvae could also be injured or killed as a result of impingement on the water intake screens at Landsburg. Improvements for fish protection, however, include new screens designed to minimize impingement of salmonids on the screens. It is presumed by the Service, though not known, that such improvements to the screens will minimize impingement of lampreys as well (Section 4.3.2).

Because of the installation of new fish screens committed to in the HCP and the habitat conditions discussed above that are related specifically to the Landsburg Diversion Dam, the Service does not believe that disturbance to, direct injury to, or death of individuals as a result of the City's water supply operation will have any effects on Pacific or river lamprey with population-level consequences. However, an unknown quantity of individuals will be taken as a result of these Diversion Facilities and maintenance thereof.

Effects Related to Instream Flows

Rapid downramping of stream flows in the mainstem of the Cedar River as a result of City water supply and hydroelectric operations could strand Pacific and river lamprey larvae in shallow areas, particularly along stream margins, potentially resulting in death of some individuals from high temperature or dehydration, to the extent that those individuals could not move back into flowing water. 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). The HCP will moderate the rate at which instantaneous stream flow could be reduced by the operations of the City's water supply and storage facilities. This moderation would decrease the risk of stranding larval lamprey, as well as fry and juveniles of other species (see Section 4.4.2). A recent analysis of the frequency and magnitude of instream flow changes on the Cedar River suggests that significant downramping events can now occur quite frequently during normal operations (Section 3.5.10). Prior to the HCP, no formal downramping criteria were used to guide flow control operations.

Effects Related to Land Management in the Municipal Watershed

The primary activities that may result in disturbance, direct injury, potentially even including death, of Pacific and river lamprey in the watershed under the HCP include operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) instream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (8) routine road use. It should be noted that only a portion of each of the above activities will occur within the lower municipal watershed.

Disturbance to, injury of, or death of Pacific and river lamprey is expected to occur as a result of the actions described above. However, the effects on habitat are expected to be short-term in nature, and not significant to the population of Pacific and river lamprey in the watershed because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of Pacific and river lamprey habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which minimizes potential disturbance overall; and (4) removal of 38 percent of forest roads, which will reduce the potential for negative effects resulting from road maintenance, improvement, and use over the long term.

Summary/Conclusion

For several reasons, the Service believes that the HCP will have an overall positive effect on Pacific and river lamprey populations in the Cedar River Watershed over the long term. The following measures included in the HCP should have positive impacts on populations of Pacific or river lamprey: (1) higher guaranteed instream flows, and flexibility to manage supplemental flows to benefit anadromous species; (2) downramping controls on instream flows, to reduce the chance of stranding; (3) after completion of the fish passage facilities, ther will be improved access to high quality habitat above Landsburg; and (4) funding for habitat protection and improvement in the Cedar River Basin below Landsburg. While some losses of lampreys may occur during annual forebay cleaning, the extensive habitat available to lamprey in the Cedar River from Lake Washington to lower Cedar Falls (34 miles of stream) makes it unlikely that the losses will be significant to the population of either Pacific or river lamprey.

The HCP also provides a number of distinct benefits to Pacific and river lamprey as part of the Watershed Management Mitigation and Conservation Strategies (Section 4.2), including (1) protection of key habitat through reserve status; (2) improvements and substantial decommissioning of forest roads; and (3) restoration of stream and riparian habitats over the long term to more natural conditions (see above). Any short-term, local impacts to Pacific and river lamprey from these restoration activities in streams and riparian areas will be more than offset by long-term, landscape-level benefits. Increases in the quantity and quality of accessible habitat, in both stream and riparian areas, will benefit Pacific and river lamprey populations in the municipal watershed.

The Service believes the overall net beneficial effect of the HCP upon lamprey populations in the Cedar River will have positive effects on the range-wide populations of both lamprey species. However, due to the small size of the drainage relative to the entire range of these wide-ranging species, the incremental improvement is likely to be small, and perhaps undetectable.

Group #30 Kokanee

Addressed in NMFS's Biological Opinion (NMFS 2000).

Group #31 Sea-run Cutthroat Trout

Addressed in NMFS's Biological Opinion (NMFS 2000).

Group #32 – Tailed Frog, Pacific Giant Salamander, Cascade Torrent Salamander

Introduction
The tailed frog and Pacific giant salamander are widely distributed and known to breed in the Cedar River Municipal Watershed. No comprehensive surveys to determine the presence or absence of the Cascade torrent salamander have been conducted in the municipal watershed and no incidental observations of this species have been documented to date. It is also significant to note that the watershed is outside the current known range of the Cascade torrent salamander (Leonard et al. 1993; Corkran and Thoms 1996).

Each of the amphibians in species Group #32 is dependent on headwater aquatic and riparian ecosystems during at least one or more phases of its life cycle, although specific habitat requirements do vary somewhat among the three species. All three species deposit their eggs in free water, typically in streams above the limit of fish distribution, and their larval forms rear in the stream environment, as long as 5 to 6 years at higher elevations in the case of the Pacific giant salamander (Leonard et al. 1993). Adults of each of the three species are typically found in cold, clear headwater streams (rocky substrates particularly for tailed frogs), but also utilize terrestrial environments. In contrast to the other two species, especially the tailed frog, Pacific giant salamanders can be found in mountain lakes. Adult Cascade torrent salamanders are usually found in or near cold, clear streams above the limit of fish distribution, seepages, waterfall splash zones, and in seepages in talus slopes (Leonard et al. 1993) and of the three species, appears to be the species most consistently associated with free water as adults. Adult tailed frogs feed in both streams and adjacent forest habitats and adult Pacific giant salamanders forage in cool, moist coniferous forest habitats, especially in the vicinity of free water (Leonard et al. 1993). Cold water temperature (especially for the Cascade torrent salamander) and the absence, or minimum levels, of fine sediment (especially for the tailed frog) are important aspects of habitat quality for these amphibian species in Group #32.

Potential key habitat for the tailed frog, Pacific giant salamander, and Cascade torrent salamander (if present) in the municipal watershed includes headwater streams, mountain lakes, seepages, near-stream riparian areas, especially in mature, late-successional, and old-growth forests (particularly in headwater stream basins).

Group #32 species could be negatively affected by silvicultural treatments, road management, or other operational activities in streams and in riparian or upland forested areas. Such effects could be direct (e.g., through direct injury to, or death of, individuals) or indirect, through influences on habitat (e.g., removal of overstory vegetation, increased stream temperature). Group #32 species could also be negatively affected on a short-term basis by management actions that contribute sediment to streams (e.g., stream restoration projects, silvicultural treatments in riparian areas, road maintenance, use, and decommissioning).

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for Group #32 species are described in Section 4.2.2 and summarized below: (1) protection of all key aquatic and riparian habitat including streams, lakes, ponds, seepages, and headwalls to support reproductive and foraging behaviors; (2) protection of all key non-forested habitat (talus/felsenmeer slopes) as inclusions within reserve forest, also to support reproductive and foraging behaviors; (3) protection of all old growth and recruitment of a substantial amount of mature and late-successional forest over time, maintaining or lowering stream temperatures and facilitating dispersal; (4) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance; (5) silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests, improving forest and riparian habitat conditions (especially aquatic and terrestrial temperature regimes); (6) stream habitat restoration projects, reestablishing more natural stream function; (7) streambank stabilization projects to reduce sediment input to streams; (8) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams; (9) guidelines and prescriptions designed to reduce sediment production during watershed management activities; (10) overall improvements in water quality; (11) removal of 38 percent of watershed roads, reducing the risk of direct injury or death as a result of road use; and (12) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All lands outside limited developed areas, including 13,889 acres of old-growth forest, are in reserve status. As a result, all key aquatic and riparian habitats (streams, lakes, ponds, seepages, especially where associated with late-successional and old-growth forest) for Group #32 species within the municipal watershed are protected in reserve status. All secondary and potential habitat is also protected in reserve status. In addition, protection in reserve status of all streams, as well as all forested areas of the watershed, will facilitate dispersal throughout suitable habitat in both aquatic and terrestrial ecosystems over the entire watershed landscape for all three amphibians in Group #32. In addition, silvicultural activities (heavy equipment, tree cutting) are restricted within 50 ft of streams and during any operations near special habitats (e.g., talus/felsenmeer slopes) activity will be restricted within a 200-foot zone to minimize the potential for habitat impacts or disturbance to key wildlife species, including Group #32 species.

Although old growth (by definition) will not increase in extent under the HCP, substantial increases in the quantity of mature and late-successional coniferous forest habitat for Group #32 species, especially in riparian corridors, are expected over the 50-year term of the HCP. Increases in the quantity of the forest types will be a result of natural maturation of second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in some areas of second-growth forest. Solely as a result of natural forest maturation, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a fivefold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.5). Silvicultural treatments including: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; and (3) ecological thinning of about 2,000 acres is expected to make habitat conditions more suitable in some second-growth forest by improving moisture regimes on the forest floor (e.g., increasing organic debris) and either maintaining cold stream temperatures or by improving shade conditions to reduce stream temperatures over the long term. In addition, by the end of the HCP term, older forest habitat will be more evenly distributed throughout the watershed landscape, including the entire elevation range and all stream corridors, than under current conditions.

In addition to aquatic, riparian, and certain forested habitats used by Group #32 species, the Cascade torrent salamander also utilizes seepages in non-forested talus/felsenmeer slopes. The Cascade torrent salamander is thus also expected to benefit from management actions designed to protect, restore, or enhance these special habitats. All vegetated talus/felsenmeer (329 acres) and non-vegetated talus/felsenmeer (1,189 acres) slopes, most of which are surrounded by reserve forest or are adjacent to key aquatic and riparian habitat, are protected in reserve status.

Short-term and long-term gains in the quality and/or quantity of aquatic and riparian habitats are expected under the HCP as a result of the natural development of mature forest in riparian areas. Development of mature and late-successional forest significantly contributes to the reestablishment of a more naturally functioning ecosystem, thus benefitting amphibians in species Group #32. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of the HCP, "riparian" zones of 300 ft (on Type I-III waters), 150 ft (on Type IV waters), and 100 ft (on Type V waters) were established using GIS data and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase.

The HCP also includes management actions designed to help restore and/or enhance aquatic and riparian habitats. Stream bank stabilization, placement of large woody debris, stream bank re-vegetation, restoration planting and thinning, and ecological thinning in riparian areas are all expected to contribute to accelerating the reestablishment of more natural aquatic and riparian ecosystem functions. The re-establishment of more natural aquatic ecosystem function, combined with the development of additional mature and late-successional characteristics in younger second-growth forests, especially in streamside riparian areas, will re-establish a more naturally functioning forest ecosystem throughout the watershed landscape that will improve habitat quality and availability, as well as the potential for dispersal, for the three amphibian species in Group #32.

Silvicultural treatments in riparian areas may result in short-term negative impacts on streamside habitat and/or water quality. Such impacts may occur if reduced canopy cover leads to increased solar heating of stream water, or to increased rates of soil erosion. However, no harvest for commercial purposes will occur in riparian areas, the use of mechanical equipment and cutting of trees are restricted within 50 feet of streams, and interdisciplinary teams will evaluate and plan silvicultural and operational projects in any key habitat, especially within riparian zones, in order to eliminate or minimize any short-term impacts to habitat of Group #32 species. As a result, potential impacts to habitat or water quality resulting from removal of vegetative cover will be virtually eliminated. In addition, during restoration or ecological thinning activities, no tree removal that has the potential to reduce streambank stability will be allowed within 25 feet of any stream. In addition, the HCP also includes a comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) intended to minimize the potential for erosion and mass wasting associated with silvicultural treatments in riparian areas. Following these prescriptions will reduce the rate of sediment loading to aquatic systems, and help maintain high water quality.

Road repair, maintenance, and decommissioning can all impact stream and riparian areas. The comprehensive suite of Watershed Assessment Prescriptions are, however, intended to minimize the probability of erosion and mass wasting associated with roads. Implementing these prescriptions, along with the program to improve and decommission roads (Section 4.2.2), will reduce the rate of sediment loading to streams and help maintain high water quality. It is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads come near streambanks, but improved road maintenance under the HCP will help mitigate those impacts.

Disturbance Effects and Injury/Mortality

The primary activities that may result in disturbance, injury, potentially even including death, of Group #32 species include operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) instream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) monitoring and research. Occasionally, individual amphibians of this group may be injured or killed inadvertently by vehicles when they attempt to cross watershed roads while dispersing. Further, an occasional individual might be injured inadvertently as a result of management actions in riparian areas or occasionally by vehicle traffic on watershed roads.

Disturbance to, injury of, or death of Group #32 species is expected to occur as a result of the actions described above. However, the effects on habitat are expected to be short-term in nature, and not significant to the population of Group #32 species in the watershed because of the specific mitigation and minimization measures committed to in the HCP:(1) interdisciplinary team site evaluations and protection of Group #32 species habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which further minimizes the risk of injury or death of dispersing salamanders; and (4) removal of 38 percent of forest roads which will reduce the potential for negative effects resulting from related to road maintenance, improvement, and use over the long term.

Summary/Conclusion

For populations of Group #32 amphibian species in the watershed, the Service expects the long-term effect of the HCP to be positive. Under the HCP, all key aquatic, riparian, and non-forested (talus/felsenmeer) habitat, including headwall basins, will be protected and improved in quality over time. Water quality will also be improved over time as a result of habitat restoration and road maintenance and decommissioning programs intended to reduce sediment input to aquatic systems. Any short-term, local impacts to these species resulting from restoration activities in aquatic and riparian areas will be more than offset by long-term, landscape-level benefits. In addition, the current substantial amount of watershed forest in fragmented condition will mostly be replaced by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early or mid-seral forest habitat less than 50 years old will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early seral stages as a result of recent commercial logging will mature over the term of the HCP, and no additional commercial harvest will be conducted. The total amount of late-seral habitat (over 80 years old) is expected to increase by a factor of nearly five.

Protection in reserve status of all aquatic and riparian habitats, as well as upland forest, will improve habitat connectivity, thereby facilitating dispersal and movement of organisms dependent on aquatic and riparian habitats, including the three amphibian species in Group #32. The substantial degree of habitat protection and water quality and habitat improvement provided under the HCP should thus benefit populations of these 3 species that may occur in the Cedar River Municipal Watershed. In addition, increases in mature and late-successional forest habitat, especially where closely associated with aquatic systems, will facilitate dispersal of these species throughout the watershed landscape and possibly, over the long term, enable the municipal watershed to serve to connect with other populations of Group #32 species in the immediate region.

Because the long-term net effects of the HCP are expected to be positive for these species at the scale of the municipal watershed, the Service concludes that range-wide effects of the HCP on Group #32 amphibians are expected to be positive as well. However, because the watershed comprises only a small fraction of any of these species' range, the overall net effect of the HCP is likely to be relatively small. It is likely that the watershed could serve as a source population for these species over time. However, the mobility of these species is limited, and therefore dispersal between drainages is likely to be problematic even in ideal habitat conditions.

Group #33 – Long-Toed Salamander, Roughskin Newt, Northwestern Salamander, Western Toad, Northern Red-Legged Frog, Cascades Frog, Oregon Spotted Frog, Northwestern Pond Turtle

Introduction

The northwestern salamander, long-toed salamander, roughskin newt, western toad, northern red-legged frog, and Cascades frog are widely distributed and known to breed in the Cedar River Municipal Watershed. No comprehensive surveys to determine the presence or absence of the Oregon spotted frog and northwestern pond turtle have been conducted in the Cedar River Municipal Watershed, and no incidental observations of these species have been documented to date. Members of this species group require and/or use a wide range of habitat types, ranging from open, non-forested wetlands to closed-canopy forest habitat types (HCP Table 4.2-3). Habitat associations are described in detail in Section 3.6 for all eight species (seven amphibians, one reptile) in Group #33. The common name of the northern red-legged frog and the Oregon spotted frog, in particular, as given above may be indicated simply as the red-legged frog and the spotted frog, respectively, in some reference materials. Other names in common usage may also vary among these species as included in a variety of information sources.

Potential key habitat for Group #33 species in the municipal watershed includes lakes, ponds, springs, emergent wetlands, sphagnum bogs, forested swamps, and slow-moving streams, as well as riparian habitat, conifer and hardwood forest, and meadows. For certain species in this group, potential key upland habitat also includes habitat elements typically present in mature, late-successional, and old-growth forest, such as decaying coarse woody debris and moist conditions on the forest floor. Forest is primary habitat for some species and dispersal habitat for others, and rapid-flowing streams may be used by some species in the group as secondary habitat.

Group #33 species could be negatively affected by silvicultural treatments, road management, or other operational activities in riparian or upland areas. Such effects could be direct through direct injury to, or death of individuals or indirect, through influences on habitat (e.g., removal of overstory vegetation, elevated water temperature). Group #33 species could also be negatively affected by management actions that may contribute sediment to aquatic habitats on a short- or long-term basis (e.g., stream habitat restoration projects, silvicultural treatments in riparian areas, road maintenance, use, and decommissioning).

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for Group #33 species are described in Section 4.2.2 and summarized below: (1) protection of all key and secondary habitats (streams, ponds, lakes, and wetlands, riparian habitat, meadows, and forest); (2) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance and protecting forest habitats that could be used as primary habitat by some species or for dispersal by others; (3) protection of all old growth and recruitment of a substantial amount of mature and late-successional forest over time, facilitating dispersal and providing improved habitat conditions for those species that prefer conditions typically existing in late-seral forests; (4) silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests in some areas; (5) stream restoration projects; (6) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams and other aquatic habitats; (7) guidelines and prescriptions designed to reduce sediment production during watershed management activities; and (8) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All lands outside developed areas, including all aquatic and riparian ecosystem elements and all forest outside limited developed areas, are in reserve status. As a result, all key and secondary habitat for Group #33 species within the municipal watershed (i.e., streams, ponds, lakes, and wetlands, riparian habitat, meadows, and forest) is protected through reserve status. In addition, protection in reserve status of all forested areas of the watershed will facilitate dispersal by these species. As a whole, Group #33 species clearly depend on a naturally functioning complex of aquatic, riparian, and upland forest habitats.

Both the hydrologic regimes of, and habitat conditions within, many wetlands in the municipal watershed have likely been affected to some degree by past timber harvest, especially where virtually all trees were removed adjacent to lakes, ponds, wetlands, or streams. In such cases, an opportunity exists to improve hydrologic and other habitat conditions, contributing to reestablishment of the more natural conditions that existed prior to harvest.

Short-term and long-term gains in the quality of wetland, stream, and riparian habitats are expected under the HCP as a result of the natural maturation of younger seral-stage forest in riparian areas. By placing all lands outside of limited developed areas in reserve status, the HCP includes provisions that will serve to protect and/or reestablish forest vegetation adjacent to open wetland systems, retain forested wetlands, and protect hydrologic recharge areas. Conservation measures of this type will allow wetland communities to maintain and/or reestablish, over time, more naturally functioning hydrologic regimes as part of a naturally functioning forest ecosystem similar to what existed in the watershed before the twentieth century. Therefore, any changes in the hydrologic regimes of wetland communities affected by the HCP will be the result of natural processes of forest succession. In addition, maturation of protected forest in riparian forests near streams will help restore more natural ecological functioning in the riparian/aquatic ecosystem as a whole. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of the HCP, "riparian" zones of 300 ft on Type I-III waters, 150 ft on Type IV waters, and 100 ft on Type V waters were established using GIS data and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase.

Protection of upland forest through reserve status under the HCP will also provide short-term and long-term gains in the quality of upland habitats as a result of the natural maturation of younger seral-stage forests. Habitat effects related to mature, late-successional, and old-growth forest are, generally, as described for species addressed by the HCP that are associated with those habitats. Solely as a result of natural forest maturation, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a fivefold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.2). Development of riparian and upland forest into mature and late-successional seral stages will promote micro climatic conditions that will facilitate overland dispersal of Group #33 species, and result in increased abundance of key habitat elements, such as large woody debris, important to some species in Group #33.

The HCP includes management actions designed to improve and help restore aquatic, riparian, and upland forest habitats. Stream bank stabilization projects, placement of large woody debris (LWD), a stream bank re-vegetation program, and a program of restoration planting, restoration thinning, and ecological thinning in riparian areas are expected to help (1) restore natural aquatic and riparian ecosystem functioning and (2) accelerate the development of mature or late-successional characteristics in younger second-growth forests, especially in riparian areas. Restoration of a more naturally functioning aquatic ecosystem benefits Group #33 species over the long term. Over the short term, however, these management interventions may cause some localized decline in habitat function. Such impacts might include reduced canopy cover that could lead to increased solar heating of stream water or to increased rates of soil erosion.

Restoration and ecological thinning activities in riparian areas will occur according to the following general forest management guidelines: (1) tree removal will be limited to restoration thinning and ecological thinning to restore riparian ecosystem function, maintain or improve bank stability, accelerate development of late successional/old-growth stand conditions, or to maintain rights-of-way, including roads, or to conduct salvage after catastrophic events; (2) during restoration thinning or ecological thinning, no ground-based equipment will be allowed within 50 ft of streams or other aquatic habitat; (3) no trees will be cut near streams in a manner that would reduce bank stability; and (4) within wetlands, no cutting of trees will be allowed, except in limited circumstances where needed for restoration of natural wetland functions, and no ground-based equipment will be allowed within wetlands. Site evaluations by an interdisciplinary team prior to initiating such activities in riparian areas will also help minimize any such impacts on Group #33 species. In addition, the HCP also includes a comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) and other guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with silvicultural treatments in riparian areas. Following these prescriptions and guidelines will help reduce the rate of sediment loading to aquatic systems and will help maintain high water quality in potential habitats for all species in Group #33.

Under the HCP, upland forest habitat is also expected to benefit from management actions (e.g., ecological thinning and restoration thinning) intended to accelerated development of mature and late-successional forest habitat characteristics in some areas of previously harvested forest. Although silvicultural intervention to develop late-successional forest characteristics will benefit Group #33 species over the long term by recruiting important habitat elements, such as coarse woody debris, and by providing better microsites to facilitate dispersal, over the short term these management actions may cause some temporary, local impacts. As mitigation, site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions in key habitat to ensure that habitat for Group #33 species is only minimally impacted.

Forest management and management activities associated with forest roads (including road construction, repair, maintenance, and decommissioning) can, if not done properly, impact wetlands and streams through erosion and mass wasting that increases sediment loads and decreases water quality. The HCP also includes a comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) and other guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with roads. Implementing these prescriptions and guidelines, along with the programs to improve roads and to decommission about 38 percent of watershed roads, will reduce the rate of sediment loading to aquatic systems and help maintain high water quality. Although it is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads are adjacent to streambanks, improved road maintenance under the HCP, as well as the expected low level of road use, will help mitigate those impacts.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance and injury, including death, of Group #33 species that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) in-stream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about

380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) some types of monitoring and research.

Disturbance to, injury of, or death of Group #33 species is expected to occur as a result of the actions described above. However, the effects on habitat are expected to be short-term in nature, and not significant to populations of Group #33 species in the watershed because of the specific mitigation and minimization measures as listed above and in the HCP.

Summary/Conclusion

The likelihood of injury or mortality occurring at a level that may compromise the viability of Group #33 species populations within the municipal watershed is expected to be very low because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of Group #33 species habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which further minimizes the risk of injury or death of dispersing amphibians or reptiles; and (4) removal of 38 percent of forest roads, which will reduce the potential for negative effects resulting from related to road maintenance, improvement, and use over the long term. In addition, dispersing individuals might be injured or killed inadvertently by management activities in upland or riparian areas, or by vehicles on watershed roads.

Overall, population-level effects on the Group #33 species are expected to be positive. Key riparian, aquatic, and upland forest habitat will be protected and improved in quality. Any short-term, local impacts to these species from restoration activities in streams, riparian areas, or upland forests will be more than offset by long-term, landscape-level benefits. Increases in the quantity and quality of mature and late-successional forest habitat, in both riparian and upland areas, will benefit populations of Group #33 species by providing improved key habitat for some species and by facilitating the movement and dispersal of individuals of all species throughout the Cedar River Municipal Watershed and, potentially, by facilitating movement between the municipal watershed and adjacent watersheds to the north and south.

Thus, because the long-term net effects of the HCP are expected to be positive for these species at the scale of the municipal watershed, range-wide population-level effects should also be positive for Group #33 species. However, because the watershed comprises only a small fraction of any of these species' range, the overall net effect of the HCP is likely to be relatively small. It is likely that the watershed could serve as a source population for these species over time. However, the mobility of these species is limited, and therefore dispersal between drainages is likely to be problematic even in ideal habitat conditions.

Group #34 – Van Dyke's Salamander

Introduction

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. Van Dyke's salamander is found only in Washington State, with scattered, widely spaced populations known primarily from the Olympic Mountains, the southern Cascades to the northern extent of Mt. Rainier, and the Willapa Hills (including Long Island) up to an elevation of 3,600 ft (Leonard et al. 1993). However, 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; USDA 1994). Van Dyke's salamander may be sympatric with the red-backed salamander in the Washington Cascades (Nussbaum et al. 1983) (please see Group #35, red-backed salamander). Although typically grouped as a Woodland Salamander, Van Dyke's salamander, with the possible exception of Dunn's salamander, is considered to be the most closely related to water of these woodland species (Leonard et al. 1993). Because the Van Dyke's salamander demonstrates an apparent affinity for water (provides suitable moisture regimes in the terrestrial environment), it is classed as an "aquatic/riparian" species under the HCP, however, the species' association with terrestrial habitats (mature to old-growth forest key habitat) and similarities to late-successional and old-growth dependent species groups addressed in the HCP is also emphasized.

Potential key habitat for Van Dyke's salamander in the municipal watershed includes seeps, stream-side and waterfall splash zones in riparian areas, montane lakes, and stream-side talus/felsenmeer slopes, particularly in mature, late successional, and old-growth forest that typically, and most consistently, accumulates substantial quantities of decaying logs, leaf litter, bark piles, and other debris on the forest floor. The moisture regimes typically maintained in certain riparian (stream-side) habitats, organic debris on the forest floor in older forest, and in many talus/felsenmeer slopes, especially those closely associated with streams, provide suitable foraging, breeding, and hiding cover for Van Dyke's salamanders. Only two nests have been documented: one was located under a moss-covered stone, the other inside a large Douglas-fir log near a creek (Leonard et al. 1993).

In addition, this species may also be found in other habitats, including talus slopes, rock outcrops, and other seral-stages of coniferous forest, even substantial distances from streams, if site conditions (aspect, shading) maintain adequate microclimate regimes (moisture and temperature levels). Within the municipal watershed, these habitat types (some talus/felsenmeer slopes, rock outcrops, younger forest) are considered of secondary importance for the Van Dyke's salamander.

Van Dyke's salamanders could be negatively impacted by silvicultural treatments, road management, or other activities especially in riparian areas and in the vicinity of talus/felsenmeer slopes. Such impacts could be direct (e.g., through direct injury to, or death of, individuals) or indirect, through influences on habitat (e.g., removal of overstory, shade reduction).

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the Van Dyke's salamander are described in Section 4.2.2 and summarized below: (1) protection of all key habitat in riparian stream corridors, including headwalls and inner gorges; (2) protection of all existing key forested habitat in reserve forest status, facilitating dispersal; (3) protection of all key non-forested habitat (talus/felsenmeer slopes, open water) as inclusions within reserve forest; (4) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance; (5) natural maturation of second-growth forests into mature and late-successional seral stages, potentially recruiting increased amounts of organic debris to the forest floor and improving habitat function; (6) stream restoration and bank stabilization projects, improving stream-side cover; (7) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams; (8) guidelines and prescriptions designed to reduce sediment production during watershed management activities, reducing potential impacts to aquatic habitats; (9) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas, also improving habitat conditions on the forest floor (long term) and facilitating dispersal; (10) retention, creation, and recruitment of logs and large snags during silvicultural treatments, supplying organic debris to the forest floor on both a short- and long-term basis; (11) removal of 38 percent of watershed roads, reducing the risk of direct injury or death as a result of road use; (12) protection of secondary habitat (other talus/felsenmeer slopes, rock outcrops, earlier seral-stage forest) as inclusions within reserve forest; and (13) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All lands outside limited developed areas, including all 13,889 acres of old-growth forest, are in reserve status. As a result, all key habitat (seeps, riparian/ stream-side corridors, and talus/ felsenmeer slopes, especially where associated with mature, late-successional and old-growth forests, for the Van Dyke's salamander within the municipal watershed is in reserve status. In addition, secondary habitat, including other talus/felsenmeer slopes, rock outcrops, and other seral-stage forest is also protected in reserve status. Protection in reserve status of all forested areas of the watershed, including riparian corridors, will also facilitate dispersal for this species. In addition, silvicultural activities (heavy equipment, tree cutting) are restricted (see general forest management guidelines below in this section) within 50 ft of streams. Finally, during any watershed operations near special habitats (e.g., talus/felsenmeer slopes or rock outcrops) a 200-foot perimeter, in which activities will be restricted, will be established to minimize the potential for habitat impacts or disturbance to key wildlife species, including Van Dyke's salamanders. Interdisciplinary teams will determine what silvicultural interventions, if any, should be conducted to restore proper ecological functions at the site.

Although old growth (by definition) will not increase in extent under the HCP, substantial increases in the quantity of mature and late-successional coniferous forest habitat for Van Dyke's salamander are expected over the 50-year term of the HCP as a result of natural maturation of second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in some areas of second-growth forest. Solely as a result of natural forest maturation, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a fivefold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.5). Silvicultural treatments including: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; and (3) ecological thinning of about 2,000 acres, are expected to make habitat conditions more suitable in some second-growth forest by improving moisture regimes (increasing shade) and providing additional habitat structure (large woody debris) on the forest floor over the long term. In addition, by the end of the HCP term, older forest habitat will be more evenly distributed throughout the watershed landscape, including the entire elevation range and all stream corridors, than under current conditions.

In addition to forested habitats, Van Dyke's salamanders also utilize open, non-forested talus/felsenmeer slopes and rock outcrops. The Van Dyke's salamander is thus also expected to benefit from management actions designed to protect, restore, or enhance these habitats. All vegetated talus/felsenmeer (329 acres) and non-vegetated talus/felsenmeer (1,189 acres) slopes, and rock outcrops, most of which are surrounded by or are adjacent to key forested habitat, are protected in reserve status.

Short-term and long-term gains in the quality and/or quantity of aquatic and riparian habitats are expected under the HCP as a result of the natural development of mature forest in riparian areas. Development of mature and late-successional forest significantly contributes to the reestablishment of a more naturally functioning ecosystem, thus benefitting Van Dyke's salamander. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of HCP, "riparian" zones of 300 ft (on Type I-III waters), 150 ft (on Type IV waters), and 100 ft (on Type V waters) were established using GIS data and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase.

The HCP also includes management actions designed to help restore and/or enhance aquatic and riparian habitats. Stream bank stabilization, placement of large woody debris, stream bank re-vegetation, restoration planting and thinning, and ecological thinning in riparian areas are all expected to contribute to accelerating the reestablishment of more natural aquatic and riparian ecosystem functions. The reestablishment of more natural aquatic ecosystem function, combined with the development of additional mature and late-successional characteristics in younger second-growth forests, especially in stream-side riparian areas, will reestablish a more naturally functioning forest ecosystem throughout the watershed landscape that will improve habitat quality and availability, as well as the potential for dispersal, for the Van Dyke's salamander.

Silvicultural treatments in riparian areas may result in short-term negative impacts on stream-side habitat and/or water quality. However, no timber harvest for commercial purposes will occur in the watershed and interdisciplinary teams will evaluate and plan silvicultural and operational projects in any key habitat, especially within riparian zones, in order to eliminate or minimize any short-term impacts to habitat of Van Dyke's salamander. The following general forest management guidelines will be followed for areas near streams and other aquatic habitats: (1) tree removal will be limited to restoration thinning and ecological thinning to restore riparian ecosystem function, maintain or improve bank stability, accelerate development of late successional/old-growth stand conditions, or to maintain rights-of-way, including roads, or to conduct salvage after catastrophic events; (2) during restoration thinning or ecological thinning, no ground-based equipment will be allowed within 50 ft of streams or other aquatic habitat; (3) no trees will be cut near streams in a manner that would reduce bank stability; and (4) within wetlands, no cutting of trees will be allowed, except in limited circumstances where needed for restoration of natural wetland functions, and no ground-based equipment will be allowed within wetlands. In addition, the HCP also includes a comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) intended to minimize the potential for erosion and mass wasting associated with silvicultural treatments in riparian areas. This will reduce the rate of sediment loading to aquatic systems and help maintain high water quality.

Road repair, maintenance, and decommissioning can all impact stream and riparian areas. The comprehensive suite of Watershed Assessment Prescriptions are, however, intended to minimize the probability of erosion and mass wasting associated with roads. Following these prescriptions and guidelines, along with the program to improve and decommission about 38 percent of existing roads (Section 4.2.2), will reduce the rate of sediment loading to streams and help maintain high water quality. It is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads are adjacent to streambanks, but improved road maintenance under the HCP will help mitigate those impacts.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance or injury or mortality of Van Dyke's salamanders in the watershed include any operations that involve human activities on roads or in suitable habitat. Such activities include the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) riparian and in-stream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) monitoring and research. Occasionally, individual Van Dyke's salamanders may be injured or killed inadvertently by vehicles when they attempt to cross watershed roads while dispersing.

The likelihood of disturbance or injury or mortality occurring at a level which may compromise the viability of Van Dyke's salamander populations that may occur in the watershed is expected to be discountable because of the specific mitigation and minimization measures committed to in the HCP:

(1) interdisciplinary team site evaluations and protection of Van Dyke's salamander habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of injury or death of dispersing salamanders; and (4) removal of 38 percent of forest roads, which will reduce the potential for negative effects resulting from related to road maintenance, improvement, and use over the long term.

Summary/Conclusion
Population-level effects on the Van Dyke's salamander within the watershed are expected to be positive. Under the HCP, all key riparian, aquatic, forested, and non-forested habitat will be protected and improved in quality over time. In addition, the current substantial amount of watershed forest in fragmented condition will mostly be replaced by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early or mid-seral forest habitat less than 50 years old will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early seral stages as a result of recent commercial logging will mature over the term of the HCP, and no additional commercial harvest will be conducted. The total amount of late-seral habitat (over 80 years old) is expected to increase by a factor of nearly five.

Protection in reserve status of all riparian, as well as upland forest, will improve habitat connectivity, thereby facilitating dispersal and movement of organisms dependent on riparian habitats, including Van Dyke's salamander. This substantial degree of protection complies with the principal management recommendation of WDW (1991) for Van Dyke's salamander, and should thus benefit any populations of the species that may occur in the Cedar River Municipal Watershed.

Because the long-term net effects of the HCP are expected to be positive for Van Dyke's salamander populations at the scale of the municipal watershed, the Service concludes that range-wide effects of the HCP on Van Dyke's salamander is expected to be positive as well. However, because the watershed comprises only a fraction of this species range, the overall net effect of the HCP is likely to be relatively small. It is likely that the watershed could serve as a source population for Van Dyke's salamander over time. However, the mobility of Van Dyke's salamander is limited, and therefore dispersal between drainages is likely to be problematic even in ideal habitat conditions.

Group #35 – Western Red-backed Salamander

Introduction
The western red-backed salamander is present and hence likely breeding in the Cedar River Municipal Watershed. Potential key habitat for this salamander in the watershed includes talus/felsenmeer slopes, rock outcrops, and dense coniferous forest, particularly forest that has accumulated substantial quantities of decaying logs, leaf litter, bark piles, and other debris on the forest floor, as is more typically and consistently present in mature, late-successional, and old-growth forest. The presence of organic debris on the forest floor in older forest and the moist environment

of many talus/felsenmeer slopes and rock outcrops provides foraging and hiding cover for red-backed salamanders, as well as suitable microclimate conditions for egg deposition below the substrate surface. Other seral-stage coniferous forest, including riparian forest (especially stream-side areas), is considered of secondary importance.

The western red-backed salamander could be negatively affected by silvicultural treatments, road management, or other operational activities, especially in or adjacent to key habitat. Such effects could be direct (e.g., through injury to individuals) or indirect, through influences on habitat (e.g., disturbance of cover objects or removal of tree canopy).

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the western red-backed salamander are described in Section 4.2.2 and summarized below: (1) protection of all existing key forested habitat in reserve forest status; (2) protection of all key non-forested habitat (talus/felsenmeer slopes, rock outcrops) as inclusions within reserve forest; (3) elimination of timber harvest for commercial purposes within the watershed; (4) natural maturation of second-growth forests into mature and late-successional seral stages, potentially recruiting increased amounts of organic debris to the forest floor and improving habitat function; (5) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas, also improving habitat conditions on the forest floor (long term); (6) retention, creation, and recruitment of logs and large snags during silvicultural treatments, supplying organic debris to the forest floor on both a short- and long-term basis; (7) removal of 38 percent of watershed roads, reducing the risk of direct injury or death as a result of road use; (8) protection of secondary habitats including younger, closed canopy forest and riparian stream corridors in reserve status; and (9) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All lands outside limited developed areas, including all 13,889 acres of old-growth forest, are in reserve status. As a result, all key habitat (mature, late-successional, and old-growth forest, talus/felsenmeer slopes, rock outcrops), as well as all secondary habitat, for the western red-backed salamander within the municipal watershed is protected in reserve status.

Although old growth (by definition) will not increase in extent under the HCP, substantial increases in the quantity of mature and late-successional coniferous forest habitat for the western red-backed salamander are expected over the 50-year term of the HCP as a result of natural maturation of second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in some areas of second-growth forest. Solely as a result of natural forest maturation, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a five-fold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.5). In addition, by the end of the HCP term, older forest habitat will be more evenly distributed throughout the watershed landscape, including the entire elevation range, than under current conditions. And, only 4,708 acres (less than 7 percent) of key forested habitat will be above 4,000 feet, beyond the documented extent of the western red-backed salamander's elevation range.

In addition to forested habitats, western red-backed salamanders also utilize open, non-forested talus/felsenmeer slopes and rock outcrops. The western red-backed salamander is thus also expected to benefit from management actions designed to protect, restore, or enhance these habitats. All vegetated talus/felsenmeer (329 acres) and non-vegetated talus/felsenmeer (1,189 acres) slopes, and rock outcrops, most of which are surrounded by or are adjacent to key forested habitat, are protected in reserve status. In addition, during any watershed operations near special habitats (e.g., talus/felsenmeer slopes or rock outcrops) a 200-foot perimeter, in which activities will be restricted, will be established to minimize the potential for habitat impacts or disturbance to key wildlife species, including western red-backed salamanders. Interdisciplinary teams will determine what silvicultural interventions, if any, should be conducted to restore proper ecological functions at the site.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance or injury or mortality of western red-backed salamanders in the watershed include any operations that involve human activities on roads or in suitable habitat. Such activities include the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (7) routine road use; and (8) monitoring and research. Occasionally, individual red-backed salamanders may be injured or killed inadvertently by vehicles when they attempt to cross watershed roads while dispersing.

The likelihood of disturbance or injury or mortality occurring at a level that may compromise the viability of western red-backed salamander populations in the watershed is expected to be low, due to the specific mitigation and minimization measures committed to in the HCP: (1) elimination of commercial logging activities (including virtually all log hauling) from the watershed, reducing impacts to key forest habitat and essentially eliminating the chance of mortality associated with log hauling; (2) interdisciplinary team site evaluations prior to silvicultural or road management activities; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which further minimizes the risk of injury or death of dispersing salamanders; and (4) removal of 38 percent of forest roads which will reduce the potential for negative effects resulting from related to road maintenance, improvement, and use over the long term.

Summary/Conclusion

Population-level effects on the western red-backed salamander are expected to be positive. Under the HCP, the current substantial amount of watershed forest in fragmented condition will mostly be replaced by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early- or mid-seral forest habitat (less than 50 years old) will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early-seral stages as a result of recent commercial logging will mature over the term of the HCP, and no additional commercial harvest will be conducted. The total amount of late-seral habitat (over 80 years old) is expected to increase by a factor of nearly five.

Mitigation and minimization measures in the HCP create a linear system of protected forested corridors adjacent to streams for the dispersal and movement of organisms dependent on riparian habitats, as well as large areas of older forest in upland areas between stream systems. This increased acreage of preferred forest habitat and landscape connectivity will benefit populations of western red-backed salamanders by increasing the overall habitat carrying capacity of the municipal watershed, thereby potentially increasing populations and also by facilitating the movement or dispersal of individuals between patches of available habitat throughout the Cedar River Municipal Watershed.

Because the long-term net effects of the HCP are expected to be positive for western red-backed salamander populations at the scale of the municipal watershed, the Service concludes that range-wide effects of the HCP on western red-backed salamander is expected to be positive as well. However, because the watershed comprises only a fraction of this species range, the overall net effect of the HCP is likely to be relatively small. It is likely that the watershed could serve as a source population for western red-backed salamander over time. However, the mobility of western red-backed salamander is limited, and therefore dispersal between drainages is likely to be problematic even in ideal habitat conditions.

Group #36 – Larch Mountain Salamander

Introduction

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. The Larch Mountain salamander is generally considered to be one of the rarest amphibians in Washington State, and until recently, was thought to be confined to reaches of the Columbia Gorge of the Oregon and Washington Cascades (Leonard et al. 1993). Recently, however, several Larch Mountain salamander populations have been found near Mt. St. Helens and Mt. Rainier to an elevation of 3,400 feet (Leonard et al. 1993). In addition to several other Cascade locations, the species has also been documented recently in the Green River watershed adjacent to (south of) the Cedar River drainage (Foster Wheeler Environmental field survey data, 1998). Also, 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 (Crisafulli 1998). This woodland salamander, although requiring moist microclimate conditions, is almost never associated with free water. Potential key habitat for this salamander in the watershed includes mature, late-successional, and old-growth coniferous forests, particularly those forests with rocky substrates and/or including talus/felsenmeer slopes with organic debris incorporated.

Larch Mountain salamanders could be negatively affected by silvicultural treatments, road management, or other operational activities, especially in or near key habitat (mature to old-growth forest, especially with talus/felsenmeer slopes incorporated). Such effects could be direct (e.g., through direct injury to, or death of, individuals) or indirect, through influences on habitat (e.g., microclimate changes as a result of the removal of overstory vegetation).

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures pertinent to Larch Mountain salamander are described in Section 4.2.2 and summarized below: (1) protection of all existing key forested habitat in reserve forest status; (2) protection of all key non-forested habitat (talus/felsenmeer slopes) as inclusions within reserve forest; (3) elimination of timber harvest for commercial purposes within the watershed; (4) natural maturation of second-growth forests into mature and late-successional seral stages, potentially recruiting increased amounts of organic debris to the forest floor, thereby improving habitat function and facilitating dispersal; (5) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas, also improving habitat conditions on the forest floor (long term); (6) retention, creation, and recruitment of logs and large snags during silvicultural treatments, supplying organic debris to the forest floor on both a short- and long-term basis; (7) removal of 38 percent of watershed roads, reducing the risk of direct injury or death as a result of road use; (8) protection of secondary habitats including younger, closed canopy forest and riparian stream corridors in reserve status; and (9) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All lands outside limited developed areas, including all 13,889 acres of old-growth forest, all vegetated talus/felsenmeer (329 acres), and non-vegetated talus/felsenmeer (1,189 acres) are in reserve status. As a result, all key habitat (mature, late-successional, and old-growth forest, especially with talus/felsenmeer slopes incorporated), as well as all secondary habitat, for the Larch Mountain salamander within the municipal watershed is in reserve status. It is significant to note that protection in reserve status of all forested areas of the watershed, including riparian corridors, will facilitate dispersal for this species. In addition, during any watershed operations near special habitats (e.g., talus/felsenmeer slopes or rock outcrops) a 200-foot perimeter, in which activities will be restricted, will be established to minimize the potential for habitat impacts or disturbance to key wildlife species, including Larch Mountain salamanders. Interdisciplinary teams will determine what silvicultural interventions, if any, should be conducted to restore proper ecological functions at the site.

Major habitat effects on the Larch Mountain salamander are similar, in general, to those described for other species addressed by the HCP that are associated with late-successional and old-growth forests, as well as for those associated with special habitats (e.g., talus/felsenmeer slopes). Although the acreage of talus/felsenmeer and old growth (by definition) will not increase in extent under the HCP, substantial increases in the quantity of mature and late-successional coniferous forest habitat for the Larch Mountain salamander are expected over the 50-year term of the HCP as a result of natural maturation of second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in some areas of second-growth forest. Solely as a result of natural forest maturation, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a fivefold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.5). In addition, by the end of the HCP term, older forest habitat will be more evenly distributed throughout the watershed landscape than under current conditions.

Under the HCP, some potential salamander habitat in the watershed is expected to benefit from management actions (ecological thinning and restoration thinning) intended to accelerate the development of mature and late-successional characteristics in second-growth forests. Development of late-successional and old-growth characteristics in younger second-growth forests is expected to benefit Larch Mountain salamanders over the long term. Silvicultural treatments including: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; and (3) ecological thinning of about 2,000 acres, are expected to make habitat conditions more suitable in some second-growth forest by improving moisture regimes (increasing shade) and providing additional habitat structure (large woody debris) on the forest floor over the long term. However, over the short term, these management actions may cause some localized decline in habitat function. As partial mitigation, site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions in the watershed to ensure that habitat for Larch Mountain salamanders is minimally impacted.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance to or injury or mortality of Larch Mountain salamanders in the watershed include any operations that involve human activities on roads or in suitable habitat. Such activities include the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (7) routine road use; and (8) monitoring and research. Occasionally, individual Larch Mountain salamanders may be injured or killed inadvertently by vehicles when they attempt to cross watershed roads while dispersing.

The likelihood of disturbance or injury or mortality occurring at a level that may compromise the viability of Larch Mountain salamander populations in the watershed is expected to be low, due to the specific mitigation and minimization measures committed to in the HCP: (1) elimination of commercial logging activities (including virtually all log hauling) from the watershed, reducing impacts to key forest habitat and essentially eliminating the chance of mortality associated with log hauling; (2) interdisciplinary team site evaluations prior to silvicultural or road management activities around or near any talus habitats; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which further minimizes the risk of injury or death of dispersing salamanders; and (4) removal of 38 percent of forest roads which will reduce the potential for negative effects resulting from related to road maintenance, improvement, and use over the long term.

Summary/Conclusion
Population-level effects on the Larch Mountain salamander are expected to be positive, assuming this species occurs in the watershed. Under the HCP, all key forested and non-forested habitat will be protected and improved in quality over time. In addition, the current substantial amount of watershed forest in fragmented condition will mostly be replaced by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early or mid-seral forest habitat less than 50 years old will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early seral stages as a result of recent commercial logging will mature over the term of the HCP, and no additional commercial harvest will be conducted. The total amount of late-seral habitat (over 80 years old) is expected to increase by a factor of nearly five. Protection in reserve status of all forested areas will improve habitat connectivity, thereby facilitating dispersal and movement of organisms dependent on forested habitats, as well as species (such as the Larch Mountain salamander) which use forested habitats for dispersal between patches of suitable non-forested habitat. This substantial degree of for Larch Mountain salamander should benefit any populations of the species that may occur in the Cedar River Municipal Watershed.

Because the long-term net effects of the HCP are expected to be positive for Larch Mountain salamander populations at the scale of the municipal watershed, the Service concludes that range-wide effects of the HCP on Larch Mountain salamander is expected to be positive as well. However, because the watershed comprises only a fraction of this species range, the overall net effect of the HCP is likely to be relatively small. It is likely that the watershed could serve as a source population for Larch Mountain salamander over time. However, the mobility of Larch Mountain salamander is limited, and therefore dispersal between drainages is likely to be problematic even in ideal habitat conditions.

Group #37 – Papillose Taildropper, Fender's Soliperlan Stonefly, Carabid Beetles (*Bembidion gordoni*, *B. stillaguamish*, *Nebria kincaidi*, *N. gebleri cascadensis*, *N. paradisi*, *Pterostichus johnsoni*)

Introduction
No comprehensive surveys to determine the presence or absence of the papillose taildropper, Fender's soliperlan stonefly, or any of the six species of carabid beetles included in Group #37 have been conducted in the municipal watershed, and no incidental observations of these species have been documented to date. Habitat associations of these eight species are not well understood, but all are believed to occur typically in association with streams and stream-side habitats.

Potential key habitat in the municipal watershed for all eight species in Group #37 includes streams, stream-side areas, and riparian habitat over a broad elevation range, as well as upland forest for papillose taildropper. Papillose taildroppers appear to be strongly associated with riparian vegetation in moist coniferous forests, but also may occur in moist situations in non-forest habitats and in upland forests (Section 3.6). Under the Northwest Forest Plan, the papillose taildropper is estimated to have a 50 percent chance that sufficient habitat will be provided so as 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 (Frest and Johannes (1993)).

Fender's soliperlan stoneflies occur in cool, fast-flowing, well oxygenated rocky streams (Nelson 1996) as well as seeps, and are sensitive to changes in riparian zones that can raise stream temperature. All six species of carabid beetles are associated with mountain streams. *Bembidion gordoni* is associated with fast-flowing streams (Bergdahl 1996), and *Nebria kincaidi* and *N. paradisi* occur along small, high-elevation (subalpine) streams (Bergdahl 1996). *N. gebleri cascadensis* is associated with streams and streamside habitats at most elevations (Bergdahl 1996), and *Pterostichus johnsoni* is dependent on streams and found in headwaters of wall-based channels and in steep, wet, unstable sand-mud-scree slopes (Bergdahl 1996). *B. stillaguamish*, widespread and likely to occur in the municipal watershed, is found along the margins of fairly large mid-elevation streams, often on stabilized sand/gravel bars, and in stream-side vegetation with sandy soil, often at the margins of large pools (Bergdahl 1996; Bergdahl 1996, 1997; Bergdahl, J., Northwest Biodiversity Center, June 19, 1998, personal communication).

Group #37 species could be negatively affected by silvicultural treatments, road management, or other activities in riparian areas. Such effects could be direct (e.g., through direct injury to or death of individuals) or indirect, through influences on habitat (e.g., removal of overstory). Group #37 species could also be negatively affected by management activities that contribute sediment to streams (timber harvest done to implement restoration and ecological thinning, road construction, maintenance, and use), thereby reducing water quality. For the purposes of this effects analysis, the Service is assuming these species are not aquatic species existing in either the mainstem Cedar River downstream of the Reservoir, or in the Reservoir. Thus, the Service assumes water system operation and hydro-electric generation will not have any effects on these species.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for Group #37 species are described in Section 4.2.2 and summarized below: (1) protection through reserve status of all key stream habitat, stream-side forest, and riparian habitat; (2) elimination of timber harvest for commercial purposes within the municipal watershed, reducing the overall level of habitat disturbance and protecting upland forest habitat that could be used as primary habitat by the papillose taildropper or for dispersal by the other seven species; (3) protection of all old growth and recruitment of a substantial amount of mature and late-successional forest over time, facilitating dispersal and creating more microsites with the moisture regimes preferred by the papillose taildropper; (4) silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests, increasing the abundance of sites suitable for papillose taildropper; (5) stream restoration projects; (6) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams; (7) guidelines and prescriptions designed to reduce sediment production during watershed management activities; (8) funding for optional species and sensitive habitat surveys (Section 4.5.5), which can be used to increase understanding of these species; (9) development of a species-habitat relations model (Section 4.5.5), which can better define habitat needs of these species; and (10) the flexibility to alter mitigation in response to better understanding of the habitat relationships of these species through the adaptive management program (Section 4.5.7).

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All lands outside limited developed areas, including all aquatic and riparian ecosystem elements, are in reserve status. As a result, all key habitats (streams and riparian areas) for the Group #37 species within the municipal watershed are in reserve status. In addition, protection in reserve status of all forested areas of the watershed will protect all key upland habitat for the papillose taildropper and will facilitate overland dispersal of all eight species; activities that could impact aquatic habitat are restricted near water bodies; and silvicultural treatments in riparian and upland forest will be conducted in many areas previously harvested to restore natural ecological functions and to develop characteristics of late-successional forest habitat.

Short-term and long-terms gains in the quality of wetland and riparian habitats are expected under the HCP as a result of the natural maturation of younger seral-stage forest in riparian corridors. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of HCP, "riparian" zones of 300 ft on Type I-III waters, 150 ft on Type IV waters, and 100 ft on Type V waters were established using GIS data and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase. Development of young forest into mature and late-successional seral stages in such areas will help restore a more naturally functioning riparian/aquatic ecosystem, thus potentially benefitting these three species.

The HCP also includes management actions designed to help restore streams and riparian habitats. Stream-bank stabilization projects, placement of large woody debris, and a stream bank re-vegetation program should benefit all eight species in Group #37 by improving stream and stream-side habitats. In addition, a program of restoration planting, restoration thinning, and ecological thinning in riparian areas should also benefit all eight species by helping to accelerate the restoration of natural aquatic and riparian ecosystem functioning and the development of mature or late-successional characteristics in younger second-growth forests in riparian areas.

Forest management and management activities associated with forest roads (including road construction, repair, maintenance, and decommissioning) can, if not done properly, impact streams through erosion and mass wasting that increases sediment loads and decreases water quality. Because no harvest for commercial purposes will occur in the municipal watershed, however, any potential impacts associated with commercial timber harvest are eliminated. Silvicultural treatments near streams and riparian areas, however, could result in some short-term, negative impacts on water quality if not properly conducted.

Silvicultural treatments in riparian areas may result in short-term negative impacts on stream-side habitat and/or water quality. No commercial timber harvest will occur in the watershed, however, and, in order to eliminate or minimize any short-term impacts to habitat of Group #37 species, mechanical equipment and cutting of trees are restricted within 50 feet of streams, and interdisciplinary teams will evaluate and plan silvicultural and operational projects in any key habitat, especially within riparian zones. One important set of constraints is that during restoration or ecological thinning activities, no mechanized equipment will be allowed within 50 ft of streams and no tree removal that has the potential to reduce stream-bank stability will be allowed within 25 ft of any stream. In addition, the HCP also includes a comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) and other guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with road systems and silvicultural treatments in riparian areas. Implementing these prescriptions and guidelines will help reduce the rate of sediment loading to aquatic systems, and will help maintain high water quality in potential habitats for all eight species in Group # 37.

Improvement in upland forest habitat will benefit the papillose taildropper as an improvement in potential key habitat and the other seven species as an improvement in dispersal habitat. Overall, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by year 2050, a near fivefold increase over current conditions for these three seral stages in total and a fiftyfold increase in mature and late-successional forest (Section 4.2.2).

Under the HCP, upland forest habitat is also expected to benefit from management actions (e.g., ecological thinning and restoration thinning) intended to accelerate development of mature and late-successional forest habitat characteristics in some areas of previously-harvested forest, creating more microsites that could be used by the papillose taildropper and generally improving conditions for dispersal for all these invertebrate species. Although silvicultural intervention to develop late-successional forest characteristics will benefit Group #37 species over the long term, over the short term these management actions may cause some temporary, local impacts. As mitigation, site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions in key habitats to ensure that habitat for Group #37 species is only minimally impacted.

Road repair, maintenance, and decommissioning can all impact aquatic and riparian areas. The HCP includes a comprehensive suite of Watershed Assessment Prescriptions and other management guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with roads. Following these prescriptions and guidelines, along with implementing the program to improve and decommission roads (Section 4.2.3), will reduce the rate of sediment loading to aquatic systems, and help maintain high water quality. It is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads come near streambanks, but several conservation and mitigation measures included in the HCP will help mitigate those impacts. These measures include removal (decommissioning) of about 38 percent of the road system, substantial re-engineering (improvement) of other roads, improved road maintenance, and the highly reduced level of road use under the HCP as compared to past levels of use incurred as a result of commercial timber harvest.

Disturbance Effects and Injury/Mortality

The Service assumes that any major alterations of aquatic habitat conditions, such as water temperature, dissolved oxygen, sediment routing, water-level fluctuation, velocity of flow and biological oxygen demand could affect Group #37 species. Therefore, the Service believes the following activities under the HCP may result in direct injury and disturbance of *V. mergella*, if this species occurs in the watershed: (1) the City's water delivery system, including reservoir-level manipulations, in-stream flow regulation and water withdrawals from the Cedar River at Landsburg, and, (2) the City's operation of a hydro-power generating facility at Cedar Falls. Also, direct injury or disturbance may occur during any operations that involve human activities on roads or near suitable aquatic habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) in-stream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) some types of monitoring and research.

The likelihood of injury or mortality occurring at a level which may compromise the viability of Group #37 species populations in the watershed is expected to be very low because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which further minimizes the risk of injury or death of dispersing Group #37 species; and (4) removal of 38 percent of forest roads, which will reduce the potential for negative effects resulting from related to road maintenance, improvement, and use over the long term. Occasionally, dispersing individuals from Group #37 species (especially papillose taildroppers) might be killed or injured by such activities in riparian or upland areas, or by vehicles on watershed roads.

Summary/Conclusion

Because our understanding of the ecology of Group #37 species is limited, and because none of the these species have been documented as present in the municipal watershed, population-level effects for these species cannot be specified with certainty. The conservation and mitigation measures included in the HCP, however, because they provide substantial protection and improved conditions with respect to all key habitat for Group #37 species in the municipal watershed, should have a beneficial effect on populations of these species, if they occur in the watershed. Any short-term, local impacts to these species from restoration activities in or near streams and riparian areas will be offset by long-term, landscape-level benefits. Protection in reserve status of all riparian areas, as well as increases in mature and late-successional forest habitat, will benefit populations of Group #37 species by facilitating the movement and dispersal of individuals throughout the municipal watershed, and the municipal watershed could serve as a population source for other areas in the future. Thus, the overall population-level effects should be positive for those species that may be present in the municipal watershed.

Group #38 – Beller's Ground Beetle, Hatch's Click Beetle, Long-Horned Leaf Beetle

Introduction
The presence of Beller's ground beetle has been documented recently in the Cedar River Municipal Watershed. No comprehensive surveys to determine the presence or absence of the Hatch's click beetle and the long-horned leaf beetle have been conducted in the municipal watershed, and no incidental observations of these two species have been documented to date. The Beller's ground beetle and the Hatch's click beetle are closely associated with, and may be restricted to, sphagnum bogs and sphagnum wetlands below 3,000 ft elevation (Section 3.5.6). Beller's ground beetle was documented in two sphagnum bog-like wetlands at the east end of Chester Morse Lake, south of Little Mountain. Adult Beller's ground beetles are typically found near open water and larvae are aquatic; larvae of Hatch's click beetles are often found near bog margins, above the water line. Similar to Beller's ground beetle and Hatch's click beetle, the long-horned leaf beetle inhabits low-elevation sphagnum bogs, but can also be found in a variety of other types of wetlands, with adults located typically near open water and larvae using submerged portions of aquatic plants (Section 3.5.6). Potential key habitat in the municipal watershed includes sphagnum bogs and other wetlands (including open water), as well as associated riparian habitats important to protection of the wetland environment.

Group #38 species could be negatively affected by silvicultural treatments, road management, or other activities in riparian areas. Such effects could be direct (e.g., through direct injury to or death of individuals) or indirect, through influences on habitat (e.g., removal of overstory). Group #38 species could also be negatively affected by management activities that contribute sediment to streams (timber harvest done to implement restoration and ecological thinning, road construction, maintenance, and use), thereby reducing water quality.

Pertinent Mitigation and Minimization Measures
Mitigation and minimization measures for Group #38 species are (1) protection of all key habitat (sphagnum bogs, other wetland types and associated open water and riparian habitat); (2) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance and any potential effects on wetlands, recharge areas, and water bodies; (3) protection of all old growth and recruitment of substantial mature and late-successional forest over time, facilitating dispersal between wetland systems; (4) silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests, increasing levels of protection for adjacent wetland systems; (5) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to wetland systems; (6) guidelines and prescriptions designed to reduce sediment production during watershed management activities; (7) funding for optional species and sensitive habitat surveys (Section 4.5.5), which can be used to increase understanding of these species; (8) development of a species-habitat relation model (Section 4.5.5), which can better define habitat needs of these species; and (9) the flexibility to alter mitigation in response to better understanding of the habitat relationships of these species through the adaptive management program (Section 4.5.7).

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the watershed, all lands outside limited developed areas are in reserve status. This includes the only known bog-like wetlands in the watershed, which are south of Little Mountain, as well as all other types of wetland systems and associated open water. As a result, all key habitat for Group #38 species within the municipal watershed (sphagnum bogs, other wetlands, and associated riparian habitat) is in reserve status. In addition, protection in reserve status of all forested areas of the watershed will facilitate overland dispersal for these species.

Some short-term and long-term gains in the quality of wetland habitats are expected under the HCP as a result of the natural development of mature forest in the vicinity of wetlands. Development into mature and late-successional forest helps restore a more naturally functioning ecosystem, thus benefitting Group #38 species. As discussed above under Group #33, the hydrologic regimes of wetland communities may change as a result of forest succession, but wetland hydrology should approach more natural, pre-disturbance conditions, and all recharge areas of bog-like and other wetland types are protected under the HCP.

Silvicultural treatments and the use, repair, maintenance, and decommissioning of forest roads can, in some circumstances, impact wetlands through the removal of vegetative cover and/or through erosion and mass wasting, increasing sediment loading to wetlands and decreasing water quality and thus have negative effects upon Group #38 species. Similarly, silvicultural treatments near streams and riparian areas could result in some short-term, negative impacts on water quality if not properly conducted.

Because of these potential negative effects, the HCP contains Watershed Assessment Prescriptions (Appendix 16) and other management guidelines (Section 4.2.2) that are intended to minimize the potential for erosion and mass wasting associated with silvicultural treatments in riparian areas, and to minimize the probability of erosion and mass wasting associated with road use, repair, maintenance, and decommissioning. Implementing these prescriptions and guidelines will help reduce the rate of sediment loading to aquatic systems, including wetlands, and help maintain high water quality.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance and direct injury, including death, of Group #38 species that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) those in-stream habitat restoration projects, if any, that may affect wetlands; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (8) routine road use; and (9) some types of monitoring and research.

Disturbance to, direct injury to, or death of, Group #38 species is expected to result from the 9 activities listed in the previous paragraph. However, the effect is expected to be short-term in nature, because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of Group #38 species habitat prior to silvicultural or road management activities near wetlands or in riparian habitat; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which further minimizes the risk of injury or death of dispersing beetles; and (4) removal of 38 percent of forest roads, which will reduce the potential for negative effects resulting from related to road maintenance, improvement, and use over the long term.

Summary/Conclusion

Overall, population-level effects on the Group #38 beetle species are expected to be positive. Key wetland and riparian habitat, as well as all associated upland habitat that protects recharge areas or could be used for dispersal, will be protected in reserve status. Any short-term, local impacts to these species from restoration activities near wetlands or in riparian areas will be more than offset by long-term, landscape-level benefits. Protection in reserve status of all wetlands and associated riparian habitat, and increases in mature and late-successional forest habitat could benefit regional populations of Group #38 species by facilitating the movement and dispersal of individuals throughout the Cedar River Municipal Watershed and, potentially, by facilitating movement between the municipal watershed and adjacent watersheds to the north and south. However, dispersal and colonization abilities of these species are unknown, and presumed to be limited.

Group #39 – Carabid Beetles (*Omus dejeanii, Bembidion viator, Bradycellus fenderi*)

Introduction

Omus dejeanii has been documented to be present and breeding in the Cedar River Municipal Watershed. No comprehensive surveys to determine the presence or absence of *Bembidion viator* and *Bradycellus fenderi* have been conducted in the municipal watershed, and no incidental observations of these two species have been documented to date. Habitat associations of these three species are not well understood, but all three species occur at lower elevations. *Omus dejeanii* is known to occur in swamps, forests, forest glades, and along stream banks (Section 3.6), *Bembidion viator* to occur in swamps, bogs, and forested marshes, and *Bradycellus fenderi* to occur in swamps, forested marshes, and foothill stream-side zones (Bergdahl 1996, 1997; Bergdahl, J., Northwest Biodiversity Center, June 19, 1998, personal communication).

Potential key habitats for these three species in the municipal watershed are low-elevation swamps, forested wetlands, riparian areas, and forest. Low-elevation forest is considered to be secondary habitat for *Bembidion viator* and *Bradycellus fenderi*, and would be used primarily for dispersal. For the purposes of this effects analysis, the Service is assuming these species are not aquatic species existing in either the mainstem Cedar River downstream of the Reservoir, or in the Reservoir. Thus, the Service assumes water system operation and hydro-electric generation will not have any effects on these species.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for Group #39 species include: (1) protection through reserve status of all key wetland habitat and riparian habitat; (2) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance and protecting forest habitats that could be used as primary habitat by *Omus dejeanii* or for dispersal by the other two carabid species; (3) protection of all old growth and recruitment of substantial mature and late-successional forest over time (including large areas at low elevation), facilitating dispersal and increasing habitat quality for *Omus dejeanii*; (4) silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests; (5) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to wetlands; (6) guidelines and prescriptions designed to reduce sediment production during watershed management activities; and (8) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

No commercial timber harvest will be conducted in the watershed, thus, all lands outside developed areas, including all key habitat and secondary habitat for Group #39 species, are in reserve status. In addition, activities that could impact aquatic habitat are restricted near water bodies, and silvicultural treatments in riparian and upland forest will be conducted in many areas previously harvested to restore natural ecological functions and to develop characteristics of late-successional forest habitat.

Short-term and long-terms gains in the quality of wetland and riparian habitats are expected under the HCP as a result of the natural maturation of younger seral-stage forest in riparian areas. Development of young second-growth forest into mature and late-successional seral stages in riparian areas will help restore a more naturally functioning aquatic ecosystem, thus potentially benefitting these three species. In order to estimate how the relative amount of older forest age classes will change in "riparian" forest over the 50-year term of HCP, "riparian" zones of 300 ft (on Type I-III waters), 150 ft (on Type IV waters), and 100 ft (on Type V waters) were established using GIS data and acreage for forest age classes under current and future predicted conditions were calculated. Currently, only 16 percent of the 15,160 acres of forest within this riparian zone is over 80 years old (mature, late-successional, or old growth), while at the end of the HCP term (year 2050) 85 percent will be more than 80 years old, a near fivefold increase.

The HCP also includes management actions designed to help restore wetland and riparian habitats. Stream-bank stabilization projects, placement of large woody debris, and a stream bank re-vegetation program should benefit *Omus dejeanii* by improving stream-side habitats, and a program of restoration planting, restoration thinning, and ecological thinning in riparian areas should benefit all three species by helping to accelerate the reestablishment of natural aquatic and riparian ecosystem functioning and the development of mature or late-successional characteristics in younger second-growth forests in riparian areas.

Forest management and management activities associated with forest roads (including road construction, repair, maintenance, and decommissioning) can, if not done properly, impact wetlands and streams through erosion and mass wasting that increases sediment loads and decreases water quality, and thus have negative effects upon Group #39 species. Similarly, silvicultural treatments near streams and riparian areas could result in some short-term, negative impacts on water quality if not properly conducted.

Because of these potential negative effects, the HCP contains the following minimization measures. During restoration or ecological thinning activities, no tree removal that has the potential to reduce stream-bank stability will be allowed within 25 feet of any stream. In addition, the HCP also includes Watershed Assessment Prescriptions (Appendix 16) and other guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with road systems and silvicultural treatments in riparian areas. Implementing these prescriptions and guidelines will help reduce the rate of sediment loading to aquatic systems, and will help maintain high water quality in potential habitats for all three species of carabid beetles in Group #39. Expected changes in the hydrologic regimes of wetland communities resulting from forest succession are discussed above under Group #33.

Improvement in upland forest habitat, including forest openings and glades, will benefit *Omus dejeanii* as an improvement in potential key habitat and the other two species as an improvement in dispersal habitat. Overall, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by year 2050, a near fivefold increase over current conditions for these three seral stages in total and a fiftyfold increase in mature and late-successional forest (Section 4.2.2). Because the vast majority of the lower-elevation forest in the watershed was harvested in the early twentieth century, most of the mature and late-successional forest habitat in year 2050 will develop at low elevations, where the second-growth is currently older than in most other parts of the watershed (Section 4.2.2). At elevations below 3,000 ft elevation at year 2050, mature and late-successional forest is projected to total 47,988 acres, a forty-one-fold increase over current conditions, and mature, late-successional, and old-growth forest is projected to total 50,563 acres.

Under the HCP, upland forest habitat is also expected to benefit from management actions (e.g., ecological thinning and restoration thinning) intended to accelerated development of mature and late-successional forest habitat characteristics in some areas of previously harvested forest. Although silvicultural intervention to develop late-successional forest characteristics will benefit Group #39 species over the long term, over the short term these management actions may cause some temporary, local impacts. As mitigation, site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions to ensure that habitat for Group #39 species is only minimally impacted.

Road repair, maintenance, and decommissioning can all impact aquatic and riparian areas. To minimize these potential impacts, the HCP includes Watershed Assessment Prescriptions and other management guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with roads. Implementing these prescriptions and guidelines, along with the program to improve and decommission roads (Section 4.2.3), will reduce the rate of sediment loading to aquatic systems, and help maintain high water quality. It is inevitable that ongoing road use and maintenance will continue to produce some level of sedimentation and retard succession of riparian vegetation where roads come near streambanks, but several conservation and mitigation measures included in the HCP will help mitigate those impacts. These measures include removal (decommissioning) of about 38 percent of the road system, substantial re-engineering (improvement) of other roads, improved road maintenance, and a highly reduced level of road use under the HCP as compared to past levels of use related to commercial timber harvest.

Disturbance Effects and Injury/Mortality
The primary activities under the HCP that may result in disturbance and injury, including death, of Group #39 species that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) in-stream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (8) routine road use.

Disturbance to, direct injury to, or death of, Group #39 species is expected to result from the 8 activities listed in the previous paragraph. However, the effect is expected to be short-term in nature, because of the specific mitigation and minimization measures committed to in the HCP:: (1) interdisciplinary team site evaluations in key habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which further minimizes the risk of injury or death of dispersing beetles; and (4) removal of 38 percent of forest roads, which will reduce the potential for negative effects resulting from related to road maintenance, improvement, and use over the long term. Occasionally, however, dispersing individuals might be injured or killed inadvertently by management activities in upland or riparian areas, or vehicles on watershed roads.

Summary/Conclusion
Because even a general understanding of the ecology of Group #39 species is limited, and because only one of these species has been documented as present in the municipal watershed, population-level effects for these species cannot be specified with any certainty. The conservation and mitigation measures included in the HCP, however, because they provide substantial protection and improved conditions of all key habitat in the municipal watershed, should have a beneficial effect on populations of these species if they occur in the watershed. Any short-term, local impacts to these species from restoration activities near wetlands and in or near riparian areas are expected to be offset by long-term, landscape-level benefits. Protection in reserve status of all riparian areas, as well as increases in mature and late-successional forest habitat, will benefit populations of Group

#39 species by facilitating the movement and dispersal of individuals throughout the municipal watershed, and the municipal watershed could serve as a population source in the future. Thus, the Service believes the overall population-level effects should be positive for those Group #39 species that may be present in the municipal watershed.

Group #40 – Snail (*Valvata mergella*)

Introduction

Valvata mergella is an aquatic snail whose only known population in North America occurs at Paradise Lake in Snohomish County, Washington (located about 25 miles north of the watershed). This species was observed in the Pacific Northwest and Alaska in the 1800s, but had not been recorded this century until it was confirmed in Paradise Lake in September 1995 (Richter 1995-Need full citation). Surveys of apparently suitable habitats in western WA, British Columbia, Yukon Territory, Alaska and the Northwest Territories have been unsuccessful. No comprehensive surveys to determine the presence or absence of *V. mergella* have been conducted in the municipal watershed and no incidental observations of this species have been documented to date (Frest and Johannes, *Northwestern United States' Sensitive Mollusks, In Press)*. Potential key habitat for *V. mergella* in the municipal watershed may include lakes (or ponds) with a muddy bottom and well oxygenated water. Given the lack of information on the habitat associations of *V. mergella*, the Service is assuming that this species may use some other types of water bodies, including the Reservoir, and potentially some streams.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the *V. mergella* are (1) reduced siltation resulting from protecting (in reserve status) all key riparian habitat (including lakeshore), along with all lakes and ponds; (2) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance and any potential effects on water bodies; (3) protection of all old growth and recruitment of a substantial amount of mature and late-successional forest over time, potentially promoting the reestablishment of natural functioning in streams, lakes, and ponds; (4) silvicultural treatments designed to accelerate the development of natural functions in riparian forests; (5) stream restoration projects; (6) road improvements and substantial decommissioning, and improved road maintenance, reducing sediment loading to streams; (7) guidelines and prescriptions designed to reduce sediment production during watershed management activities; and (8) monitoring and research.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

V. mergella could be negatively affected by the City's water delivery system, such as reservoir-level manipulations or instream flow regulation. Also, silvicultural treatments, road management, or other operational activities conducted in close proximity to lakes and streams could negatively affect this species. Direct effects (direct injury to or death of individuals) may occur from any of these activities, if *V. mergella* occurs in the aquatic environments of the Watershed. Also, indirect effects, through influences on habitat, particularly water quality, might occur (e.g., excessive sediment or nutrient input).

All lands outside limited developed areas, including all key habitat of *V. mergella*, are protected in reserve status. In addition, activities that could impact aquatic habitat are restricted near water bodies, and silvicultural treatments in riparian forest will be conducted in many areas of previously harvested riparian forest in order to restore natural ecological functions.

Short-term and long-terms gains in the quality of aquatic and riparian habitats are expected under the HCP as a result of the natural maturation of younger seral-stage forest in riparian areas. Development of forest into mature and late-successional seral stages in such areas will help restore a more naturally functioning aquatic ecosystem, thus potentially benefitting this species. The HCP also includes management actions designed to help restore and enhance stream and riparian habitats. Stream bank stabilization projects, placement of large woody debris, a stream bank re-vegetation program, and a program of restoration planting, restoration thinning, and ecological thinning in riparian areas are all expected to help accelerate the restoration of natural aquatic and riparian ecosystem functioning and the development of mature or late-successional characteristics in younger second-growth forests in riparian areas. Restoration of a more naturally-functioning aquatic ecosystem potentially benefits *V. mergella,* if the species occurs in the municipal watershed.

Silvicultural treatments and management activities associated with forest roads (including road construction, repair, maintenance, and decommissioning) can impact reservoirs, lakes, ponds, and streams through erosion and mass wasting that increases sediment loads and decreases water quality. The HCP commits the City to remove almost 40% of the existing roads in the watershed, and improve and upgrade the remaining road system to certain standards that are designed to minimize sediment from entering the aquatic system. Further, the road improvement program is designed to restore original hydrology to basins where hydrology has been altered by road construction.

Measures contained in the HCP, such as restoration and ecological thinning are designed to help ameliorate past and lingering effects of forest management upon hydrology and sediment production. During restoration or ecological thinning activities, no tree removal is allowed that has the potential to reduce stream-bank stability, and no tree removal will be allowed within 25 feet of any stream. In addition, the HCP also includes a comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) and other guidelines (Section 4.2.2) intended to minimize the probability of erosion and mass wasting associated with road systems and silvicultural treatments in riparian areas. Implementing these prescriptions and guidelines will help reduce the rate of sediment loading to aquatic systems and will help maintain high water quality in potential habitat for *V. mergella.*

Disturbance Effects and Injury/Mortality

The Service assumes that any major alterations of aquatic habitat conditions, such as water temperature, dissolved oxygen, sediment routing, water-level fluctuation, velocity of flow and biological oxygen demand would likely effect *V. mergella*. Therefore, the Service believes the following activities under the HCP may result in direct injury and disturbance of *V. mergella,* if this species occurs in the watershed: (1) the City's water delivery system, including reservoir-level manipulations, instream flow regulation and water withdrawals from the Cedar River at Landsburg, and, (2) the City's operation of a hydro-power generating facility at Cedar Falls. Also, direct injury or disturbance may occur during any operations that involve human activities on roads or near suitable aquatic habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) in-stream habitat restoration projects; (5) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (6) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (7) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (8) routine road use.

Because pertinent information regarding the ecology of *V. mergella* is lacking, the potential effects of water supply operations on a *V. mergella* population, if it were to exist in the reservoir system, are unknown. Further, because the habitat requirements of this species are so poorly known, the Service assumes it could be present in any aquatic environments within the watershed. Thus, the hydro-power generating facility and the suite of restoration activities of this HCP have the potential to negatively affect *V. mergella*, though we do not know to what extent.

Summary/Conclusion

Because pertinent information regarding the ecology of *V. mergella* is severely lacking, and the species is currently known to be present from one site in the world, population-level effects for this species cannot be specified with certainty. However, because this species is so rare, effects to individuals would likely cause population effects. The conservation and mitigation measures included in the HCP, however, because they provide substantial protection and improved conditions with respect to all aquatic habitats in the municipal watershed, should have an overall beneficial effect on the habitat for any populations of *V. mergella* that may occur in the watershed.

Group #41 – Johnson's (Mistletoe) Hairstreak Butterfly

Introduction

No comprehensive surveys to determine the presence or absence of the Johnson's (mistletoe) hairstreak butterfly have been conducted in the municipal watershed, and no incidental observations of this species have been documented to date. Potential key habitat for Johnson's (mistletoe) hairstreak in the Cedar River Municipal Watershed is low-elevation (below 3,500 feet) mature, late-successional, and old-growth coniferous forests containing dwarf mistletoe of the genus *Arceuthobium*. Coniferous forest in younger seral stages, if mistletoe is present in sufficient abundance, is considered secondary habitat.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures pertinent to the Johnson's (mistletoe) hairstreak are described in Section 4.2.3 and summarized below: (1) protection of all existing mature, late successional and old growth forest present in the watershed; (2) elimination of timber harvest for commercial purposes within the watershed; (3) natural maturation of second-growth forests into mature and late-successional seral stages, potentially recruiting increased amounts of organic debris to the forest floor and improving habitat function; (4) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas, including spread of mistletoe infections (long term); (5) protection of secondary habitats including younger, closed canopy forest and riparian stream corridors in reserve status; (6) prohibition on the use of all pesticides, including insecticides and *Bacillus thuringensis*; (7) funding for optional species and sensitive habitat surveys (Section 4.5.5), which can be used to increase understanding of these species; and (8) the flexibility to alter mitigation in response to better understanding of the habitat relationships of these species through the adaptive management program (Section 4.5.7).

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All forests outside limited developed areas, including all 13,889 acres of old-growth forest, are in reserve status. As a result, all key habitat (low-elevation mature to old-growth coniferous forests containing dwarf mistletoe of the genus *Arceuthobium*) for the Johnson's (mistletoe) hairstreak within the municipal watershed is protected in reserve status.

Increases in the quantity of mature and late-successional coniferous forest habitat for this species are expected over the 50-year term of the HCP as a result of natural maturation of all second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in second growth in some areas. In the near term, mature and late successional coniferous forest (over 80 years old) below 3,000 feet elevation will increase from a current level of 1,165 acres to 35,844 acres by the end of the second decade of HCP. In this elevation zone on a long-term basis, approximately 24,109 acres of mature forest, 23,889 acres of late-successional forest, and 2,565 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a nine-fold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (5,727 acres total).

Under the HCP, some habitat for the Johnson's (mistletoe) hairstreak in the municipal watershed is expected to benefit from ecological and restoration thinning intended to produce mature and late-successional forest habitat characteristics in second-growth forests. Ecological thinning and restoration thinning in second-growth forests in the CHU and other areas of the watershed are expected to hasten the development of late-successional and old-growth characteristics in treated forests, thereby more effectively connecting all extant patches of old-growth forest within the term of the HCP from the standpoint of the hairstreak. Under the HCP, approximately 11,000 acres are projected to be treated by restoration thinning and approximately 2,000 acres are projected to be treated by ecological thinning in the watershed.

Disturbance Effects and Injury/Mortality

The primary activities under the HCP that may result in disturbance and injury, including death, of Johnson's hairstreak that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat such as the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the

HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); and (7) routine road use.

Disturbance to, direct injury to, or death of, Johnson's (mistletoe) hairstreaks is expected to result from silvicultural treatments, road management, and other operational activities. However, the effect is expected to be short-term in nature and not significant to the population of Johnson's (mistletoe) hairstreaks in the watershed because of the specific mitigation and minimization measures committed to in the HCP: (1) protection of all existing old-growth forest; (2) elimination of timber harvest for commercial purposes within the watershed; (3) natural maturation of second-growth forests into mature and late-successional seral stages; (4) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas; (5) restriction on the use of insecticides and herbicides; (7) monitoring and research, including ; and (8) identification of suitable breeding habitat by interdisciplinary teams, and resultant protection of that suitable habitat during restoration activities.

Summary/Conclusion

Population-level effects on the Johnson's (mistletoe) hairstreak are expected to be positive. Under the HCP, the current substantial amount of watershed forest in fragmented condition will mostly be replaced by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early or mid-seral forest habitat (less than 50 years old) will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early seral stages as a result of recent commercial logging will mature over the term of the HCP, as no additional commercial harvest will be conducted. The total amount of late seral habitat (over 80 years) is expected to increase by a factor of nearly five in the watershed on the whole, and by a factor of nearly nine at elevations below 3,000 ft.

The improved landscape connectivity and increased acreage of preferred forest habitat within the municipal watershed should benefit the Johnson's (mistletoe) hairstreak population in the vicinity by providing improved forest habitat conditions that facilitate movement and/or dispersal of individuals throughout the watershed, and also by providing critical older forest habitat for breeding and foraging. This landscape connectivity may further benefit Johnson's (mistletoe) hairstreak populations on a more regional level by facilitating movement and dispersal of individuals between the municipal watershed and other watersheds to the north, east, and south.

Group #42 – Blue-gray Taildropper, Puget Oregonian, Oregon Megomphix

Introduction

No comprehensive surveys to determine the presence or absence of the mollusk species blue-gray taildropper, Puget Oregonian, and Oregon megomphix have been conducted in the Cedar River Municipal Watershed, and no incidental observations of these species have been documented to date. The municipal watershed, however, is located within the identified range of each of these species. Although habitat associations are not well established for each individual species in this group of mollusks, they, as a group, appear to be most closely associated with low- to mid-elevation, moist forest, especially where organic debris has accumulated on the forest floor, as well as certain aquatic habitats such as streams, seeps, and springs. It is also significant to note that Frest and Johannes (1993) estimated that the Northwest Forest Plan has a relatively low probability of providing sufficient habitat to maintain well-distributed, interacting populations of these species across their ranges on federal lands in the next 100 years (blue-gray taildropper and Oregon megomphix, 30 percent; Puget Oregonian, 0 percent) and relatively high risks of extirpation (blue-gray taildropper and Oregon megomphix, 20 percent; Puget Oregonian, 50 percent).

Potential key habitat for the blue-gray taildropper, Puget Oregonian, and Oregon megomphix in the municipal watershed includes low- to mid-elevation mature, late-successional, and old-growth coniferous forest, especially within riparian habitat corridors. Other seral-stage, closed canopy coniferous forest, deciduous forest, and non-forested habitats are considered of secondary importance.

The blue-gray taildropper, Puget Oregonian, and Oregon megomphix could be negatively affected by silvicultural treatments, road management, or other operational activities in low- to mid-elevation mature to old-growth forests. Such effects could be direct (i.e., through direct injury to or death of individuals) or indirect, through influences on habitat (e.g., microclimate changes due to the removal of overstory vegetation) or disturbance.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the blue-gray taildropper, Puget Oregonian, and Oregon megomphix are described in Section 4.2.2 and summarized below: (1) protection of all existing key forested habitat, including riparian corridors, in reserve status; (2) elimination of timber harvest for commercial purposes within the watershed, reducing the level of habitat disturbance; (3) natural maturation of second-growth forests into mature and late-successional seral stages, potentially recruiting increased amounts of organic debris to the forest floor and improving habitat function; (4) silvicultural treatments designed to accelerate the development of mature, late-successional, and old-growth structural characteristics in second-growth forests in some areas, including riparian forests, and improving habitat conditions on the forest floor (long term); (5) retention, creation, and recruitment of logs and large snags during silvicultural treatments, supplying organic debris to the forest floor on both a short- and long-term basis; (6) removal of 38 percent of watershed roads, reducing the risk of direct injury or death as a result of road use; (7) protection of secondary habitat including younger, closed canopy forest; (8) funding for optional species and sensitive habitat surveys (Section 4.5.5), which can be used to increase understanding of these species; and (9) the flexibility to alter mitigation in response to better understanding of the habitat relationships of these species through the adaptive management program (Section 4.5.7).

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

All forests outside developed areas, including all 13,889 acres of old-growth forest, are in reserve status. As a result, all key habitat (low- to mid-elevation mature to old-growth forest and riparian corridors) for the blue-gray taildropper, Puget Oregonian, and Oregon megomphix within the municipal watershed is in reserve status.

Increases in the quantity of mature and late-successional coniferous forest habitat for these species are expected over the 50-year term of the HCP as a result of natural maturation of all second-growth forests (a long-term habitat gain) and silvicultural intervention designed to accelerate development of older forest characteristics in second-growth in some areas. In the near term, and solely as a result of natural maturation, there will be more than a 30-fold increase in the amount of mature (80-119 year old) conifer forest realized in the watershed within the first two decades of the HCP, totaling 34,745 acres by the year 2020. Of that increase of mature forest, 34,580 acres (99.5 percent) will occur below an elevation of 3,000 feet. Overall, approximately 34,932 acres of mature forest, 23,918 acres of late-successional forest, and 13,889 acres of old-growth forest are projected to exist in the watershed by the year 2050, representing nearly a fivefold increase in combined mature, late-successional, and old-growth forest as compared with current conditions (Section 4.2.5). As discussed for Group #34, the amount of mature, late-successional, and old-growth forest in the riparian zone will also increase nearly fivefold. This mature riparian habitat should be largely uninterrupted along the stream network, with few or no reaches of stream bordered by vegetation types in a "hostile" condition that would inhibit dispersal by these terrestrial mollusk species.

All riparian corridors (key habitat), forested wetlands, substantial areas of mixed and deciduous forest seeps, springs, lakes, and ponds are also protected as reserve forest or as inclusions in reserve forest and constitute potential habitat for the blue-gray taildropper, Puget Oregonian, and Oregon megomphix within the municipal watershed. In particular, the large Walsh Lake wetlands and forest complex, in the western section of the watershed, represents a diverse, low-elevation ecosystem that includes extensive forested riparian corridors, mixed coniferous/deciduous forest, extensively developed horizontal diversity and organic debris accumulation, and a relatively high level of tree species diversity. It also includes a substantial number of mature big leaf maple and black cottonwood, many of which have survived since historic harvest activity many decades ago.

Under the HCP, some potential habitat for Group #42 species in the watershed, particularly riparian habitat, is also expected to benefit from ecological thinning and restoration thinning that is intended to produce mature and late-successional forest habitat characteristics in second-growth forests. Ecological thinning and restoration thinning in second-growth forests in the CHU and other parts of the watershed is expected to hasten the development of late-successional and old-growth characteristics in those forests, thereby effectively connecting all extant patches of old-growth forest within the term of the HCP. Under the HCP, approximately 11,000 acres are projected to be treated by restoration thinning and approximately 2,000 acres are projected to be treated by ecological thinning in the watershed.

In addition, during restoration activities, existing biological legacies (logs, snags) will, whenever possible, be retained and protected and substantial amount of large woody debris will be added to the forest floor on both a short- and long-term basis. As a result, both habitat diversity and potential for the blue-gray taildropper, Puget Oregonian, and Oregon megomphix will be increased, especially within riparian corridors, throughout the landscape of the municipal watershed. Tree species diversity, including both coniferous and deciduous species (big leaf maple, vine maple, black cottonwood, alder) will also be retained and/or encouraged in appropriate areas.

These species' habitat would likely have an overall habitat improvement over the long term. However, any activity that alters overstory or under-story of occupied habitat, even in the short term, can have negative effects to these species. Slight modifications to the micro-climate can render these species vulnerable to dessication.. They are not tolerant to habitat modifications and will not recover or distribute to new habitats easily. In addition, any direct injury or compaction of forest floor detritus or vegetation caused by thinning equipment, site preparation, or other silviculture techniques will have severe acute effects that are very difficult, if not impossible, for these non-mobile species to overcome. Dry seasonal work may help in protecting these species from direct injury, as long as all rotting logs and wood debris are preserved. Extra precautions should be taken near permanent water sources, no matter how small, especially during dry periods. Protection of permanent water sources should include equipment exclusions. These species must survive *in situ* since we have no reason to believe that re-colonization will occur off-site within the span of the HCP (50 years).

Development of late-successional characteristics, especially ecological diversity on the forest floor, in younger second-growth forests is also expected to benefit the three Group #42 species over the long term. However, over the short term, ground-disturbing management actions, including silvicultural treatments, may cause some localized decline in habitat function. Site evaluations will be conducted by an interdisciplinary team prior to undertaking management actions in the watershed to ensure that habitat for the blue-gray taildropper, Puget Oregonian, and Oregon megomphix will be minimally impacted. These teams can include representatives of the Service if we choose to be involved.

Disturbance Effects and Injury/Mortality

Disturbance effects and the potential for injury or mortality of the blue-gray taildropper, Puget Oregonian, and Oregon megomphix, assuming they occur in the watershed, are likely to occur as a result of restoration activities performed under the HCP. Terrestrial mollusks are thought to be highly sensitive to micro climatic changes, with the primary issue being vulnerability to dessication (acute vulnerability to dessication is a factor that makes this species group different from others in the HCP.) The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of any of these species that may occur in the watershed include any operations that involve human activities on roads or in suitable habitat including the following: (1) restoration planting of about 1,400 acres; (2) restoration thinning of about 11,000 acres; (3) ecological thinning of about 2,000 acres; (4) removal of approximately 240 miles of road over the first 20 years (with the potential for additional road removal later); (5) maintenance of about 520 miles of road per year at the start of the HCP, diminishing as roads are removed over time to about 380 miles per year at year 20; (6) improvement of about 4 to 10 miles of road per year (occasionally more in some years); (7) routine road use; and (8) monitoring and research.

Disturbance and injury or mortality of blue-gray taildroppers, Puget Oregonians, and Oregon megomphix in the watershed, if they occur, is expected to occur. However, the amount and nature of the negative effects should be minimized via the following mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations prior to silvicultural or road management activities, to establish protection measures for potential habitat structure whenever possible, and limit human disturbance in suitable habitat; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) the City's policy restricting unsupervised public access (including no access for hunting) to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to breeding other resident individuals; (4) removal of 38 percent of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use over the long term; and (5) prohibition on use of pesticides in the watershed.

Because of specific mitigation and minimization measures committed to in the HCP as listed above, the net effect of disturbance to, direct injury to, or death of any Group #42 species as a result of silvicultural treatments, road management, or other operational activities is not expected to be significant. Though there will be short-term adverse effects as a result of these HCP activities, the long-term effect is expected to be positive via improved habitat diversity, hastening of late-successional characteristics, and reduced milage of roads and associated opportunity for introduction of exotic species that can compete with the native mollusk fauna.

Summary/Conclusion

Population-level effects of the HCP on blue-gray taildroppers, Puget Oregonians, or Oregon megomphix are expected to be positive, assuming they occur in the watershed. Under the HCP, the current substantial amount of watershed forest in fragmented condition will mostly be replaced by large blocks of older forest habitat, interrupted only by natural openings, roads, and limited areas of development. By HCP year 50, no early or mid-seral forest habitat less than 50 years old will remain in the watershed, except for that resulting from natural events (e.g., fire, wind, disease, insect infestation); forest now in early-seral stages as a result of recent commercial logging will mature over the term of the HCP, and no additional commercial harvest will be conducted. The total amount of late-seral habitat (over 80 years old) is expected to increase by a factor of nearly five.

The improved landscape connectivity and increased acreage of preferred forest habitat within the municipal watershed should benefit populations of blue-gray taildroppers, Puget Oregonians, or Oregon megomphix that may exist in the vicinity by providing improved forest habitat conditions that facilitate movement and/or dispersal of individuals throughout suitable habitat within the watershed, and also by providing critical older forest habitat for breeding and foraging. The commitment to not use herbicides, pesticides, or any type of chemical for habitat management of maintenance could be a significant benefit to these species, if they occur in the watershed. Finally, the possibility of introducing exotic species that compete with the native mollusk fauna are greatly reduced within the closed watershed.

Because mechanisms and rates of dispersal are virtually unknown for these species, it is impossible, as well as impractical to hypothesize, as to the potential for population-level effects on a regional level except to recognize that if populations of these species do exist and are protected within the municipal watershed, then it is theoretically possible that they could, on a very long-term basis, serve as a source of population expansion and/or recolonization if and/or when potential suitable habitat in adjacent lands becomes available.

PROVISION FOR POST-TERMINATION MITIGATION

Post-termination mitigation is an issue described in the Implementation Agreement, section 6.3, Permit suspension and revocation, and section 6.4, Relinquishment of the permit. In brief, post-termination mitigation could become an issue in this HCP in the event of early termination, by either the Services or the City, of the HCP and Permit. The Service's preliminary determinations regarding post-termination mitigation are contained here-in. These determinations will be re-assessed according to the terms of the Implementation Agreement at time of an early termination.

The City is offering to continue to provide some conservation benefits to covered species in the event that the permit is suspended or revoked before the end of the 50 year plan term, according to the following details described in the Implementing Agreement:

> **6.3 Permit suspension or revocation.** The Services may suspend or revoke the permit only for cause, and only in accordance with regulations in force at the time of such suspension or revocation. (These regulations are currently codified at 50 C.F.R. §§ 13.27 through 13.29, and 222.27, and 15 C.F.R. Part 904.) Such suspension or revocation may apply to the entire permit, or may apply only to specified covered species, covered lands, or covered activities. In the event of suspension or revocation, the Services will review all relevant data to determine whether take of the Covered Species listed in the Services' biological opinions on the permit, occurring prior to the date of suspension or revocation, has been substantially mitigated in accordance with the permit conditions. If the Services demonstrate that take of such species that occurred during the term of the permit has not been substantially mitigated, they may require continuation of specified HCP activities until such time as mitigation is substantially completed. Substantial mitigation will have occurred if the mitigation that has been provided under the HCP at least compensates for the take that has occurred under the permit as of that date.

Determination of Post Termination Mitigation

As described in the Implementation Agreement clause above, the Services will, in the event of suspension or revocation, or in the event of permit relinquishment (Implementation Agreement section 6.4), review all relevant data to determine whether take of the Covered Species occurring prior to the date of suspension or revocation has been substantially mitigated in accordance with the permit conditions. If the Services demonstrate that take of species occurring during the term of the permit has not been substantially mitigated, they may require continuation of specified HCP activities until such time as mitigation is substantially completed. Substantial mitigation will have occurred if the mitigation that has been provided under the HCP at least compensates for the take that has occurred under the permit as of that date.

At this time, the Service believes, based on the preceding effects analyses, that for most of the Covered Species the rate of mitigation will be commensurate with the rate of negative effects accruing under the HCP. In fact, most of the species will realize a net positive effect immediately upon implementation of the HCP. Further, the short-term negative effects of the restoration activities, such as riparian forest restoration, will be more than offset by other mitigation facets of the plan that are being implemented contemporaneously. Therefore, the Service does not anticipate that the City will be responsible for post-termination mitigation in the event of early termination of the HCP for most Covered Species. The exceptions, where the Service believes mitigation debt could be owed in the event of early termination, are stated below:

With respect to bull trout, Pacific and river lampreys, stream-breeding amphibians and stream-breeding invertebrates:

> Road improvement included in the HCP (section 4.2) is focused on reducing sediment loading to streams and improving fish passage at road crossings. Benefits to aquatic species will increase over time with completion of specific road improvement projects through reduction of sediment loading levels to more natural levels and consequent improvement of aquatic habitat. To achieve a level of mitigation under the HCP that would not require any post-termination mitigation, the City will complete five years of the road improvement program specified in Section 4.2 of the HCP.
>
> Road decommissioning included in the HCP is focused on reducing sediment loading to streams, improving fish passage at road crossings (by removal of roads), and reducing the road network to those roads needed for municipal watershed management under a program of no timber harvest for commercial purposes. Benefits to aquatic species will increase over time with decommissioning of specific road segments with potential to deliver sediment to streams through reduction of sediment loading levels to more natural levels and consequent improvement of aquatic habitat. To achieve a level of mitigation under the HCP that would not require any post-termination mitigation, the City will decommission 20 miles of roads under the program specified in Section 4.2 of the HCP, and section 3.2.5 of the Final Mass Wasting and Surface Erosion Assessment Cedar River Watershed Habitat Conservation Plan (Foster Wheeler Env. Corp. 1995), with a priority on removal of road segments with high potential for sediment delivery to streams.

With respect to bull trout, Pacific lamprey and river lamprey:

> Construction of the fish screens and fish ladders, proposed for HCP year 3, would, when shown to be successfully operating for a period of at least 2 years, substantially remove the potential take associated with the current lack of fish passage at Landsburg and the nearby pipeline. By making the water diversion structures at Landsburg and the pipeline essentially neutral to up- and down-stream passage of anadromous fish (except for introduced sockeye salmon), any take associated with those City facilities would be negligible.

With respect to bull trout:

> Completion of certain studies described and budgeted in section 4.5.4, Watershed Aquatic Species Monitoring and Research, will be considered by the Service to be

the substantially completed mitigation necessary for satisfying provisions of sections 6.3 and 6.4 of the Implementation Agreement. Specifically, the studies the Service needs to see completed include;

1. Bull trout surveys and relative population indices

    A. Adult surveys through year ten, using methodology mutually agreed upon by the Service and the City

    B. Juvenile and emergent fry studies

2. Bull trout telemetry study to investigate occurrence of lake spawning

3. Bull trout redd inundation and egg mortality study

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Several of the more important Federal actions expected to result in cumulative effects include on-going implementation of the Northwest Forest Plan on US Forest Service lands in the region, on-going implementation of the Plum Creek Timber Company HCP in the Snoqualmie Pass area and Washington Department of Natural Resources HCP, and the recently completed land exchange between Plum Creek Timber Company and the US Forest Service in the Central Cascades. Future Federal actions include completion of City of Tacoma's HCP for the neighboring Green River Watershed and the Tri-County HCP in Snohomish, King and Pierce Counties. Also, the Service anticipates future section 7 consultations with the Army Corps of Engineers regarding fish passage issues at the Hiram Chittenden Locks. Finally, the Service anticipates consultation on changes to the State Forest Practices, which are currently being revised to comport with the substance of the Forest and Fish Agreement (Washington Department of Natural Resources, April 1999).

Actions not expected to be subject to separate consultation pursuant to section 7 of the Act include the following:

1. On-going commercial forest management: The Service anticipates that existing non-Federal forest lands in the action area will continue to be cut as they reach harvestable diameters and stocking levels. Existing roads will be maintained to access the forest stands, and some new roads will be constructed to access the timber.

2. Residential and commercial development is expected to continue to occur at a rapid rate, resulting in loss of fish and wildlife habitat and individual animals. This loss is expected to continue adjacent to the City ownership, as it already has in the lower elevations of the watershed, east of Renton, Cedar Grove, Maple Valley and Hobart. This change in land-use is not an activity contemplated in the HCP, nor analyzed in this Opinion. The public's knowledge that the municipal watershed will not be developed and will remain in a near-pristine state may make it more attractive as a neighbor, and thus serve to increase development pressure at the periphery.

Under the restricted access set forth in the HCP, cumulative effects such as poaching loss, increased fishing pressure and other effects resulting from access by humans are not expected to impact bull trout, pygmy whitefish, or any large mammals or birds that might otherwise be sought by recreationists.

CONCLUSION

Species of Greatest Concern/Critical Habitat

After reviewing the current status of the spotted owl, marbled murrelet, bald eagle, grizzly bear, gray wolf and bull trout, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the Cedar River Watershed HCP, as proposed, is not likely to jeopardize the continued existence of these species. The Effects of the Action section above fully describes the Service's rationale for arriving at this conclusion. Below is a summary of the components of the proposed HCP that were particularly instrumental in supporting the Service's conclusion with regard to the spotted owl, marbled murrelet, bald eagle, grizzly bear, and gray wolf:

1. Cessation of commercial timber harvest within the municipal watershed;

2. All old growth, special habitats and aquatic habitats are in an ecological reserve;

3. All previously-harvested forest will be allowed to develop into older forest stages. By 2045, 85% of the forest is expected to be >80 yrs of age;

4. The only actions permitted in the ecological reserve, and then only after investigations by an interdisciplinary team, are restoration activities designed to restore ecological functions disrupted by previous human actions;

5. Effectiveness monitoring will be conducted on many of the HCP's restoration activities to determine whether they are attaining the goals and objectives of the HCP, and if not, adaptive management will be used to make changes to the HCP;

6. Thirty-eight percent, or about 240 miles, of the existing roads will be decommissioned, with hydrologic functions restored and native vegetation re-established on and along old road grades;

7. The general public is not permitted to enter the watershed for any reason, unless part of an organized tour hosted by the City. Consumptive and non-consumptive recreation is prohibited within the watershed.

For bull trout, the above measures all apply and are relevant to the Service's conclusion. Further, poaching and other illegal acts resulting in harm and harassment to bull trout are unlikely to occur because the watershed is closed to fishing and public access is precluded by security patrols. Given the City's commitment to minimize adverse effects to bull trout from redd inundation, blockage or impedance to spawning habitat and entrainment as well as its commitment to provide research and monitoring, the Service believes that riparian and reservoir management activities are not likely to compromise the continued existence of bull trout. In addition, the following measures designed to avoid, minimize or mitigate for the negative effects of water supply operations and hydroelectric generation further reinforce the Service's determination:

1. Restoration of upstream and downstream fish passage for all native anadromous fish, which will make available 18 miles of pristine habitat that has been blocked for over 80 years;

2. Commitment to an Instream Flow Agreement that has higher minimum flows than occur currently, requires increased water conservation efforts by the City, and results in more useable habitat for all anadromous salmonids than would occur under present flow conditions or under natural, unregulated flow conditions;

3. City is committed to funding habitat restoration efforts in Cedar River floodplain below Landsburg Diversion.

Critical habitat for the spotted owl has been designated in the watershed; however, the HCP does not affect it, and no destruction or adverse modification of that critical habitat is anticipated. Critical Habitat for the marbled murrelet has been designated in Washington, but not in the watershed, and therefore, no destruction or adverse modification of that critical habitat is anticipated. No critical habitat has been designated for bald eagle, grizzly bear, or gray wolf, therefore, none will be affected.

Other Covered Species – Listed as Threatened or Endangered

After reviewing the current status of the Canada lynx, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's conference opinion that the Cedar River Watershed HCP is not likely to jeopardize the continued existence of the proposed Canada lynx. No critical habitat for Canada lynx has been proposed. The Effects of the Action section above fully describes the Service's rationale for arriving at this conclusion. Below is a summary of the components of the proposed HCP that were particularly instrumental in supporting the Service's conclusion with regard to Canada lynx:

1. Cessation of commercial timber harvest within the municipal watershed;

2. All old growth, special habitats and aquatic habitats are in an ecological reserve;

3. All previously-harvested forest will be allowed to develop into older forest stages. By 2045, 85% of the forest is expected to be >80 yrs of age;

4. The only actions permitted in the ecological reserve, and then only after investigations by an interdisciplinary team, are restoration activities designed to restore ecological functions disrupted by previous human actions;

5. Effectiveness monitoring will be conducted on many of the HCP's restoration activities to determine whether they are attaining the goals and objectives of the HCP, and if not, adaptive management will be used to make changes to the HCP;Thirty-eight percent, or about 240

miles, of the existing roads will be decommissioned, with hydrologic functions restored and native vegetation re-established on and along old road grades;

6. The general public is not permitted to enter the watershed for any reason, unless part of an organized tour hosted by the City. Consumptive and non-consumptive recreation is prohibited within the watershed.

Other Covered Species – Not Listed as Threatened or Endangered

After reviewing the current status of the other 70 Covered Species (see Table 1 for list of these species), the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, and the issuance of an incidental take permit, it is the Service's opinion that should any of these species be listed in the future, issuing the incidental take permit and executing the process described in the Implementation Agreement are not likely to jeopardize the continued existence of the 70 unlisted Covered Species in the wild. The Effects of the Action section above fully describes the Service's rationale for arriving at this conclusion. Below is a summary of the components of the proposed HCP that were particularly instrumental in supporting the Service's conclusion with regard to currently unlisted, terrestrial, Covered Species:

1. Cessation of commercial timber harvest within the municipal watershed;

2. All old growth, special habitats and aquatic habitats are in an ecological reserve;

3. All previously-harvested forest will be allowed to develop into older forest stages. By 2045, 85% of the forest is expected to be >80 yrs of age;

4. The only actions permitted in the ecological reserve, and then only after investigations by an interdisciplinary team, are restoration activities designed to restore ecological functions disrupted by previous human actions;

5. Effectiveness monitoring will be conducted on many of the HCP's restoration activities to determine whether they are attaining the goals and objectives of the HCP, and if not, adaptive management will be used to make changes to the HCP;

6. Thirty-eight percent, or about 240 miles, of the existing roads will be decommissioned, with hydrologic functions restored and native vegetation re-established on and along old road grades;

7. The general public is not permitted to enter the watershed for any reason, unless part of an organized tour hosted by the City. Consumptive and non-consumptive recreation is prohibited within the watershed.

For currently unlisted, aquatic, Covered Species, the above measures all apply and are relevant to the Service's conclusion. In addition, the following measures designed to avoid, minimize or mitigate for the negative effects of water supply operations and hydroelectric generation further reinforce the Service's determination:

1. Restoration of upstream and downstream fish passage for all native anadromous fish, which will make available 18 miles of pristine aquatic habitat that has been blocked for over 80 years;

2. Commitment to an Instream Flow Agreement that has higher minimum flows than occur currently, requires increased water conservation efforts by the City, and results in more useable habitat for all anadromous salmonids than would occur under present flow conditions or under aquatic natural, unregulated flow conditions;

3. City is committed to funding habitat restoration efforts in Cedar River floodplain below Landsburg Diversion.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act, and Federal regulations issued pursuant to section 4(d) of the Act, prohibit take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The proposed Cedar River Watershed HCP and it's associated documents clearly identify anticipated impacts to Covered Species likely to result from the proposed action and the measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the proposed HCP, together with the terms and conditions described in the Implementing Agreement and the section 10(a)(1)(B) permit are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement, pursuant to 50 CFR Section 402.14(i). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the Act to apply. If the Seattle Public Utility fails to adhere to these terms and conditions, the protection of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse. The amount or extent of incidental take anticipated under the proposed Cedar River Watershed HCP, associated reporting requirements, and provisions for disposing of dead or injured animals are as described in the HCP and the accompanying section 10(a)(1)(B) permit.

Note that 70 of the 77 species addressed in this Biological and Conference Opinion are not currently listed or proposed. Therefore, there is no take prohibition in place for these species at the time of this writing. The incidental take statements below, and the section 10(a)(1)(B) permit, do not become effective until the currently unlisted species are listed under the Act.

To the extent these incidental take statements conclude that take of any migratory bird species listed as threatened or endangered under the Act will result from the Service's issuance of the Incidental Take Permit, the Service will not refer the incidental take of such migratory bird or eagle for prosecution under Migratory Bird Treaty Act of 1918, as amended (16 USC sections 703-712) or the Bald and Golden Eagle Protection Act of 1940, as amended (16 USC sections 668-668-d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Amount or Extent of Take

Species of Greatest Concern/Critical Habitat:

Spotted Owl

The Service anticipates that an undetermined number of spotted owls associated with 4 activity centers and an unknown number of potential activity centers could be taken over a 50-year period as a result of this proposed action. The number of spotted owls taken annually could not be determined. However, the number of owls expected to be taken is very small, both because of the low number of owls thought to occur within the watershed at this time, and due to the level of protection provided by the proposed HCP. Specifically, the Service is authorizing incidental take of owls within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of streambank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to effect the 4 existing sites to the point where impairment of occupancy or reproduction will occur. However, there may be short-term negative effects to owl habitat as a result of some of the Covered Activities. Therefore, the Service is authorizing harm of owls as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting) over the 50-year term of the HCP. Table 2 of this document displays the number of acres per year, by activity, that will be entered over the 50-year permit term.

Harassment - Minimal harassment, in the form of disturbance, is expecte to occur near undiscovered nest sites in proportion to the amount of Covered Activities pursued by the City under the HCP specifically, the Service is authorizing disturbance of owls within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of streambank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP.

Injury or Death - Because there is no explicit commitment by the City to do comprehensive owl surveys in the immediate vicinity of Covered Activities, there is some remote possibility that owlets in a nest or newly fledged juveniles at unknown sites could be injured or killed. The Service is authorizing an undetermined number of owls to be injured or killed as a result of Covered Activities of the HCP. The City is required to notify the Service if this instance occurs.

Marbled Murrelet

The Service anticipates that an undetermined number of marbled murrelets associated with 1 known occupied stand and an unknown number of other occupied stands could be taken over a 50-year period as a result of this proposed action. The number of marbled murrelets taken annually could not be determined. However, the number of marbled murrelets expected to be taken is very small, both because of the low number of marbled murrelets thought to occur within the watershed at this time, and due to the level of protection of current and future occupied stands provided by the proposed HCP. Specifically, the Service is authorizing incidental take of marbled murrelets within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of streambank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to effect habitat suitability of the 1 known occupied site or any other occupied sites now and in the future because all old growth and late successional forest is wholly contained within the ecological reserve, and the Service does not expect Covered Activities to occur within these older forests.

Harassment - Minimal harassment, in the form of disturbance to undiscovered nesting murrelets, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP. Specifically, the Service is authorizing disturbance of marbled murrelets within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of streambank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near murrelets during the nesting season. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP. This disturbance will be minimized by disturbance restrictions for known occupied stands.

Injury or Death - All suitable nesting habitat is wholly contained within the ecological reserve, therefore, the Service does not expect injury or death of murrelets to occur from implementing any Covered Activities.

Bald Eagle

The Service anticipates that an undetermined number of bald eagles may be taken over a 50-year period as a result of this proposed action. The number of bald eagles taken annually could not be determined. However, the number of bald eagles expected to be taken is very small, both because of the low number of bald eagles thought to occur within the watershed at this time (only transients and migrants and no known nesting activity), and due to the level of protection provided by the proposed HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to effect habitat suitability of bald eagles. All mature riparian forest where roosting and perching would be expected to occur is within the ecological reserve, and will not be altered. Nesting, if it occurs within the watershed during the term of the HCP is also likely to be in mature forest near the reservoir or major rivers and streams, and all this habitat is also contained within the ecological reserve. Further, water level manipulations of the reservoir or in the lower Cedar River downstream of the reservoir are not expected to detrimentally affect the bald eagle's ability to obtain fish.

Harassment - Minimal harassment, in the form of disturbance, is expected to occur near undiscovered bald eagle nests and winter roosts in proportion to the amount of Covered Activities pursued by the City under the HCP. Specifically, the Service is authorizing disturbance of bald eagles within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near undiscovered bald eagles. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - The Service believes there is little risk of injury or death of bald eagles as a result of implementing the HCP because all nesting habitat is mature forest contained within the ecological reserve, and Covered Activities are not expected to occur within mature forests.

Grizzly Bear

The Service anticipates that an undetermined number of grizzly bears may be taken over a 50-year period as a result of this proposed action. The number of grizzly bears taken annually could not be determined. However, the number of grizzly bears expected to be taken is very small, both because of the low number of grizzly bears thought to occur within the watershed at this time (no evidence of use), and due to the high level of protection provided by the proposed HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to effect habitat suitability of grizzly bears.

Harassment - Because the City has committed to provide seasonal disturbance protection around sites of documented grizzly bear use within the watershed, minimal harassment of transient or resident grizzly bears is expected. However, because there is no explicit commitment by the City to do comprehensive grizzly bear surveys in the immediate vicinity of Covered Activities, there is a very remote possibility that an area of consistent grizzly bear use would go undetected, and that HCP activities would occur in that area. Specifically, the Service is authorizing disturbance of grizzly bears within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of streambank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near grizzly bears not known to be in the vicinity. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - The Service believes there is little or no risk of injury or death of grizzly bears as a result of implementing the HCP.

Gray Wolf

The Service anticipates that an undetermined number of gray wolves may be taken over a 50-year period as a result of this proposed action. The number of gray wolves taken annually could not be determined. However, the number of gray wolves expected to be taken is very small, both because of the low number of gray wolves thought to occur within the watershed at this time (no evidence of use), and due to the level of protection provided by the proposed HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to effect habitat suitability of gray wolves.

Harassment - Because the City has committed to provide seasonal disturbance protection around sites of documented gray wolves within the watershed, minimal harassment of transient or resident wolves is expected. However, because there is no explicit commitment by the City to do comprehensive wolf surveys in the immediate vicinity of Covered Activities, there is a very remote possibility that an area of consistent wolf use would go undetected, and that HCP activities would occur in that area. Specifically, the Service is authorizing disturbance of gray wolves within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of streambank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near gray wolves not known to be in the vicinity. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - The Service believes there is little or no risk of injury or death of gray wolves as a result of implementing the HCP.

Bull Trout

The Service expects that this action is likely to result in incidental take of bull trout in the form of harm, harassment, and injury or death due to effects from reservoir management operations and related activities, including road maintenance and removal, stream crossings, canopy removal, and potential increases in sediments and temperature which may adversely impact bull trout at a number of life-history stages. Estimates of incidental take account for the operation of these conservation measures. Because of the inherent biological characteristics of bull trout, the likelihood of discovering an individual death or injury attributable to this action is very small.

The Service anticipates that impacts to bull trout will be difficult to detect at the individual organism level for the following reason(s): (1) Bull trout are wide-ranging and are affected by factors beyond the control of the City; (2) Juveniles, fry, and eggs have small body size and are, therefore, difficult to detect when alive; (3) Finding dead or impaired specimens is unlikely, especially considering the often small body size of eggs and fry, denseness of vegetation/ substrate, and remoteness of the area; (4) Losses may be masked by seasonal fluctuations in numbers or other causes; (5) Dead or impaired specimens may be washed downstream of the site where the impact occurred; (6) Dead or impaired specimens may be consumed by other fish and wildlife species; (7) There is a large area with many stream miles to monitor. However, other variables may be used as a surrogate preliminary indicator of take or impact. This assessment focused on the amounts and quality of habitats provided/impacted for the Coastal/Puget Sound distinct population segment; and, (8) The amount of take is largely dependent upon how close normal environmental conditions follow those used in the effects analysis. Therefore, even though the Service expects incidental take to occur from the effects of the action, the best scientific and commercial data available are not sufficient to enable the Service to estimate a specific number of individuals incidentally taken based on loss or injury of individuals of the species. For instance, if the estimated bull trout population were to increase during the permit period, a larger number of individuals may become subject to some level of take. Conversely, if bull trout were to decrease, less take might occur. Consequently, take is estimated based on conditions likely to result in take during the 50-year HCP period.

Harm and harassment - The following two mechanisms may result in harm and harassment of bull trout:

1. Incidental take of bull trout in the form of harm and harassment may occur as a result of the restoration activities in riparian forests. These activities are expected to include 420 acres of restoration thinning (0-30-year old trees) conducted in the first fifteen years on the HCP and 150 acres of ecological thinning (30-60-year old trees) over the full term of the HCP (Table 2). It is not possible to predict how every stream would be addressed at this point in

time, so the Service has relied on its best assessment of a worst-case scenario. Thereby, the Service expects take on an annual basis to be associated with only about 28 acres per year of restoration thinning and about 3 acres of ecological thinning of riparian stands to be conducted per year.

2. Incidental take in the form of harm and harassment of bull trout may occur from on-going negative effects of roads in the watershed. The Service anticipates incidental take in the form of harm of bull trout associated with the maintenance of 520 miles of currently maintained roads, and with the ground disturbance associated with removing about 240 miles of existing roads during the first 20 years of the HCP (Table 2). However, by year twenty of the HCP, the total maintained road mileage will drop to approximately 380. We also anticipate some incidental take in the form of harm associated with improvement of about 4 to 10 miles of road per year.

The rationale for the two harm and harassment estimates are based on the assumption that bull trout occur throughout lands managed by the City. Because bull trout distribution is not continuous, only a fraction of the acres and activities described above have the potential to impact bull trout. Take is generally expected to be avoided; but, if it occurs, only a minimal number of individuals would likely be affected and impacts should be rare and localized. Therefore, the number of individuals likely to be subject to disturbance at any particular time, or the numbers of individuals which may be taken, is low, yet unquantifiable. Estimates of indirect take are in terms of the amount of habitat impacted to the extent that take could possibly occur.

Injury and death - The following three mechanisms may result in incidental take of bull trout in the form of injury or death:

1. Incidental take of bull trout in the Chester Morse Lake/Masonry Pool system occurs from entrainment through two intakes devices; a) Cedar Falls Hydroelectric Project at Masonry Dam and b) Overflow Dike into Masonry Pool. Take can occur at any time at Masonry Dam, but is limited at the Overflow Dike to periods when pool levels are below 1550 feet. It is expected that no more than seven percent of the estimated bull trout population will be killed per year through any combination of these intake devices.

2. Incidental take of bull trout in the Chester Morse Lake/Masonry Pool system occurs from inundating redds containing developing bull trout. Studies have shown that less than ten percent of the bull trout redds in the Cedar River have been located below the normal high pool elevation of 1563 feet. Thus, these lower elevation redds would be subject to take every year. Nearly all (~95%) Rex River bull trout redds were annually located below 1563 feet. Therefore, these redds would be subject to some form of take, because they can be reasonably expected to be inundated for some duration before juvenile bull trout emerge. Reservoir management zones (Appendix 38) of "Infrequent" (2) and "Very Infrequent" (1)

are expected to take more bull trout than the "Normal" (3) operating zone. Zone (2) and (1) are expected to occur once every ten and fifty years, respectively, with durations exceeding one week.

3. Incidental take of bull trout in the Chester Morse Lake/Masonry Pool system may occur if spawners are prevented from accessing the tributaries of the reservoir by unusually low water levels in the reservoir. Spawner access is assumed to be impeded or blocked when reservoir elevations are less than 1,540 and 1,535 feet, respectively. Short durations of spawner impedance can be expected to occur in the reservoir management zone (Appendix 38) of "Normal" (3) every year, but periods longer than one week will only occur once every four years. Spawner blockage is not expected to occur in the "Normal" (3) zone. The "Infrequent" zone (4) is expected to occur with a frequency of one in ten years where both spawner impedance and blockage is expected to occur with durations of one to three weeks. The "Very Infrequent" zone (5) will impede and block spawners, but is expected to occur only once in fifty years.

Other Covered Species – Listed as Threatened or Endangered

Canada Lynx

The Service anticipates that an undetermined number of Canada lynx may be taken over a 50-year period as a result of this proposed action. The number of Canada lynx taken annually could not be determined. However, the number of Canada lynx expected to be taken is very small, both because of the low number of Canada lynx thought to occur within the watershed at this time (no evidence of use), and due to the level of protection provided by the proposed HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to effect habitat suitability of Canada lynx.

Harassment - Because there is no explicit commitment by the City to do comprehensive Canada lynx surveys in the immediate vicinity of Covered Activities, there is a very remote possibility that an area of consistent lynx use would go undetected, and that HCP activities would occur in that area. Therefore, the Service is authorizing disturbance of Canada lynx within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of streambank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near Canada lynx. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - The Service believes there is little or no risk of injury or death of Canada lynx as a result of implementing the HCP.

Other Covered Species – Not Listed as Threatened or Endangered:

Note that none of the rest of the Covered Species are currently listed, therefore, there are no take prohibitions in place for these species. Therefore, there is no imminent need to develop incidental take statements for these species at this time. The following incidental take statements will become effective if and when these species are listed and the Service determines that continued implementation of the HCP and incidental take permit will not jeopardize the continued existence of any of these species.

Peregrine Falcon

The Service anticipates that an undetermined number of undiscovered peregrine falcons may be taken over a 50-year period as a result of this proposed action. The number of peregrine falcons taken annually could not be determined. However, the number of peregrine falcons expected to be taken is very small, both because of the low number of peregrine falcons thought to occur within the watershed at this time (only transients and migrants and no known nesting activity), and due to the level of protection provided by the proposed HCP future know sites.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to effect habitat suitability of peregrine falcons. All cliffs and rock outcrops that could be used for nesting are within the ecological reserve, and there is 200 foot buffer around these features where-in even restoration work is curtailed.

Harassment - Minimal harassment, in the form of disturbance, is expected to occur because of the disturbance avoidance measures discussed in the effects section, above. Nonetheless, because there is no explicit commitment by the City to survey for peregrine falcons prior to conducting restoration or road maintenance activities, there is some small possibility that an unknown nest of peregrine falcons could be disturbed. Therefore, the Service is authorizing disturbance of peregrine falcons within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of streambank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near unknown peregrine falcons. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - The Service believes there is very little risk of injury or death of peregrine falcons as a result of implementing the HCP. All cliffs and rock outcrops that could be used for nesting are within the ecological reserve, and there is a 200-foot buffer around these features where-in even restoration work is curtailed.

Northern Goshawk

The Service anticipates that an undetermined number of goshawks associated with 1 known activity center and an unknown number of current and future undiscovered activity centers could be taken over a 50-year period as a result of this proposed action. The number of goshawks taken annually could not be determined. However, the number of goshawks expected to be taken is very small, both because of the low number thought to occur within the watershed at this time, and due to the level of protection provided by the proposed HCP. Note that the HCP contains seasonal disturbance restrictions for known goshawk net sites.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to effect the 1 existing site to the point where impairment of occupancy or reproduction will occur. However, there may be short-term negative effects to goshawks habitat as a result of some of the Covered Activities. Therefore, the Service is authorizing harm of goshawks as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting) over the 50-year term of the HCP. Table 2 of this document displays the number of acres per year, by activity, that will be entered over the 50-year permit term.

Harassment - Minimal harassment, in the form of disturbance, is expected to occur at undiscovered goshawk nest sites in proportion to the amount of Covered Activities pursued by the City under the HCP. Specifically, the Service is authorizing disturbance of goshawks within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of streambank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because there is no explicit commitment by the City to do comprehensive goshawk surveys in the immediate vicinity of Covered Activities, there is some remote possibility that goshawk chicks in a nest or newly- fledged juveniles at unknown activity centers could be injured or killed. Thus, the Service is authorizing an undetermined number of subadult goshawks to be injured or killed as a result of Covered Activities of the HCP. The City is required to notify the Service if this instance occurs.

Common Loon

The Service is expecting take of an undetermined number of common loons in the forms of harm, harassment and injury/ death to occur as a result of implementing the proposed HCP. The Service believes the City's reservoir management operations are going to be the primary source of take, but the number of individuals that might be taken as a result of the HCP could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Service expects reservoir management to result in changes to habitat that will inhibit common loons' ability to use portions of the reservoir. Reservoir oscillations will be on-going throughout the year, and generally result in high pool levels in the winter and spring and low pool levels in the summer and fall.

Harassment - The Service anticipates harassment to result from disturbance caused by implementing restoration activities and road maintenance activities near the perimeter of Chester Morse Reservoir during the breeding season. The level of these activities is not known at this time, but is expected to be only a small fraction of the overall levels and rates of Covered Activities described in Table 2.

Injury or Death - The Service anticipates injury or death of loon eggs or loon chicks to occur as a result of reservoir filling and draw-down during the loon nesting season:

1. Incidental take of common loons in the Chester Morse Lake/Masonry Pool system may occur from inundating unhatched eggs. Stationary, non-floating nest sites situated along the perimeter of the reservoir could be subject to inundation every year. Reservoir management zones (Appendix 38) of "Infrequent" (2) and "Very Infrequent" (1) are expected to inundate more loon nests than the "Normal" (3) operating zone. The Service anticipates that reservoir operations in Zones (2) and (1) are expected to occur once every ten and fifty years, respectively, with durations exceeding one week. Operations of the reservoir in Zones (2) and (1) ar fully expected to inundate non-floating nests, and could possibly result in inundation of eggs or young chicks on floating nest platforms as well.

2. Incidental take of common loons in the Chester Morse Lake/Masonry Pool system may occur if dropping water levels preclude adult loons from accessing stationary, non-floating nests along the perimeter of the reservoir. Short durations of low water are expected to occur in the reservoir management zone (Appendix 38) of "Normal" (3) every year, but adult access to the non-floating nests is not expected to occur in the "Normal" (3) zone. The "Infrequent" zone (4) is expected to occur with a frequency of one in ten years. The "Very Infrequent" zone (5) is expected to occur once in fifty years. Operations of the reservoir in Zones (4) and (5) are expected to result in blocked access of adults to non-floating nests, and could possibly result in impedance of access to nests by adult loons using floating nest platforms.

Pygmy Whitefish

The Service expects that this action is likely to result in incidental take of pygmy whitefish in the form of harm, harassment, injury and death due to effects from reservoir management operations and other Covered Activities, including road maintenance and removal, stream crossings, canopy removal, and potential increases in sediments and temperature which may adversely impact pygmy whitefish at a number of life-history stages. Estimates of incidental take account for the operation of these conservation measures. Because of the inherent biological characteristics of pygmy whitefish, the likelihood of discovering an individual death or injury attributable to this action is very small.

The Service anticipates that impacts to pygmy whitefish will be difficult to detect at the individual organism level for the following reason(s): (1) Pygmy whitefish are wide-ranging and are affected by factors beyond the control of the City; (2) Juveniles, fry, and eggs have small body size and are, therefore, difficult to detect when alive; (3) Finding dead or impaired specimens is unlikely, especially considering the often small body size of eggs and fry, denseness of vegetation/substrate, and remoteness of the area; (4) Losses may be masked by seasonal fluctuations in numbers or other causes; (5) Dead or impaired specimens may be washed downstream of the site where the impact occurred; (6) Dead or impaired specimens may be consumed by other fish and wildlife species; (7) There is a large area with many stream miles to monitor. However, other variables may be used as a surrogate preliminary indicator of take or impact. This assessment focused on the amounts and quality of habitats provided/impacted for the Coastal/Puget Sound distinct population segment; and, (8) The amount of take is largely dependent upon how close normal environmental conditions follow those used in the effects analysis.

Therefore, even though the Service expects incidental take to occur from the effects of the action, the best scientific and commercial data available are not sufficient to enable the Service to estimate a specific number of individuals incidentally taken based on loss or injury of individuals of the species. For instance, if the estimated pygmy whitefish population were to increase during the permit period, a larger number of individuals may become subject to some level of take. Conversely, if pygmy whitefish were to decrease, less take might occur. Consequently, take is estimated based on conditions likely to result in take during the 50-year HCP period.

Harm and Harassment - The following two mechanisms may result in incidental take of pygmy whitefish in the forms of harm and harassment:

1. Incidental take of pygmy whitefish in the form of harm and harassment may occur as a result of the restoration activities in riparian forests. These activities are expected to include 420 acres of restoration thinning (0-30-year old trees) conducted in the first fifteen years on the HCP and 150 acres of ecological thinning (30-60-year old trees) over the full term of the HCP (Table 2). It is not possible to predict how every stream would be addressed at this point in time, so the Service has relied on its best assessment of a worst-case scenario. Thereby, the Service expects take or an annual basis to be associated with only about 28 acres per year of restoration thinning and about 3 acres of ecological thinning of riparian stands to be conducted per year.

2. Incidental take of pygmy whitefish may occur from on-going negative effects of roads in the watershed. The Service anticipates incidental take in the form of harm of pygmy whitefish

associated with the maintenance of 520 miles of currently maintained roads, and with the ground disturbance associated with removing about 240 miles of existing roads during the first 20 years of the HCP (Table 2). However, by year twenty of the HCP, the total maintained road mileage will drop to approximately 380. We also anticipate some incidental take in the form of harm associated with improvement of about 4 to 10 miles of road per year.

The rationale for the two harm and harass estimates are based on the assumption that pygmy whitefish occur throughout lands managed by the City. Because pygmy whitefish distribution is not continuous, only a fraction of the acres and activities described above have the potential to impact pygmy whitefish. Take is generally expected to be avoided; but, if it occurs, only a minimal number of individuals would likely be affected and these impacts should be rare and localized. Therefore, the number of individuals likely to be subject to disturbance at any particular time, or the numbers of individuals which may be taken, is low, yet unquantifiable. Estimates of indirect take are in terms of the amount of habitat impacted to the extent that take could possibly occur.

Injury and death - The following three mechanisms may result in incidental take of pygmy whitefish in the form of injury and death:

1. Incidental take of pygmy whitefish in the Chester Morse Lake/Masonry Pool system occurs from entrainment through two water intake devices; one intake at Cedar Falls Hydroelectric Project at Masonry Dam and one intake at the Overflow Dike into Masonry Pool. Entrainment of pygmy whitefish can occur at any time at Masonry Dam, but is limited at the Overflow Dike to periods when pool levels are below 1550 feet. It is expected that no more than seven percent of the estimated pygmy whitefish population will be killed per year through any combination of these intake devices.

2. Incidental take of pygmy whitefish in the Chester Morse Lake/Masonry Pool system may occur from inundating unhatched eggs. Low elevation pygmy whitefish spawning areas would be subject to take every year. Reservoir management zones (Appendix 38) of "Infrequent" (2) and "Very Infrequent" (1) are expected to take more pygmy whitefish than the "Normal" (3) operating zone. Zone (2) and (1) are expected to occur once every ten and fifty years, respectively, with durations exceeding one week.

3. Incidental take of pygmy whitefish in the Chester Morse Lake/Masonry Pool system may occur if spawners access to tributaries of the reservoir are impeded or blocked when reservoir elevations are less than 1,540 and 1,535 feet, respectively. Short durations of spawner impedance can be expected to occur in the reservoir management zone (Appendix 38) of "Normal" (3) every year, but periods longer than one week will only occur once every four years. Spawner blockage is not expected to occur in the "Normal" (3) zone. The "Infrequent" zone (4) is expected to occur with a frequency of one in ten years where both spawner impedance and blockage is expected to occur with durations of one to three weeks. The "Very Infrequent" zone (5) will impede and block spawners, but is expected to occur only once in fifty years.

Band-tailed Pigeon

The Service anticipates that an undetermined number of band-tailed pigeons associated with suitable habitats could be taken over a 50-year period as a result of this proposed action. The number of band-tailed pigeons taken annually could not be determined. Specifically, the Service is authorizing incidental take of band-tailed pigeons within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to effect existing band-tailed pigeon habitat to the point where impairment of occupancy or reproduction will occur. However, there may be short-term negative effects to pigeon habitat as a result of some of the upland forest Covered Activities. Therefore, the Service is authorizing harm of pigeons as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting) over the 50-year term of the HCP. Table 2 of this document displays the number of acres per year, by activity, that will be entered over the 50-year permit term.

Harassment - Minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by band-tailed pigeons. Specifically, the Service is authorizing disturbance of band-tailed pigeons within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP.

Injury or Death - Because there is no explicit commitment by the City to do comprehensive band-tailed pigeons surveys in the immediate vicinity of Covered Activities, there is some remote possibility that young pigeons in a nest or newly-fledged juveniles could be injured or killed. The Service is authorizing an undetermined number of juvenile pigeons to be injured or killed as a result of Covered Activities of the HCP.

Black Swift

The Service anticipates that an undetermined number of black swifts associated with suitable habitats could be taken over a 50-year period as a result of this proposed action. The number of black swifts taken annually could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to affect existing black swift nesting or foraging habitat.

Harassment - Minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by black swifts. Specifically, the Service is authorizing disturbance of black swifts within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because black swift nesting habitat is wholly contained within the ecological reserve, and no Covered Activities are expected within black swift habitats, the Service does not anticipate the destruction of any nest sites as a result of this HCP.

Brown Creeper

The Service anticipates that an undetermined number of brown creepers associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. The number of brown creepers taken annually could not be determined. Specifically, the Service is authorizing incidental take of brown creepers within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of streambank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - Some of the upland forest restoration activities of the HCP could result in short-term negative effects to brown creeper habitat. Therefore, the Service is authorizing harm of brown creepers as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting) over the 50-year term of the HCP. Table 2 of this document displays the number of acres per year, by activity, that will be entered over the 50-year permit term.

Harassment - Minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by brown creepers. Specifically, the Service is authorizing disturbance of brown creepers within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP.

Injury or Death - Because there is no explicit commitment by the City to do comprehensive brown creeper surveys in the immediate vicinity of Covered Activities, there is some possibility that young brown creepers in a nest or newly-fledged juveniles could be injured or killed. The Service is authorizing an undetermined number of juvenile brown creepers to be injured or killed as a result of Covered Activities listed above under "Harassment".

Golden Eagle

The Service anticipates that an undetermined number of golden eagles associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. The number of golden eagles taken annually could not be determined. However, the number of golden eagles expected to be taken is very small, both because of the low number of golden eagles thought to occur within the watershed at this time (only transients), and due to the level of protection provided by the proposed HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Service does not anticipate any harm of foraging habitat (very early successional habitats) or nesting habitat (large trees in old growth forests and cliffs) used by golden eagles.

Harassment - Minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by golden eagles. Therefore, the Service is authorizing disturbance of golden eagles within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because of the kinds of habitats used by golden eagles in the western Washington Cascades, and the protection measures of the HCP relative to those habitats, the Service does not anticipate any injury or death of golden eagles as a result of the HCP.

Great Blue Heron

The Service anticipates that an undetermined number of great blue herons may be taken over a 50-year period as a result of this proposed action. The number of great blue herons taken annually could not be determined. However, the number of great blue herons expected to be taken is very small due to the level of protection provided by the proposed HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to affect habitat suitability of great blue herons. All mature riparian forest where roosting and perching would be expected to occur is within the ecological reserve, and will not be altered. Nesting, if it occurs within the watershed during the term of the HCP is also likely to be in mature forest near the reservoir or major rivers and wetland complexes, and all this habitat is also contained within the ecological reserve, and is not expected to be altered. Further, water level manipulations of the reservoir or in the lower Cedar River downstream of the reservoir are not expected to detrimentally affect the great blue heron's ability to obtain prey.

Harassment - Minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP and to the extent those activities are conducted in or near habitats used by great blue herons. Specifically, the Service is authorizing disturbance of great blue herons within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near great blue herons. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - The Service believes there is little risk of injury or death of great blue herons as a result of implementing the HCP because all nesting habitat is contained within the ecological reserve and no restoration activities are expected within mature forests.

Harlequin Duck

The Service anticipates that an undetermined number of harlequin ducks associated with suitable habitats could be taken over a 50-year period as a result of this proposed action. The number of harlequin ducks taken annually could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm and Harass - Some of the riparian Covered Activities of the HCP could result in short-term negative effects to harlequin duck habitat, and cause harassment of harlequin ducks as a result of disturbance. Therefore, the Service is authorizing take in the form of harm and harassment of harlequin ducks as a result of 1,270 acres of riparian forest restoration (ecological and restoration thinning, and conifer under-planting), road removal when in proximity to occupied riparian habitat, and on-going road maintenance in proximity to riparian areas, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because there is no explicit commitment by the City to do comprehensive surveys for harlequin ducks in the immediate vicinity of Covered Activities, there is some possibility that young harlequin ducks in a nest or newly-fledged juveniles could be injured or killed as a result of Covered Activities in riparian areas. Therefore, the Service is authorizing an undetermined number of juvenile harlequin ducks to be injured or killed as a result of riparian restoration activities listed above.

Merlin

The Service anticipates that an undetermined number of merlins associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. The number of merlins taken annually could not be determined. However, the number of merlins expected to be taken is very small, both because of the low number of merlins thought to occur within the watershed at this time, and due to the level of protection provided by the proposed HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Service does not anticipate any harm of foraging habitat (very early successional habitats) nor of nesting habitat (large trees in old growth forests and cliffs) used by merlins.

Harassment - Minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by merlins. Therefore, the Service is authorizing disturbance of merlins within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because of the kinds of habitats used by merlins in the western Washington Cascades, and the protection measures of the HCP relative to those habitats, the Service does not anticipate any injury or death of merlins as a result of the HCP.

Olive-sided Flycatcher

The Service anticipates that an undetermined number of olive-sided flycatchers associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. The number of olive-sided flycatchers taken annually could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm and Harassment - Some of the upland forest restoration activities and some of the riparian restoration activities of the HCP could result in short-term negative effects to olive-sided flycatcher habitat. Further, the Covered Activities, to the extent they are conducted in or near habitat occupied by olive-sided flycatchers, could cause harm in the form of disturbance. Therefore, the Service is authorizing harm and harassment of olive-sided flycatchers as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because there is no explicit commitment by the City to do comprehensive olive-sided flycatchers surveys in the immediate vicinity of Covered Activities, there is some possibility that young olive-sided flycatchers in a nest or newly-fledged juveniles could be injured or killed by felling of a nest tree. The Service is authorizing an undetermined number of juvenile olive-sided flycatchers to be injured or killed as a result of Covered Activities listed immediately above.

Osprey

The Service anticipates that an undetermined number of ospreys may be taken over a 50-year period as a result of this proposed action. The number of ospreys taken annually could not be determined. However, the number of ospreys expected to be taken is very small due to the level of protection provided by the proposed HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to effect habitat suitability of ospreys. All mature riparian forest where roosting and perching would be expected to occur is within the ecological reserve, and will not be altered. Nesting sites are expected to continue to be within areas designated as part of the ecological reserve, and are not expected to be subject to Covered Activities. Further, water level manipulations of the reservoir or in the lower Cedar River downstream of the reservoir are not expected to detrimentally affect the osprey's ability to obtain fish.

Harassment - Minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP. Specifically, the Service is authorizing disturbance of ospreys within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near ospreys. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or death - The Service believes there is little risk of injury or death of ospreys as a result of implementing the HCP because all nesting habitat is contained within mature forests within the ecological reserve, and restoration activities are not expected to occur within mature forests.

Pileated Woodpecker

The Service anticipates that an undetermined number of pileated woodpeckers associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. The number of pileated woodpeckers taken annually could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm and Harassment- Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage of dead and down woody material, could result in short-term negative effects to pileated woodpecker habitat. Further, minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by pileated woodpeckers. Therefore, the Service is authorizing harm and harassment of pileated woodpeckers as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because there is no explicit commitment by the City to do comprehensive pileated woodpecker surveys in the immediate vicinity of Covered Activities, there is some possibility that young pileated woodpeckers in a nest or newly-fledged juveniles could be injured or killed. The Service is authorizing an undetermined number of juvenile pileated woodpeckers to be injured or killed as a result of Covered Activities listed above.

Rufous Hummingbird

The Service anticipates that an undetermined number of rufous hummingbirds associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. The number of rufous hummingbirds taken annually could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm and Harassment - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage of nectar-producing plants, could result in short-term negative effects to rufous hummingbird habitat. Further, minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by rufous hummingbirds. Therefore, the Service is authorizing harm and harassment of rufous hummingbirds as a result of

14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because finding nests of rufous hummingbirds is not required under the HCP, nor is practical at this time, there is some possibility that young rufous hummingbirds in a nest or newly-fledged juveniles could be injured or killed. The Service is authorizing an undetermined number of juvenile rufous hummingbirds to be injured or killed as a result of Covered Activities listed above.

Three-toed Woodpecker

The Service anticipates that an undetermined number of three-toed woodpeckers associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. The number of three-toed woodpeckers taken annually could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm and Harassment - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage of dead and down woody material, could result in short-term negative effects to three-toed woodpecker habitat. Further, minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by three-toed woodpeckers. Therefore, the Service is authorizing harm and harassment of three-toed woodpeckers as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because there is no explicit commitment by the City to do comprehensive three-toed woodpecker surveys in the immediate vicinity of Covered Activities, there is some possibility that young three-toed woodpeckers in a nest or newly-fledged juveniles could be injured or killed.

The Service is authorizing an undetermined number of juvenile three-toed woodpeckers to be injured or killed as a result of Covered Activities listed above.

Vaux's Swift

The Service anticipates that an undetermined number of Vaux's swifts associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. The number of Vaux's swifts taken annually could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm and Harassment - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage of large hollow snags, could result in short-term negative effects to Vaux's swift habitat. Further, minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by Vaux's swifts. Therefore, the Service is authorizing harm and harassment of Vaux's swifts as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because there is no explicit commitment by the City to do comprehensive Vaux's swift surveys in the immediate vicinity of Covered Activities, there is a remote possibility that young Vaux's swifts in a nest or newly-fledged juveniles could be injured or killed via felling of a large hollow snag. The Service is authorizing an undetermined number of juvenile Vaux's swifts to be injured or killed as a result of Covered Activities listed above.

Western Bluebird

The Service anticipates that an undetermined number of western bluebirds associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. The number of western bluebirds taken annually could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm and Harassment - Many of the upland forest Covered Activities of the HCP, especially those that result in loss of suitable cavities within snags within large openings, could result in short-term negative effects to western bluebirds habitat. Further, minimal harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by western bluebirds. Therefore, the Service is authorizing harm and harassment of western bluebirds as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - There is no evidence of nesting by western bluebirds within the watershed, and none is expected as the forests in the watershed mature under the HCP. Adults are expected to avoid injurious Covered Activities; only young would lack mobility to vacate the area. Therefore, the

Service believes there is little or no risk of injury or death of western bluebirds from implementing the HCP.

Willow Flycatcher

The Service anticipates that an undetermined number of willow flycatchers associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. The number of willow flycatchers taken annually could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm and harassment - Some of the riparian Covered Activities of the HCP could result in short-term negative effects to willow flycatcher habitat. Further, the Covered Activities, to the extent they are conducted in or near habitat occupied by willow flycatchers, could cause harm in the form of disturbance. Therefore, the Service is authorizing harm and harassment of willow flycatchers as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or death - Because there is no explicit commitment by the City to do comprehensive willow flycatcher surveys in the immediate vicinity of Covered Activities, there is some possibility that young willow flycatchers in a nest or newly-fledged juveniles could be injured or killed by felling of a nest tree. The Service is authorizing an undetermined number of juvenile willow flycatchers to be injured or killed as a result of Covered Activities listed immediately above.

Pacific Lamprey and River Lamprey

Based on our current knowledge of life history and habitat use patterns of Pacific and river lampreys, the Service is not able to identify differential impacts or levels of take of these 2 species as a result of the proposed action. Therefore, to reduce redundancy in this Biological and Conference Opinion, the Incidental Take Statements for Pacific lampreys and river lampreys have been combined.

The Service expects that this action is likely to result in incidental take of Pacific or river lamprey in the form of harassment, killing, and harming due to effects from reservoir management operations and other Covered Activities, including road maintenance and removal, stream crossings, canopy removal, and potential increases in sediments and temperature which may adversely impact Pacific or river lamprey at a number of life-history stages. Estimates of incidental take account of the operation of these conservation measures. Because of the inherent biological characteristics of Pacific and river lamprey, the likelihood of discovering an individual death or injury attributable to this action is very small.

The Service anticipates that impacts to Pacific or river lamprey will be difficult to detect at the individual organism level for the following reason(s): (1) Pacific and river lamprey are wide_ranging and are affected by factors beyond the control of the City; (2) larvae and eggs have small body size and are, therefore, difficult to detect when alive; (3) Finding dead or impaired specimens is unlikely, especially considering the often small body size of eggs and larvae, denseness of vegetation/substrate, and remoteness of the area; (4) Losses may be masked by seasonal fluctuations in numbers or other causes; (5) Dead or impaired specimens may be washed downstream of the site where the impact occurred; (6) Dead or impaired specimens may be consumed by other fish and wildlife species; (7) There is a large area with many stream miles to monitor. However, other variables may be used as a surrogate preliminary indicator of take or impact. This assessment focused on the amounts and quality of habitats provided/impacted for the Coastal/Puget Sound distinct population segment; and, (8) The amount of take is largely dependent upon how close normal environmental conditions follow those used in the effects analysis.

Therefore, even though the Service expects incidental take to occur from the effects of the action, the best scientific and commercial data available are not sufficient to enable the Service to estimate a specific number of individuals incidentally taken based on loss or injury of individuals of the species. For instance, if the estimated Pacific or river lamprey population were to increase during the permit period, a larger number of individuals may become subject to some level of take. Conversely, if Pacific or river lamprey were to decrease, less take might occur. Consequently, take is estimated based on conditions likely to result in take during the 50-year HCP period.

Harm and Harassment - The following two mechanisms may result in incidental take of Pacific or river lamprey:

1. Incidental take of Pacific or river lamprey in the form of harm and harassment may occur as a result of the restoration activities in riparian forests. These activities are expected to include 420 acres of restoration thinning (0-30-year old trees) conducted in the first fifteen years on the HCP and 150 acres of ecological thinning (30-60-year old trees) over the full term of the HCP (Table 2). It is not possible to predict how every stream would be addressed at this point in time, so the Service has relied on its best assessment of a worst-case scenario. Thereby, the Service expects take to result from about 28 acres per year of restoration thinning and about 3 acres per year of ecological thinning of riparian stands.

2. Incidental take of Pacific or river lamprey in the form of harm and harassment may occur from on-going negative effects of roads in the watershed. The Service anticipates incidental take in the form of harm of bull trout associated with the maintenance of 520 miles of currently maintained roads, and with the ground disturbance associated with removing about 240 miles of existing roads during the first 20 years of the HCP (Table 2). However, by year twenty of the HCP, the total maintained road mileage will drop to approximately 380. We also anticipate some incidental take in the form of harm associated with improvement of about 4 to 10 miles of road per year.

The rationale for the two estimates take in the form of harm and harassment are based on the assumption that Pacific or river lamprey occur throughout lands managed by the City. Because Pacific or river lamprey distribution is not continuous, only a fraction of the acres and activities described above have the potential to impact Pacific or river lamprey. Take is generally expected to be avoided; but, if it occurs, only a minimal number of individuals would likely be affected and, these impacts should be rare and localized. Therefore, the number of individuals likely to be subject to disturbance at any particular time, or the numbers of individuals which may be taken, is low, yet unquantifiable. Estimates of indirect take are in terms of the amount of habitat impacted to the extent that take could possibly occur.

Injury and Death - The following two mechanisms may result in incidental take of Pacific and river lamprey in the form of injury and death:

1. Incidental take of Pacific and river lamprey in the City Watershed occurs from annual forebay cleaning at Landsburg. It is expected that all Pacific or river lamprey will be killed annually in the 50 by 80-foot dredging zone located adjacent to the Landsburg forebay. A majority of the Pacific and river lamprey located in the 3,000-foot de-watered forebay are also expected to be killed annually during the 48-hour maintenance period.

2. Direct take may also occur from entrainment at the water intake device located at Landsburg Dam. The status of Pacific and river lamprey populations are unknown and undetermined in the Lower Cedar River below Landsburg Dam. However, the Service expects that both lamrey species will be able to access the river above Landsburg after completion of fish passsage facilities, scheduled for year 3 of the HCP. Therefore, annual entrainment from intake devices above Landsburg Dam will be conservatively set at 50 Pacific and 50 river lamprey larvae (ammocoetes) individuals per year. Larvae entrained during the 48 hour period of Landsburg forebay cleaning are excluded from this total. In addition, since nearly all Pacific and all river lamprey adults die after spawning, adult individuals are not to be included in the annual entrainment count total concerning take. If credible larvae population estimates are obtained using the best scientific and commercial data available, the City has the option of proposing new incidental take limits for Pacific and river lamprey at any time during the term of the HCP. This request by he City would cause the Service would re-initiate consultation. Absent a finding of unforeseen circumstances by the Service, the Service would be required to increase the level of take authorized under the incidental take permit, as per the No Surprises Regulations (Fed. Reg. Vol. 63, No. 35, Pp. 8859-8873).

Big Brown Bat

The Service anticipates that an undetermined number of big brown bats associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage to structures used for roosting, including dead or dying standing trees, bridges and culverts, could result in short-term negative effects to habitat of big brown bats.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by bats.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. snags or bridges, are removed via Covered Activities.

Therefore, the Service is authorizing harm, harassment and injury/death of bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, including replacement of wood stringer bridges with concrete bridges; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

California Myotis

The Service anticipates that an undetermined number of California myotis associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage to structures used for roosting, including dead or dying standing trees, bridges and culverts, could result in short-term negative effects to habitat of California myotis.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by bats.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. snags or bridges, are removed via Covered Activities.

Therefore, the Service is authorizing harm, harassment and injury/death of bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, including replacement of wood stringer bridges with concrete bridges; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Pacific Fisher

The Service does not expect that Pacific fishers currently exist within the municipal watershed, and therefore does not anticipate take of this species will occur. However, over the term of the HCP this species may colonize the watershed, or be re-introduced. If either event occurs, the Service anticipates that Pacific fishers associated with forested habitats (both upland and riparian) in the watershed could be harmed and harassed but likely not injured or killed as a result of implementing the HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - If fishers are present in the watershed, Covered Activities of the HCP could result in short-term reductions in habitat suitability for fishers. However, these effects, if they occur, are not expected to render habitat unuseable for fishers. Specifically, ecological and restoration thinning of 14,400 acres of 0 to 60-year old upland and riparian forest could result in short-term reductions in habitat suitability for fishers.

Harassment - Because there is no explicit commitment by the City to do comprehensive fisher surveys in the immediate vicinity of Covered Activities, there is a very remote possibility that an areas of consistent fisher use would go undetected, and that HCP activities would occur in that area. Specifically, the Service is authorizing disturbance of Pacific fishers within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near unknown fishers use areas. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - The Service believes there is little or no risk of injury or death of fishers as a result of implementing the HCP. The Service believes any adult fishers that are present would be able to avoid injury or death, and the probability of felling a den tree via conduct of the Covered Activities is extremely remote.

Fringed Myotis

The Service anticipates that an undetermined number of fringed myotis associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage to structures used for roosting, including dead or dying standing trees, bridges and culverts, could result in short-term negative effects to habitat of fringed myotis.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by bats.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. snags or bridges, are removed via Covered Activities.

Therefore, the Service is authorizing harm, harassment and injury/death of bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, including replacement of wood stringer bridges with concrete bridges; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Hoary Bat

The Service anticipates that an undetermined number of hoary bats associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage to structures used for roosting, including dead or dying standing trees, and culverts, could result in short-term negative effects to habitat of hoary bats.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by bats.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. snags or caves, are removed via Covered Activities.

Therefore, the Service is authorizing harm, harassment and injury/death of bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, including replacement of wood stringer bridges with concrete bridges; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Keen's Myotis

The Service anticipates that an undetermined number of Keen's myotis associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage to structures used for roosting, including dead or dying standing trees, could result in short-term negative effects to habitat of Keen's myotis.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by bats.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. snags are removed via Covered Activities.

Therefore, the Service is authorizing harm, harassment and injury/death of bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, including replacement of wood stringer bridges with concrete bridges; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Little Brown Myotis

The Service anticipates that an undetermined number of little brown myotis associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage to structures used for roosting, including dead or dying standing trees, bridges and culverts, could result in short-term negative effects to habitat of little brown myotis.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by bats.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. snags or bridges, are removed via Covered Activities.

Therefore, the Service is authorizing harm, harassment and injury/death of bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, including replacement of wood stringer bridges with concrete bridges; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Long-eared Myotis

The Service anticipates that an undetermined number of long-eared myotis associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage to structures used for roosting, including dead or dying standing trees, bridges and culverts, could result in short-term negative effects to habitat of long-eared myotis.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by bats.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. snags or bridges, are removed via Covered Activities.

Therefore, the Service is authorizing harm, harassment and injury/death of bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, including replacement of wood stringer bridges with concrete bridges; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Long-legged Myotis

The Service anticipates that an undetermined number of long-legged myotis associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage structures used for roosting, including dead or dying standing trees, bridges and culverts, could result in short-term negative effects to habitat of long-legged myotis.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by bats.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. snags or bridges, are removed via Covered Activities.

Therefore, the Service is authorizing harm, harassment and injury/death of bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, including replacement of wood stringer bridges with concrete bridges; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

American Marten

The Service anticipates that martens associated with forested habitats (both upland and riparian) in the watershed could be harmed, harassed and injured/killed as a result of implementing the HCP. However, because of the high level of protection provided by the HCP, the level of take is expected to be very low.

The incidental take over 50 years is expected to be in the following forms:

Harm - Covered Activities of the HCP could result in short-term decreases in habitat suitability for martens. However, these effects, if they occur, are not expected to render habitat unuseable for martens. Specifically, ecological and restoration thinning of 14,400 acres of zero to 60-year old upland and riparian forest could result in short-term decreases in habitat suitability for martens.

Harassment - Because there is no explicit commitment by the City to do comprehensive marten surveys in the immediate vicinity of Covered Activities, there is a possibility that an area of consistent marten use would go undetected, and that HCP activities would occur in that area. Therefore, the Service is authorizing disturbance of martens within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near marten. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - Because there is no explicit commitment by the City to do comprehensive marten surveys in the immediate vicinity of Covered Activities, the Service believes there is a risk of injury or death of martens as a result of implementing the HCP. The Service believes any adult martens that are present would be able to avoid injury or death. However, there is some limited probability of felling a den tree via conduct of the Covered Activities, which could result in injury or death of juvenile martens.

Masked Shrew

The Service anticipates that an undetermined number of masked shrews associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the Covered Activities of the HCP, especially those that result in ground-disturbing activities, could result in short-term negative effects to habitat of masked shrews.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by masked shrews.

Injury and Death - Finally, injury or death of masked shrews is expected to occur when occupied habitat is disturbed by heavy equipment, felling trees, moving dirt, or any other ground-disturbing activity.

Therefore, the Service is authorizing harm, harassment and injury/death of masked shrews as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal; 380-520 miles of on-going road maintenance; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Northern Water Shrew

The Service anticipates that an undetermined number of northern water shrews associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the Covered Activities of the HCP, especially those that result in ground-disturbing activities immediately adjacent to streams, or within streams, could result in short-term negative effects to habitat of northern water shrews.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of riparian Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by northern water shrews.
Injury and Death - Finally, injury or death of northern water shrews is expected to occur when occupied habitat is disturbed by heavy equipment, felling trees, moving dirt, or any other ground disturbing activity immediately adjacent to streambanks or within a stream channel.

Therefore, the Service is authorizing harm, harassment and injury/death of northern water shrews as a result of 1.270 acres of riparian forest restoration (ecological and restoration thinning, and conifer under-planting); in- and near-stream activities associated with removing 240 miles of road, including removal of bridges and culverts; in- and near-stream activities associated with 380-520 miles of on-going road maintenance, including replacement of bridges and culverts; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Silver-haired bat

The Service anticipates that an undetermined number of silver-haired bats associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage structures used for roosting, including dead or dying standing trees, could result in short-term negative effects to habitat of silver-haired bats.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by bats.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. snags, are removed via Covered Activities.

Therefore, the Service is authorizing harm, harassment and injury/death of bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Townsend's Big-eared Bat

The Service anticipates that an undetermined number of Townsend's big-eared bats associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - The Covered Activities of the HCP are not expected to affect caves or other rock outcrops since all these habitat features are wholly contained within the ecological reserve. Therefore, the Service does not expect any modification of roost sites used by Townsend's big-eared bats.

Harassment -Harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by Townsend's big-eared bats. Therefore, the Service is authorizing harassment of Townsend's big-eared bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, including replacement of wood stringer bridges with concrete bridges; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. bridges, are removed via Covered Activities.

Wolverine

The Service does not expect that wolverines are resident or using the watershed on a consistent basis at this time. Further, the Service believes that the proposed HCP provides a large degree of protection to habitats that wolverines may use in the watershed; therefore the level of take is expected to be very low. However, over the term of the HCP this species may become resident in the watershed, or be re-introduced. If wolverines occur in the watershed during the permit term, the Service anticipates that wolverines associated with forested habitats (both upland and riparian) in the watershed could be harassed but likely not harmed, injured or killed as a result of implementing the HCP.

The incidental take over 50 years is expected to be in the following forms:

Harm - Because of the tendency of wolverines to be habitat generalists and occupy high elevations older forests which are the reserves, and the relatively benign nature of the habitat management actions under the HCP, the Service does not expect that wolverine habitat will be harmed via the HCP.

Harassment - Because there is no explicit commitment by the City to do comprehensive wolverine surveys in the immediate vicinity of Covered Activities, there is a very remote possibility that an area of consistent wolverine use would go undetected, and that HCP activities would occur in that area. Therefore, the Service is authorizing disturbance of wolverines within the watershed as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting), 240 miles of road removal, and 380-520 miles of on-going road maintenance, and as much as 4 miles of stream-bank stabilization and re-vegetation work and 50 in-stream wood placement projects over the term of the HCP, if and when these activities are conducted near fishers. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Injury or Death - The Service believes there is little or no risk of injury or death of wolverines as a result of implementing the HCP. The Service believes any adult wolverines that are present would be able to avoid injury or death, and the probability of disturbing an occupied natal den is extremely remote under the HCP.

Yuma Myotis

The Service anticipates that an undetermined number of Yuma myotis associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the upland forest Covered Activities of the HCP, especially those that result in loss or damage to structures used for roosting, including dead or dying standing trees, bridges and culverts, could result in short-term negative effects to habitat of Yuma myotis.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by bats.

Injury and Death - Finally, injury or death of bats could occur when occupied roost sites, e.g. or bridges, are removed via Covered Activities.

Therefore, the Service is authorizing harm, harassment and injury/death of bats as a result of 14,400 acres of forest restoration (ecological and restoration thinning, and conifer under-planting); 240 miles of road removal, including removal of wood stringer bridges; 380-520 miles of on-going road maintenance, including replacement of wood stringer bridges with concrete bridges; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Cascades Frog

The Service does not anticipate that Cascades frogs associated with high elevation wetland habitats within the watershed will be harmed, harassed or killed due to full protection of such habitats within the ecological reserve. However, an undeterminable number of adult frogs using terrestrial and riparian habitats could be affected by the Covered Activities of the HCP.

Specific Covered Activities that the Service anticipates will harm, harass and injure or kill Cascades frogs within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP.

Cascade Torrent Salamander

The Service anticipates that an undetermined number of Cascade torrent salamanders associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the Covered Activities of the HCP, especially those that result in ground-disturbing activities near wetlands immediately adjacent to streams, or within streams, could result in short-term negative effects to habitat of Cascade torrent salamanders.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of riparian Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by Cascade torrent salamanders.

Injury and Death - Finally, injury or death of Cascade torrent salamanders is expected to occur when occupied habitat is disturbed by heavy equipment, felling trees, moving dirt, or any other ground disturbing activity immediately adjacent to streambanks or within a stream channel.

Therefore, the Service is authorizing harm, harassment and injury/death of Cascade torrent salamanders as a result of 1270 acres of riparian forest restoration (ecological and restoration thinning, and conifer under-planting); in- and near-stream activities associated with removing 240 miles of road, including removal of bridges and culverts; in- and near-stream activities associated with 380-520 miles of on-going road maintenance, including replacement of bridges and culverts; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Larch Mountain Salamander

The Service does not anticipate that Larch Mountain salamanders associated with talus slopes or caves within the watershed will be harmed, harassed or killed due to full protection of all talus slopes, including a 200 foot no-touch buffer around the perimeter of all talus slopes and caves within the watershed.

However, the Service anticipates that Larch Mountain salamanders associated with forested habitats (both upland and riparian) in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill Larch Mountian salamanders within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP.

Long-toed Salamander

The Service anticipates that an undetermined number of long-toed salamanders associated with wetland breeding habitat or upland feeding habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

Specific Covered Activities that the Service anticipates will harm, harass and injure/kill long-toed salamanders within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Northwestern Salamander

The Service anticipates that an undetermined number of northwestern salamanders associated with wetland breeding habitat or upland feeding habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

Specific Covered Activities that the Service anticipates will harm, harass and injure/kill northwestern salamanders within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Pacific Giant Salamander

The Service anticipates that an undetermined number of Pacific giant salamanders associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the Covered Activities of the HCP, especially those that result in ground-disturbing activities immediately adjacent to streams, or within streams, could result in short-term negative effects to habitat of Pacific giant salamanders.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of riparian Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by Pacific giant salamanders.

Injury and Death - Finally, injury or death of Pacific giant salamanders is expected to occur when occupied habitat is disturbed by heavy equipment, felling trees, moving dirt, or any other ground disturbing activity immediately adjacent to streambanks or within a stream channel.

Therefore, the Service is authorizing harm, harassment and injury/death of Pacific giant salamanders as a result of 1270 acres of riparian forest restoration (ecological and restoration thinning, and conifer under-planting); in- and near-stream activities associated with removing 240 miles of road, including removal of bridges and culverts; in- and near-stream activities associated with 380-520 miles of on-going road maintenance, including replacement of bridges and culverts; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Northern Red-legged Frog

The Service anticipates that an undetermined number of northern red-legged frogs associated with wetland breeding habitat or upland feeding habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

Specific Covered Activities that the Service anticipates will harm, harass and injure/kill northern red-legged frogs within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Roughskin Newt

The Service anticipates that an undetermined number of roughskin newts associated with wetland breeding habitat or upland feeding habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

Specific Covered Activities that the Service anticipates will harm, harass and injure/kill roughskin newts within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Oregon Spotted Frog

The Service does not expect that Oregon spotted frogs currently exist within the municipal watershed, and therefore does not anticipate take of this species will occur. However, over the term of the HCP this species may colonize the watershed, or be re-introduced. If either event occurs, the Service anticipates that an undetermined number of Oregon spotted frogs associated with upland feeding habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

Specific Covered Activities that the Service anticipates will harm, harass and injure/kill Oregon spotted frogs, if and when they are present within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Tailed Frog

The Service anticipates that an undetermined number of tailed frogs associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The incidental take over 50 years is expected to be in the following forms:

Harm - Many of the Covered Activities of the HCP, especially those that result in ground-disturbing activities immediately adjacent to streams, or within streams, could result in short-term negative effects to habitat of tailed frogs.

Harassment - Further, harassment, in the form of disturbance, is expected to occur in proportion to the amount of riparian Covered Activities pursued by the City under the HCP, and to the extent these actions are conducted in or near habitat being used by tailed frogs.

Injury and Death - Finally, injury or death of tailed frogs is expected to occur when occupied habitat is disturbed by heavy equipment, felling trees, moving dirt, or any other ground disturbing activity immediately adjacent to streambanks or within a stream channel.

Therefore, the Service is authorizing harm, harassment and injury/death of tailed frogs as a result of 1270 acres of riparian forest restoration (ecological and restoration thinning, and conifer under-planting); in- and near-stream activities associated with removing 240 miles of road, including removal of bridges and culverts; in- and near-stream activities associated with 380-520 miles of on-going road maintenance, including replacement of bridges and culverts; as much as 4 miles of stream-bank stabilization and stream-bank re-vegetation work; and 50 in-stream wood placement projects over the term of the HCP. Table 2 of this document displays the number of acres or miles of roads or streams that will be affected, per year, over the 50-year term of the HCP.

Van Dyke's Salamander

The Service does not anticipate that Van Dyke's salamanders associated with talus slopes within the watershed will be harmed, harassed or killed due to full protection of all talus slopes, including a 200' no- touch buffer around the perimeter of all talus slopes within the watershed.

However, the Service anticipates that Van Dyke's salamanders associated with riparian forests in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill Van Dyke's salamanders within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP.

Northwestern Pond Turtle

The Service does not expect that northwestern pond turtles currently exist within the municipal watershed, and therefore does not anticipate take of this species will occur. However, over the term of the HCP this species may colonize the watershed, or be re-introduced. If either event occurs, the Service anticipates that northwestern pond turtles associated with forested habitats (both upland and riparian) in the watershed could be harmed, harassed and killed as a result of implementing the HCP.

Specific Covered Activities that the Service anticipates will harm, harass and kill pond turtles within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Western Red-backed Salamander

The Service anticipates that an undetermined number of western red-backed salamanders associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The Service anticipates that western red-backed salamanders associated with forested habitats (both upland and riparian) in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill western red-back salamanders within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Western Toad

The Service anticipates that an undetermined number of western toads associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The Service anticipates that western toads associated with habitats (both upland and riparian) in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill western toads within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Bellers' Ground Beetle

The Service does not anticipate that Beller's ground beetles dwelling within acidic sphagnum wetlands within the watershed will be harmed, harassed or killed due to full protection of such habitats within the ecological reserve. However, an undeterminable number of adult beetles using terrestrial and riparian habitats near these wetlands could be affected by the Covered Activities of the HCP. The Service is unable to determine the number of individuals taken as a result of the HCP.

The Service anticipates that Beller's ground beetles associated with low elevation sphagnum wetlands in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill Beller's ground beetles within the watershed include; 1) restoration thinning in riparian forests near sphagnum wetlands, 2) ecological thinning of riparian forests during the 50 years of the Plan, 3) decommissioning of roads near sphagnum wetlands during the first 20 years of the Plan , 4) improvement and repair of roads that occur near sphagnum wetlands, 5) annual maintenance activities along roads near sphagnum wetlands such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 7) vehicles traveling roads near sphagnum wetlands to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP.

Carabid Beetles *Bembidion gordoni*; *Bembidion stillaquamish*; *Nebria gebleri cascadensis*; *Nebria kincaidi balli*; *Nebria paradisi*; *Pterostichus johnsoni*

Based on our current knowledge of life history and habitat use patterns of the Carabid beetles *Bembidion gordoni, Bembidion stillaquamish, Nebria gebleri cascadensis, Nebria kincaidi balli, Nebria paradisi*, and *Pterostichus johnsoni*, the Service is not able to identify differential impacts or levels of take of these 6 species as a result of the proposed action. Therefore, to reduce redundancy in this Biological and Conference Opinion, the Incidental Take Statements for these 6 beetles have been combined.

The Service does not anticipate that the Carabid beetles *Bembidion gordoni*, *Bembidion stillaquamish*, *Nebria gebleri cascadensis*, *Nebria kincaidi balli*, *Nebria paradisi*, and *Pterostichus johnsoni* dwelling within aquatic habitats of the watershed will be harmed, harassed or killed due to full protection of such habitats within the ecological reserve. However, an undeterminable number of adult beetles using terrestrial and riparian habitats near aquatic habitats could be affected by the Covered Activities of the HCP. The Service is unable to determine the number of individuals taken as a result of the HCP.

The Service anticipates that beetles associated with aquatic habitats in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill beetles within the watershed include; 1) restoration thinning in riparian forests near aquatic habitats, 2) ecological thinning of riparian forests during the 50 years of the Plan, 3) de-commissioning of roads near aquatic habitats during the first 20 years of the Plan, 4) improvement and repair of roads that occur near aquatic habitats, 5) annual maintenance activities along roads near aquatic habitats such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 6) vehicles traveling roads near aquatic habitats to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP.

Carabid Beetles *Bembidion viator*; *Bradycellus fenderi*; *Omus dejeanii*

Based on our current knowledge of life history and habitat use patterns of the Carabid beetles *Bembidion viator*; *Bradycellus fenderi*; *Omus dejeanii*, the Service is not able to identify differential impacts or levels of take of these 3 species as a result of the proposed action. Therefore, to reduce redundancy in this Biological and Conference Opinion, the Incidental Take Statements for these 3 beetles have been combined.

The Service does not anticipate that the Carabid beetles *Bembidion viator*, *Bradycellus fenderi* or *Omus dejeanii* dwelling within aquatic habitats of the watershed will be harmed, harassed or killed due to full protection of such habitats within the ecological reserve. However, an undeterminable number of adult beetles using terrestrial and riparian habitats near aquatic habitats could be affected by the Covered Activities of the HCP. The Service is unable to determine the number of individuals taken as a result of the HCP.

The Service anticipates that *Bembidion viator*, *Bradycellus fenderi* or *Omus dejeanii* beetles associated with low elevation aquatic habitats in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill *Bembidion viator*, *Bradycellus fenderi* or *Omus dejeanii* beetles within the watershed include; 1) restoration thinning in riparian forests near aquatic habitats, 2) ecological thinning of riparian forests during the 50 years of the Plan, 3) de-commissioning of roads near aquatic habitats during the first 20 years of the Plan, 4) improvement and repair of roads that occur near aquatic habitats, 5) annual maintenance activities along roads near aquatic habitats such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 7) vehicles traveling roads near aquatic habitats to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP.

Fender's Soliperlan Stonefly

The Service does not anticipate that Fender's soliperlan stoneflies dwelling within aquatic habitats of the watershed will be harmed, harassed or killed due to full protection of such habitats within the ecological reserve. However, an undeterminable number of adult stoneflies using terrestrial and riparian habitats near aquatic habitats could be affected by the Covered Activities of the HCP. The Service is unable to determine the number of individuals taken as a result of the HCP.

The Service anticipates that adult stoneflies associated with aquatic habitats in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill adult stoneflies within the watershed include; 1) restoration thinning in riparian forests near aquatic habitats, 2) ecological thinning of riparian forests during the 50 years of the Plan, 3) de-commissioning of roads near aquatic habitats during the first 20 years of the Plan, 4) improvement and repair of roads that occur near aquatic habitats, 5) annual maintenance activities along roads near aquatic habitats such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 6) vehicles traveling roads near aquatic habitats to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP.

Hatch's Click Beetle

The Service does not anticipate that Hatch's click beetles dwelling within acidic sphagnum wetlands within the watershed will be harmed, harassed or killed due to full protection of such habitats within the ecological reserve. However, an undeterminable number of adult beetles using terrestrial and riparian habitats near these wetlands could be affected by the Covered Activities of the HCP. The Service is unable to determine the number of individuals taken as a result of the HCP.

The Service anticipates that Hatch's click beetles associated with low-elevation sphagnum wetlands in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill Hatch's click beetles within the watershed include; 1) restoration thinning in riparian forests near sphagnum wetlands, 2) ecological thinning of riparian forests during the 50 years of the Plan, 3) decommissioning of roads near sphagnum wetlands during the first 20 years of the Plan , 4) improvement and repair of roads that occur near sphagnum wetlands, 5) annual maintenance activities along roads near sphagnum wetlands such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 7) vehicles traveling roads near sphagnum wetlands to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP.

Johnson's (mistletoe) Hairstreak Butterfly

The Service anticipates that Johnson's (mistletoe) hairstreak butterflies associated with forests infested with dwarf mistletoe (*Arceuthobium*) in the watershed could be harmed, harassed and injured killed as a result of implementing the HCP. However, because of the high level of protection provided by the HCP, the level of take is expected to be low.

The incidental take over 50 years is expected to be in the following forms:

The Service anticipates that Johnson's (mistletoe) hairstreak butterflies associated with forested habitats in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill Johnson's (mistletoe) hairstreak butterflies within the watershed include; 1) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 2) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 5) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 6) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP.

Long-horned Leaf Beetle

The Service does not anticipate that long-horned leaf beetles beetles dwelling within wetlands of the watershed will be harmed, harassed or killed due to full protection of such habitats within the ecological reserve. However, an undeterminable number of adult beetles using terrestrial and riparian habitats near these wetlands could be affected by the Covered Activities of the HCP. The Service is unable to determine the number of individuals taken as a result of the HCP.

The Service anticipates that adult beetles associated with upland and riparian habitats near low-elevation wetlands in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill long-horned leaf beetles within the watershed include; 1) restoration thinning in riparian forests near wetlands, 2) ecological thinning of riparian forests during the 50 years of the Plan, 3) decommissioning of roads near wetlands during the first 20 years of the Plan , 4) improvement and repair of roads that occur near wetlands, 5) annual maintenance activities along roads near wetlands such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 7) vehicles traveling roads near wetlands to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP.

Blue-gray Taildropper

The Service anticipates that an undetermined number of blue-gray taildroppers associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The Service anticipates that blue-gray taildroppers associated with riparian forests in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill blue-gray taildroppers within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Oregon Megomphix

The Service anticipates that an undetermined number of Oregon megomphix associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The Service anticipates that Oregon megomphix associated with riparian forests in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill Oregon megomphix within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Papillose Taildropper

The Service anticipates that an undetermined number of papillose taildroppers associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The Service anticipates that papillose taildroppers associated with riparian forests in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill papillose taildroppers within The watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Puget Oregonian

The Service anticipates that an undetermined number of Puget Oregonians associated with suitable habitat could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The Service anticipates that Puget Oregonians associated with riparian forests in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill Puget Oregonians within the watershed include; 1) conifer under-planting in about 700 acres of forested habitat during the 50-year term of the HCP (~14 acres/year) and about 1,000 acres of restoration planting during the 50 years of the Plan (~20 acres/year), 2) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year) and restoration thinning in about 10,500 acres of upland forests during the first 15 years of the Plan (~700 acres/year), 3) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year) and ecological thinning of about 2,000 acres of upland forest during the 50 years of the Plan (~40 acres/year), 4) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 5) improvement and repair of roads that occur within forested habitats (4-10 miles of roads/year), 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, 7) vehicles traveling the roads to conduct surveillance, research and monitoring, and other functions necessary to implement the HCP, 8) up to 4 miles of stream-bank stabilization and stream-bank re-vegetation work, and 9) 50 in-stream wood placement projects over the term of the HCP.

Aquatic Snail (*Valvata mergella*)

The Service does not expect that *Valvata mergella* currently exist within the municipal watershed, and therefore does not anticipate take of this species will occur. However, over the term of the HCP this species may colonize the watershed, or be re-introduced. If either event occurs, the Service anticipates that an undetermined number of *Valvata mergella* dwelling within lakes or ponds could be taken over a 50-year period as a result of this proposed action. However, the number of individuals taken could not be determined.

The Service anticipates that *Valvata mergella* associated with lakes or ponds in the watershed will be harmed, harassed and killed as a result of implementing the HCP. Specific Covered Activities that the Service anticipates will harm, harass and kill *Valvata mergella* within the watershed include; 1) restoration thinning in about 420 acres of riparian forests during the first 15 years of the Plan (~28 acres/year), 2) ecological thinning of about 150 acres of riparian forests during the 50 years of the Plan (~3 acres/year), 3) decommissioning ~240 miles of roads during the first 20 years of the Plan (about 12 miles/year), 4) improvement and repair of roads that occur near lakes and ponds, 6) annual maintenance activities along the road system within the watershed, such as grading, ditch mowing, brush control, maintaining drainage structures and other actions to keep the roads in proper condition, and 8) research and monitoring activities required under the HCP.

Effect of Take

Species of Greatest Concern/Critical Habitat:
In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the spotted owl, marbled murrelet, bald eagle, grizzly bear, gray wolf or bull trout. NMFS has made the same determination for Puget Sound Chinook salmon in it's Biological Opinion for the proposed HCP and related Agreements (NMFS 2000).

The Service believes the levels and forms of incidental take authorized in this Biological and Conference Opinions are not likely to jeopardize the continued existence of any currently listed species. Further, the incidental take authorized here-in will not substantially reduce the size, distribution, or productivity of the local, regional or range-wide populations of these species. In fact, the Service expects that the proposed action will result in population increases at the local and possibly regional scales when compared to conditions expected to exist absent the HCP.

Other Covered Species – Listed as Threatened or Endangered:
In the accompanying conference opinion, the Service determined that the level and form of incidental take authorized in this conference opinion is not likely to result in jeopardy to the proposed Canada lynx. Further, the incidental take authorized here-in will not substantially reduce the size, distribution, or productivity of the local, regional or range-wide populations of Canada lynx. In fact, the Service expects that the proposed action will result in Canada lynx population increases at the local and possibly regional scales when compared to conditions expected to exist absent the HCP. NMFS does not have any proposed species in the vicinity of the Covered Lands at this time.

Other Covered Species – Not Listed as Threatened or Endangered:
In the accompanying conference opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the following currently unlisted, unproposed Covered Species: Peregrine Falcon, Northern Goshawk, Black Swift, Brown Creeper, Golden Eagle, Great Blue Heron, Harlequin Duck, Merlin, Olive-sided Flycatcher, Osprey, Pileated Woodpecker, Rufous Hummingbird, Three-toed Woodpecker, Vaux's Swift, Western Bluebird, Willow Flycatcher, Kokanee, Pacific Lamprey, River Lamprey, Big Brown Bat, California Myotis, Pacific Fisher, Fringed Myotis, Hoary Bat, Keen's Myotis, Little Brown Myotis, Long-eared Myotis, Long-legged Myotis, American Marten, Masked Shrew, Northern Water Shrew, Silver-haired Bat, Townsend's Big-eared Bat, Wolverine, Yuma Myotis, Cascades Frog, Cascade Torrent Salamander, Larch Mountain Salamander, Long-toed Salamander, Northwestern Salamander, Pacific Giant Salamander, Northern Red-legged Frog, Roughskin Newt, Oregon Spotted Frog, Tailed Frog, Van Dyke's Salamander, Northwestern Pond Turtle , Western Red-backed Salamander, Western Toad, Beller's Ground Beetle, Carabid Beetle (*Bembidion gordoni*), Carabid Beetle (*Bembidion stillaquamish*) , Carabid Beetle (*Bembidion viator*) , Carabid Beetle (*Bradycellus fenderi*) , Carabid Beetle (*Nebria gebleri cascadensis*) , Carabid Beetle (*Nebria kincaidi balli*) , Carabid Beetle (*Nebria paradisi*) , Carabid Beetle *(Omus dejeanii)* , Carabid Beetle (*Pterostichus johnsoni*) , Fender's Soliperlan Stonefly, Hatch's Click Beetle, Johnson's (mistletoe) Hairstreak Butterfly, Long-horned Leaf Beetle, Blue-gray Taildropper, Oregon Megomphix, Papillose Taildropper, Puget Oregonian, and Aquatic Snail (*Valvata mergella*).

Reasonable and Prudent Measures & Terms and Conditions
The proposed HCP and accompanying Agreements identify anticipated impacts to all Covered Species likely to result from the proposed actions and the specific measures and levels of species and habitat protection that are necessary and appropriate to minimize those impacts. All of the conservation and management measures of the HCP and accompanying Agreements, together with the terms identified in the associated IA, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions for this incidental take statement pursuant to 50 CFR 402.14(I). Such terms and conditions are non-discretionary and must be undertaken by SPU for the

exemptions under section 10 (a)(1)(B) and section 7 (o)(2) of the Act to apply. If SPU fails to adhere to these terms and conditions the protective coverage of the section 10 (a)(1)(B) permit and section 7 (o)(2) may lapse.

Further, the following Terms and Conditions apply to the Service after issuance of the permit:

1. The Service shall provide technical assistance to SPU throughout the term of the incidental take permit, including staffing the Implementation and Oversight Committees described in the HCP and IA;

2. The Service shall conduct regular compliance monitoring of water level fluctuations in the Chester Morse Reservoir, relative to the modeling results contained in Appendix 38 of the HCP;

3. The Service shall conduct regular compliance monitoring exams and review periodic, scheduled monitoring reports;

4. The Service will, at the time of listing of any of the 70 currently unlisted Covered Species, reassess the analyses in this Biological and Conference Opinion, and determine whether continued implementation of the HCP and permit would jeopardize the existence of any Covered Species, and;

5. The Service shall participate in studies designed to determine the effects of the Permanent Dead Storage Project upon species using Chester Morse Reservoir.

<u>Reporting Requirements</u>
In accordance with 50 CFR 402.14 (I)(3), the HCP and accompanying Agreements specify provisions for monitoring and reporting the effects and effectiveness of the mitigation and minimization measures on the Covered Species and their habitats. Each individual species conservation plan, or habitat-based conservation plan, delineates the types and extents of monitoring and the manner of reporting those results to the Service. The City will also submit periodic monitoring reports to the Servce, according to the monitoring and reporting schedule contained in the HCP (see Table 4.5-7).

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, help implement recovery plans, or to develop information.

The Service recommends the following additional actions to promote the recovery of Federally listed species and their habitats:

1. The City continue to work with surrounding landowners, municipalities and regulatory entities to develop a comprehensive, regional strategy for water supply that results in sustainable use of water resources and contributes to the recovery of listed fish and other aquatic life forms.

2. The City is required to notify the Service of occurrences of all species which have disturbance restrictions under the HCP. These species include spotted owls, marbled murrelets, bald eagles, grizzly bears, gray wolves, goshawks, Pacific fishers, peregrine falcons and wolverines.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation and conference on implementation of the proposed Cedar River Watershed HCP. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or, (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

At the time of listing, the Service is to confirm the conference opinion as a biological opinion issued through formal consultation if anycurrently unlisted Covered Species is listed. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the project and no further section 7 consultation will be necessary.

After listing of any currently unlisted Covered Species, and any subsequent adoption of this conference opinion, the City shall request reinitiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or, (4) a new species is listed or critical habitat designated that may be affected by the action.

The incidental take statement provided in this conference opinion does not become effective until the any unlisted Covered Species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation. At that time, the project will be reviewed to determine whether any take of any unlisted Covered Species has occurred. Modifications of the opinion and incidental take statement may be appropriate to reflect that take. Take of any newly listed Covered Species must not occur between the listing and adoption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation.

If you have any questions regarding these biological and conference opinions, please contact Craig Hansen at (360)753-6046, or myself, Manager, Western Washington Office, at (360)753-6042.

APR 19 2000

Gerry A. Jackson

SE/HCP/1-3-99-FW-0276/King County

cc: FWS, OSO (Rich Szlemp)
NMFS, Lacey (Matt Longenbaugh)
Seattle Public Utility, Seattle (Jim Erckmann)

LITERATURE CITED

Allen, A.W. 1983. Habitat suitability index models: Fisher. U. S. Fish and Wildlife Service, FWS/OBS-82/10.45.

Allen, AW. 1987. The relationship between habitat and furbearers. *In*: Nowak et al. Wild furbearer management and conservation in North America.

Almack, J.A., W.L. Gaines, P.H. Morrison, J.R. Eby, R.H. Naney, G.F. Wooten, M.C. Snyder, S.H. Fitkin and E.R. Garcia. 1994. North Cascades Grizzly Bear Ecosystem evaluation: final report. Interagency Grizzly Bear Committee, Denver, CO.

Almack, J.A. and S.H. Fitkin. 1998. Grizzly bear and Gray wold investigations in Washington State 1994-1995, final progress report. Washington Department of Fish and Wildlife, Olympia, WA.

Altman, B. 1999. Conservation strategy for landbirds in coniferous forests of western Oregon and Washington. Version 1.0. American Bird Conservancy and Oregon-Washington Partners in Flight.

American Ornithologists' Union. 1957. Check-list of North American Birds. 5th edition. Lord Baltimore Press, Baltimore, Maryland. 691 pp.

American Ornithologists' Union. 1983. Check-list of North American birds. 6th edition. Allen Press, Lawrence, Kansas. 877 pp.

Anderson, R.J. and A.M. Bruce. 1980. A comparison of selected bald and golden eagle nests in western Washington. Pp. 117-120 *in* R.L. Knight (ed.). Proceedings of the Washington Bald Eagle Symposium, Seattle, Washington.

Aubry, K.B. and P.A. Hall. 1991. Terrestrial communities in the southern Washington Cascade Range. Pp. 32-72 *in* Ruggiero, L.F., K.B. Aubry, A.B. Carey, M.H. Huff (tech. coords.). Wildlife and vegetation of unmanaged Douglas-fir forests. Gen. Tech. Rep. PNW-GTR-285. Pacific Northwest Research Station, USDA, Forest Service, Portland, Oregon.

Aubry, K.B. and D.B. Houston. 1992. Distribution and status of fishers (*Martes pennanti*) in Washington. Northwest Naturalist 73:69-79.

Aubry, K.B., C.M. Raley, T.J. Catton, G.W. Tomb, and F.E. Wahl. 1996. Ecological characteristics of fisher in southwestern Oregon Pp. 84-90 *in* Ecology, Management, and Conservation of Sensitive Wildlife Species. Wildl. Ecol. Team, Annual Report. USDA, Forest Service, Pacific Northwest Research Station, Olympia, Washington. 123 pp.

Arthur, S.M., and W.B. Krohn. 1989. Habitat use and diet of fishers. J. Wildl. Manage. 53:680-88.

Banci, V. 1989. A fisher management strategy for British Columbia. B.C. Minist. Env., Wildl. Branch, Wildl. Bull. No. B-63.

Banci, V. 1994. Wolverine. Pp. 99-127 *in* L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L. Jack Lyon, and W.J. Zielinski (eds.). The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. Gen. Tech. Rep. RM-254. USDA Forest Service, Rocky Mountain Forest and Range Exp. Sta., Ft. Collins, Colorado. 183 pp.

Banfield, A.W.F. 1974. The mammals of Canada. University of Toronto Press, Toronto, Canada.

Barbour, R.W., and W.H. Davis. 1969. Bats of America. University of Kentucky Press, Lexington, Kentucky. 286 pp.

Beamish, R.J. 1980. Adult biology of the river lamprey (*Lampetra ayresi*) and the Pacific lamprey (*Lampetra tridentata*) from the Pacific coast of Canada. Canadian Journal of Fisheries and Aquatic Science. 37 (11):1906-1923.

Beamish, R.J., and Youson, J.H. 1987. Life history and abundance of young adult *Lampetra ayresi* in the Fraser River and their possible impact on salmon and herring stocks in the Strait of Georgia. Canadian Journal of Fisheries and Aquatic Science. 44 (3):525-537.

Beamish, R.J., and Neville, C.E.M. 1995. Pacific salmon and Pacific herring mortalities in the Fraser River plume caused by river lamprey (*Lampetra ayresi*). Canadian Journal of Fisheries and Aquatic Science. 52 (3):644-650.

Beatty, J.J., A.R. Blaustein, and R.M. Storm. 1991. A report to the northern spotted owl recovery team: the biology of amphibians and reptiles. Department of Zoology, Oregon State University. Corvallis, Oregon. 78 pp. plus figures.

Behler, J.L., and F.W. King. 1979. The National Audubon Society field guide to North American reptiles and amphibians. Alfred A. Knopf, Inc. New York, New York. 743 pp.

Bellrose, F.C. 1976. Ducks, geese, and swans of North America. Stackpole Books, Harrisburg, PA.

Beneski, J.T., Jr., and D.W. Stinson. 1987. *Sorex palustris*. Mammalian Species Accounts No. 296, pp 1-6.

Bengton, S.A. 1972. Breeding ecology of the harlequin duck (*Histrionicus histrionicus*) (L.) in Iceland. Ornis Scand. 3:1-19.

Bengton, S.A., and S. Ulfstrand. 1971. Food resources and breeding frequencies of the harlequin duck *Histrionicus histrionicus* in Iceland. Oikos 22:235-239.

Bent, A.C. 1949. Life histories of North American thrushes, kinglets, and their allies. Smithsonian Institution, U.S. Natural History Museum Bull. 196 pp.

Bergdahl, J.C. 1996. Letter to the City of Seattle Water Department regarding habitats of Pacific Northwest endemic carabids, dated October 10, 1995 (revised January 17, 1996). 2 pp.

Bergdahl, J.C. 1997. Carabid beetles (Coleoptera: Carabidae) of Puget Sound lowland *Sphagum* bogs. Pp. 11-14 *in* G. Hayslip (ed.). Proceedings 8th NW Biological Assessment Workgroup (McCall, ID: 4-6 Nov 1997). U.S. Environmental Protection Agency, Seattle, Washington.

Blaustein, A.R., and D.B. Wake. 1990. Declining amphibian populations: a global phenomenon? Trends in Ecology and Evolution 5:203-204.

Blaustein, A.R., J.J. Beatty, D.H. Olson, and R.M. Storm. 1995. The biology of amphibians and reptiles in old-growth forests in the Pacific Northwest. Gen. Tech. Rep. PNW-GTR-337. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon. 98 pp.

Blaustein, A.R., and D.B. Wake. 1995. The puzzle of declining amphibians. Sci. Amer. 272:52-57.

Blus, L. J., C. J. Henry, and T. E. Kaiser. 1980. Population ecology of breeding great blue herons in the Columbia Basin, Oregon and Washington. Murrelet 61:63-71.

Bond, C.E. 1992. Notes on the nomenclature and distribution of the bull trout and the effects of human activity on the species. Pp. 1-4 *in* Proceedings of Gearhart Mountain bull trout workshop. Oregon Chapter of the Amer. Fish. Soc., Corvallis, Oregon. 67 pp.

Bonneau, J.L., R.F. Thurow, and D.L. Scarnecchia. 1995. Capture, marking, and enumeration of juvenile bull trout and cutthroat trout in small, low-conductivity streams. North American Journal of Fisheries Management 15:563-568.

Bowman, I., and J. Siderius. 1984. Management guidelines for the protection of heroneries in Ontario. Ontario Ministry of Natural Resources. Wildlife Branch, Toronto.

Brand, C. J. and L. B. Keith. 1979. Lynx demography during a snowshoe hare decline in Alberta. Journal of Wildlife Management. 43:827-849.

Branson, B.A. 1977. Freshwater mollusca of the Olympic Peninsula, Washington. The Veliger 19(3):310-330.

Branson, B.A. 1980. Collections of gastropods from the Cascade Mountains of Washington. The Veliger 23(2):171-176.

Branson, B.A., and R.M. Branson. 1984. Distributional records for terrestrial and freshwater mollusca of the Cascade and Coast Ranges, Oregon. The Veliger 26(4):248-257.

Braun, C.E. 1994. Band-tailed pigeon. Pages 61-74 *in* T.C. Tacha and C.E. Braun (eds.). Migratory shore and upland bird management on North America. International Assoc. of Fish and Wildlife Agencies in cooperation with USDI Fish and Wildlife Service,

Brittell, J.D., R.J. Poelker, S.J. Sweeney, and G.M. Koehler. 1989. Native cats of Washington. Unpublished report. Washington Department of Wildlife, Olympia, Washington. Washington, D. C.

Brown, E.R. (ed.) 1985. Management of wildlife and fish habitats in forests of western Oregon and Washington. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, and USDI Bureau of Land Management, Publication No. R6-f&WL-192-1985. 332pp.

Brown, L.G. 1992. On the zoogeography and life history of Washington's native char; Dolly Varden, *Salvelinus malma* (Walbaum) and bull trout, *Salvelinus confluentus* (Suckley). Pp. 34-75 *in* Appendix A. Bull trout Dolly Varden management and recovery plan. Washington Department of Wildlife, Olympia, Washington.

Bruce, A.M., R.J. Anderson, and G.T. Allen. 1982. Observations of golden eagle nests in western Washington. Raptor Res. 16:132-134.

Bryant, M.D. 1983. The role and management of woody debris in West Coast salmonid nursery streams. North American Journal of Fisheries Management 3:322-330.

Buck, S. 1982. Habitat utilization by fisher (*Martes pennanti*) near Big Sur, California. M.S. Thesis. Humboldt State University, Arcata, California.

Buck, S.G., C. Mullis, and A.S. Mossman. 1983. Corral Bottom-Hayfork Bally fisher study. Final report to the U.S. Department of Agriculture, Forest Service, Region 5, San Francisco, California. 102 pp.

Buck, S.G., C. Mullis, A.S. Mossman, I. Snow, and C. Coolahan. 1994. Habitat use by fishers in adjoining heavily and lightly harvested forest. Pp. 368-376 *in* Buskirk, S.W., A.S. Harestad, M.G. Raphael, and R.A. Powell (eds.). Martens, sables, and fishers: biology and conservation. Cornell University Press, Ithaca, New York.

Buchanan, J.B. 1991. Spotted owl nest site characteristics in mixed conifer forests on the eastern Cascade mountains, Washington. M.S. Thesis. University of Washington, Seattle. 136 pp.

Buchanan, D.M. and S.V. Gregory. 1997. Development of water temperatures standards to protect and restore habitat for bull trout and other cold water species in Oregon. Pages 1-8 *in* Makay, W.C., M.K. Brewin and M. Monita. Friends of Bull Trout Conference proceedings.

Bull, E.L. 1987. Ecology of the pileated woodpecker in northeastern Oregon. J. Wildl. Manage. 51:472-481.

Bull, E.L., S.R. Peterson, and J.W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. Research Note PNW-444. USDA Forest Service. 19 pp.

Bull, E.L. 1991. Unusual summer roost of Vaux's swifts. Unpubl. Rep. Forestry and Range Sciences Laboratory, LaGrande, Oregon. 11 pp.

Bull, E.L., and H.D. Cooper. 1991. Vaux's Swift nests in hollow trees. Western Birds 22:85-91.

Bull, E.L., and J.E. Hohmann. 1992. The association between Vaux's Swifts and old-growth forests in northeastern Oregon. Western Birds 24:38-42.

Bull, E.L., R.C. Beckwith, and R.S. Holthausen. 1992. Arthropod diet of pileated woodpeckers in northeastern Oregon. Northwestern Naturalist 73:42-45.

Bull, E.L., and R.C. Beckwith. 1993. Diet and foraging behavior of Vaux's swifts in northeastern Oregon. Condor 95(4):1016-1023.

Bull, E.L., and C.T. Collins. 1993. Vaux's swift (*Chaetura vauxi*). *In* Poole, A., and F Gill (eds.). The birds of North America. Acad. Nat. Sci., Philadelphia.

Bull, E.L. and J.A. Jackson. 1995. Pileated woodpecker (*Dryocopus pileatus*). Pages 1-24 *in* Poole, A. and F. Gill (eds) Birds of North America. Acad. Nat. Sci., Philadelphia, PA.

Burke, T.E. 1994a. Mollusk species from the Record of Decision (ROD) President's Forest Plan Supplement Table C-3 Survey and Manage. Notes on molluscan species from Washington. Olympic National Forest. Olympia, Washington. 17 pp.

Burke, T.E. 1994b. Survey of the Taneum Watershed for species of the Phylum Mollusca. Report on file. USDA Forest Service, Cle Elum Ranger District. Cle Elum, Washington. 31 pp.

Buskirk, S.W., and R.A. Powell. 1994. Habitat ecology of fishers and American martens. Pages 283-296 *in* S.W. Buskirk, A.S. Harestad, M.G. Raphael, and R.A. Powell, editors. Martens, sables, and fishers: biology and conservation. Cornell University Press, Ithaca, New York.

Buskirk, S.W., and L.F. Ruggiero. 1994. American marten. Pages 7-37 *in* Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L. Jack Lyon, and W.J. Zielinski (eds.). The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western

United States. Gen. Tech. Rep. RM-254. USDA Forest Service, Rocky Mountain Forest and Range Exp. Sta., Ft. Collins, Colorado. 183 pp.

Butts, T.W. 1992. Wolverine (*Gulo gulo*) Biology and Management: A Literature Review and Annotated Bibliography. USDA Forest Service. Missoula, Montana. September 1992.

Calambokidis, J., S. M. Speich, J. Peard, G.H. Steiger, J.C. Cubbage, D.M. Fry, and L.J. Lowenstine. 1985. Biology of Puget Sound marine mammals and marine birds: population, health, and evidence of pollution effects. National Oceanic and Atmospheric Administration Tech. Memorandum NOS. OMA 18.

Calder, W.A. 1993. Rufous hummingbird (*Selasphorus rufus*). In the Birds of North America, NO. 53 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington D.C.: The American Ornithologists' Union.

Carey, A.B., M.M. Hardt, S.P. Horton, and B.L. Biswell. 1991. Spring bird communities in the Oregon Coast Range. Pp. 123-142 *in* L.F. Ruggiero, K.B. Aubry, A.B. Carey, and M.M. Huff (tech. coords.). Wildlife and vegetation in unmanaged Douglas-fir forests. Gen. Tech. Rep. PNW-GTR-285. USDA, Forest Service, Pacific Northwest Forest and Range Station, Portland, Oregon. 533 pp.

Cavender, T.M. 1978. Taxonomy and distribution of the bull trout, *Salvelinus confluentus* (Suckley), from the American Northwest. California Fish and Game 64:139-174.

Christy, R.E., and S.D. West. 1993. Biology of bats in Douglas-fir forests. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon. General Technical Report PNW-308. 28 pp.

Close, D.A., Fitzpatrick, M., Li, H., Parker, B., and Hatch, D. 1995. Status report of the Pacific lamprey (*Lampetra tridentata*) in the Columbia River Basin. Prepared for the U.S. Department of Energy, Bonneville Power Administration. Project Number 94-026. 35 p.

Close, David A., et. al., 1995. Status Report of the Pacific Lamprey (*Lampreta tridentata*) in the Columbia River Basin. Bonneville Power Admin., Portland, OR., Project No. 94-026.

Cochran, P.A. 1986. Attachment sites of parasitic lampreys: Comparisons among species. Environ. Biol. Fish. 17 (1):71-80.

Corkran, C.C., and C. Thoms. 1996. Amphibians of Oregon, Washington, and British Columbia; a field identification guide. Lone Pine Publ., Edmonton, Alberta, Canada. 175 pp.

Constantine, D.G. 1996. Ecological observations on lasiurine bats in Iowa. J. Mammal. 47:34-41.

Cook, F.R. 1984. Introduction to Canadian amphibians and reptiles. National Museum of Natural Science, National Museum of Canada.

Corkran, C.C., and C.R. Thoms. 1996. Amphibians of Oregon, Washington, and British Columbia, a field identification guide. Lone Pine Publishing, Edmonton, Alberta. 175 pp.

Corn, P.S., and R.B. Bury. 1989. Logging in western Oregon: responses of headwater habitats and stream amphibians. Forest Ecology and Management. 29:1-19.

Corn, J.G., and M.G. Raphael. 1992. Habitat characteristics at marten subnivean access sites. J. Wildl. Manage. 56: 442-448.

Cottam, C. 1939. Food habits of North America diving ducks. USDA Tech. Bull. 643. 140 pp.

Craig, S.D. 1997. Habitat conditions affecting bull trout, *Salvelinus confluentus*, spawning areas within the Yakima River Basin, Washington. Master's Thesis. Central Washington University, Ellensburg. 74 p.

Craig, S.D. and R.C. Wissmar. 1993. Habitat Conditions Influencing a Remnant Bull Trout Spawning Population, Gold Creek, Washington. (draft report) Fisheries Research Institute, University of Washington. Seattle, WA.

Crisafulli, C.M. 1998. Draft survey protocol for Larch Mountain salamander (*Plethodon larselli*). USDA, Forest Service, Pacific Northwest Research Station. 24 pp.

Cross, S.P., ed. 1976. A survey of bat populations and their habitat preferences in southern Oregon. A student originated studies project funded by the National Science Foundation. Southern Oregon State College, Ashland, Oregon. 89 pp.

Cross, S.P. 1977. A survey of the bats of Oregon Caves National Monument. Unpubl. Rep. to National Park Service (Contract CX-9000-6-0061). 40 pp.

Cross, S.P., and A.E. Kerwin. 1995. Survey of bats and their habitats in the Winema National Forest and Lakeview BLM (Klamath Resource Area) in 1994. Department of Biology, Southern Oregon State College, Ashland, Oregon. 45 pp.

Cross, S.P., and C. Schoen. 1989. Bats at Oregon Caves: 1988 status report. Unpubl. Rep. to USDA National Park Service. 25 pp.

Cross, S.P., and D. Walden. 1994. Inventory and monitoring of bats on the Medford District of the BLM in 1993. Department of Biology, Southern Oregon State College, Ashland, Oregon. 45 pp.

Cross, S.P., and D. Walden. 1995. Survey of bats and their habitats in the Roseburg District of the BLM in 1994. Department of Biology, Southern Oregon State College, Ashland, Oregon. 64 pp.

Curtis, P.D. and C.E. Braun 1983. Radio telemetry locations of nesting band-tailed pigeons in Colorado. Wilson Bull. 95:464-466

Darda, D.M. 1995. The Larch Mountain salamander, *Plethodon larselli*, on the Cle Elum Ranger District, Wenatchee National Forest. Report to the USDA Forest Service. 24 pp.

Daugherty, C.H., and A.L. Sheldon. 1982. Age-determination, growth, and life history of a Montana population of the tailed frog (*Ascaphus truei*). Herpetologica 38:461-468.

Davis, M. 1997. Bat usage of a major karst area on northern Vancouver Island. Final Report to Science Council of British Columbia. 17 pp.

DeGraaf, R.M., et al. 1991. Forest and rangeland birds of the United States: Natural history and habitat use. Agriculture Handbook No. 688. USDA Forest Service, Washington, D.C. 625 pp.

Desante, D.F. and T. L. George. 1994. Population trends in landbirds of North America. Pp. 173-190 *in* Jehl, J. R. Jr. and N. K. Johnson (eds.). A century of avifaunal change in western North America. Studies in avian biology, No. 15. Cooper Ornithological Society, San Diego, California. 348 pp.

Diller, L.V., and R.L. Wallace. 1996. Distribution and habitat of *Rhyacotriton variegatus* in managed, young growth forests in north coastal California. J. Herpetol. 30(2):184-191.

Dolloff, C.A. 1986. Effects of stream cleaning on juvenile coho salmon and Dolly Varden in southeast Alaska. Transactions of the American Fisheries Society 115: 743-755.

Donald, D.B. and D.J. Alger. 1993. Geographic distribution, species displacement, and niche overlap for lake trout and bull trout in mountain lakes. Canadian Journal of Zoology 71: 238-247.

Douglas, C.W., and M.A. Strickland. 1987. Fisher. Pp. 511-529 *in* Novak, M., J.A. Baker, M.E. Obbard, and B. Malloch (eds.). Wild furbearer management and conservation in North America. Ontario Ministry of Natural Resources and the Ontario Trappers Association. 1150 pp.

Dunlap, D.G. 1955. Inter- and intraspecific variation in Oregon frogs of the genus *Rana*. American Midland Naturalist 54:314–331.

Dvornich, K.M., K.R. McAllister, and K.B. Aubry. 1997. Amphibians and reptiles of Washington State: location data and predicted distributions. Volume 2 in Cassidy, K.M., C.E. Grue, M.R. Smith, and K.M. Dvornich (eds.). Washington State Gap Analysis – Final Report. Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle, Washington. 146 pp.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. The Birder's handbook. Simon and Schuster, New York, NY. 784 pp.

Elliot, S.T. 1986. Reduction of a Dolly Varden population and macrobenthos after removal of logging debris. Transactions of the American Fisheries Society. 115:392-400.

Elton, C. and M. Nicholson. 1942. The ten-year cycle in numbers of the lynx in Canada. J. Anim. Ecol. 11:215-244.

Engler, J., and D.C. Friesz. 1998. Draft 1998 Oregon spotted frog breeding surveys, Conboy Lake National Wildlife Refuge, Klickitat County, Washington. Unpublished Report. 5 pp.

Ernst, C.H., and R.W. Barbour. 1972. Turtles of the United States. The University Press of Kentucky, Lexington, Kentucky. 347 pp.

Evenden, F.G., Jr. 1948. Distribution of the turtles of western Oregon. Herpetologica 4:201-204.

Foerser, K.S. and C.T. Collins. 1990. Breeding distribution of the black swift in southern California. Western Birds 21:1-9.

Forsman E.D., S. DeStefano, M.G. Rapheal, R.J. Gutierrez (eds). 1996. Demography of the northern spotted owl. Studies in Avain Biology 17:21-30.

Foster Wheeler Env. Corp. 1995. Cedar River Watershed bull trout workshop: meeting minutes-November 18, 1994. Prepared for Seattle Water Department, King County, Washington. Foster Wheeler Environmental Corporation, Bellevue, Washington.

Foster Wheeler Env. Corp. 1995. Mass Wasting and Surface Erosion Assessment Cedar River Watershed Habitat Conservation Plan, Final. November 1995. Prepared for SeattleWater Department, King County, Washington. Foster Wheeler Environmental Corporation, Bellevue, Washington.

Fraley, J.J., and Shepard, B.B. 1989. Life history, ecology and population status of migratory bull trout, *Salvelinus confluentus*, in the Flathead Lake and river system, Montana. Northwest Science. 63 (4):133-143.

Frest, T.J., and E.J. Johannes. 1993. Mollusc species of special concern within the range of the Northern Spotted Owl. Prepared for Forest Ecosystem Management Working Group, U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Portland, Oregon. 98 pp.

Frest, T.J., and E.J. Johannes. In Press. Northwest United States sensitive Mollusks.

Frissell, C.A. 1993. A new strategy for watershed restoration and recovery of Pacific salmon in the Pacific Northwest. Report prepared for the Pacific Rivers Council. 33 pp.

Furlonger, C.L., H.J. Dewar, and M.B. Fenton. 1987. Habitat use by foraging insectivorous bats. Can. J. Zoology 65:284-88.

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. Chapter 8. *In* W. R. Meehan (ed.). Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19. Bethesda, Maryland.

Fyfe, R.W. and R.R. Olendorff. 1976. Minimizing the dangers of nesting studies to raptors and other sensitive species. Canadian Wild. Serv., Occasional. Paper No. 23, 17 pp.

Gaines, , W.L. and R.E. Fitzner. 1987. Winter diet of the harlequin duck at Sequim Bay, Puget Sound, Washington. Northwest Science 61:213-215.

Gilbert. F.F. and R. Allwine. 1991. Spring bird communities in the Oregon Cascade Range. Pp 145-158 *in* L.F. Ruggiero, K.B. Aubry, A.B. Carey, and M.H. Huff (tech cords.) Wildlife and vegetation of Unmanaged Douglas-fir forests. U.S. Forest Service Gen. Tech. Rept. PNW-285

Goetz, F.A., 1989. Biology of the bull trout, a literature review. U.S. Department of Agriculture, Willamette National Forest, Eugene, Oregon. 53 pp.

Goggans, R., R.D. Dixon, and L.C. Seminara. 1989. Habitat use by three-toed and black-backed woodpeckers. Deschutes National Forest Nongame Report 87-3-02. Oregon Department of Fish and Wildlife. 43 pp.

Gould, W.R. 1987. Features in the early development of bull trout (*Salvelinus confluentus*). Northwest Science. 61 (4):264-268.

Green, D.M., H. Kaiser, T.F. Sharbel, J. Kearsley, and K.R. McAllister. 1997. Cryptic species of spotted frogs, *Rana pretiosa* complex in western North America. Copeia 1997:1–8.

Grinnell, J., J.S. Dixon, and J.M. Linsdale. 1937. Furbearing mammals of California. Vol. 1. University California Press, Berkeley. 375 pp.

Gustafson, D.L. 1995. Aquatic Invertebrates of Montana: Plecoptera. http://rivers.oscs.montana.edu/dlg/aim/plecop/plecop.html

Haas, G.R. and J.D. McPhail. 1991. Systematics and distributions of Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*) in North America. Canadian Journal of Fisheries and Aquatic Sciences 48:2191-2211.

Hagmeier, E.M. 1956. Distribution of marten and fisher in North America. Can. Field-Nat. 70:149-168.

Hanson, E., D. Hayes, L. Hicks, L. Young, and J. Buchanan. 1993. Spotted owl habitat in Washington: a report to the Washington Forest Practices Board. Washington Forest Practices Board, Olympia, Washington. 116 pp.

Hardisty, M.W., and I.C. Potter (eds.). 1971. The biology of lampreys. Vol. 1. Academic Press, New York.

Hart, J.L. 1973. Pacific fishes of Canada. Bull. Fish. Res. Board Can. 180. 740 pp.

Hash, H.S. 1987. Wolverine. Pp. 575-585 *in* Novak, M., J.A. Baker, M.E. Obbard, and B. Malloch (eds.). Wild furbearer management and conservation in North America. Ontario Ministry of Natural Resources and the Ontario Trappers Association. 1150 pp.

Hayes, M.P. 1994. The spotted frog (*Rana pretiosa*) in western Oregon. Part I. Background. Part II. Current status. Oregon Department of Fish and Wildlife Technical Report 94–1–01.

Hayes, M.P. 1997. Status of Oregon spotted frog (*Rana pretiosa sensu stricto*) in the Deschutes Basin and selected other systems in Oregon and northeastern California with rangewide synopsis of the species' status. Final report prepared for The Nature Conservancy under contract to the U.S. Fish and Wildlife Service, 26000 SE 98th Ave., Suite 100, Portland, Oregon, 97266. 57 pp. plus appendices.

Hayes, M.P. 1998. The Buck Lake Oregon spotted frog (*Rana pretiosa*) population (Spencer Creek System, Klamath County, Oregon). Final report prepared for the Bureau of Land Management and The Nature Conservancy under contract to Winema National Forest. Unpublished Report. 22 pp.

Hayes, D.W., K.R. McAllister, S.A. Richardson, and D.W. Stinson. 1999. Draft Washington State recovery plan for the western pond turtle. Wash. Dept. Fish and Wildl., Olympia, WA. 53 pp.

Hays, J.B., A.R. Blaustein, J.M. Kiesecker, P.D. Hoffman, I. Pandelova, D. Coyle, and T. Richardson. 1996. Developmental responses of amphibians to solar and artificial UVB sources: a comparative study. Photochemistry and Photobiology 64(3):449-456.

Henny, C.J. 1986. Osprey (*Pandion haliaetus*). U.S. Army Corps of Engineers Tech. Rep. EL-86-5.

Hejl, S.J. 1994. Human-induced changes in bird populations in coniferous forests in western North America during the last 100 years. Pp. 232-246 *in* Jehl, J.R. Jr., and N.K. Johnson (eds.). A century of avifaunal changes in western North America. Studies in Avian Biology, No. 15. Cooper Ornithological Society, San Diego, California. 348 pp.

Herd, R.M., and M.B. Fenton. 1983. A genetic, morphological and ecological investigation of a putative hybrid zone between *Myotis lucifugus* and *Myotis yumanensis* (Chiroptera: Vespertilionidae). Can. J. Zoology 61:2020-2050.

Herrington, R.E., and J.H. Larsen, Jr. 1987. Reproductive biology of the Larch Mountain salamander (*Plethodon larselli*). Journal of Herpetology 21(1):48-56.

Herrington, R.E., and J.H. Larsen. 1985. Current status, habitat requirements and management of the Larch Mountain salamander *Plethodon larselli* Burns. Biological Conservation 34(2):169-179.

Holland, D.C. 1989. A synopsis of the ecology and current status of the western pond turtle (*Clemmys marmorata*). Unpublished Report. USDI Fish and Wildlife Service, National Ecology Research Center. Fort Collins, Colorado.

Holland, D.C., and R.B. Bury. 1994. The western pond turtle: habitat and history. Report DOE/BP-62137-1, Bonneville Power Administration, Portland, Oregon. 302 pp.

Holthausen, R.S., M.G. Raphael, K.S. McKelvey, E.D. Forsman, E.E. Starkey, and D.E. Seaman. 1995. The contribution of federal and nonfederal habitat to persistence of the northern spotted owl on the Olympic Peninsula, Washington. Final report to the Reanalysis Team, U.S. Department of Agriculture, Forest Service, Washington D. C. 75 pp.

Howell, P.J. and D.V. Buchanan (eds). 1992. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis, OR.

Hornocker, M.G., and H.S. Hash. 1981. Ecology of the wolverine in northwestern Montana. Can. J. Zool. 59:1286-1301.

Humphrey, S.R., and T.H. Kunz. 1976. Ecology of a Pleistocene relict, the western big-eared bat (*Plecotus townsendii*) in the southern great plains. J. Mammal. 57(3):470-494.

Jennings, M.R. and M.P. Hayes. 1994. Amphibians and reptile species of special concern in California. California Department of Fish and Game, Rancho Cordova, California.

Johnson, R.E., and K.M. Cassidy. 1997. Terrestrial mammals of Washington State: location data and predicted distributions. Volume 3 *in* Cassidy, K.M., C.E. Grue, M.R. Smith, and K.M. Dvornich (eds.). Washington State Gap Analysis – Final Report. Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle. 304 pp.

Jones, L.L.C. 1989. *Plethodon vandykei* (Van Dyke's Salamander). Herp. Review 20(2):48.

Jones L.L.C. and M. G. Raphael. 1991. Ecology and management of marten in fragmented habitat of the Pacific Northwest. Progress Report: Fiscal Year 1991. Pacific Northwest Research Station, Olympia, WA. 36 pp.

Jones J.L. 1991. Habitat use of fishers in north central Idaho. M.S. thesis, University of Idaho, Moscow. 147 pp.

Jones, J.L. and E.O. Garton. 1994. Selection of successional stages of fishers in north-central Idaho. Pages 377-387 *in* Buskirk, S.W., A. s. Harestad, M.G. Raphael, and R.A. Powell, eds. Martens sables, and fishers: biology and conservation. Cornell University Press, Ithaca, NY. 684 pages.

Jones, L.L.C. 1998. Survey protocol for the Van Dyke's Salamander (*Plethodon vandykei*) Gen. Tech. Rep. PNW- Draft, dated May 13, 1998. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 31 pp.

Kavanaugh, D.H. 1992. Carabid beetles (Insecta: Coleoptera: Carabidae) of the Queen Charlotte Islands, British Columbia. Memoirs of the California Academy of Sciences Number 16. California Academy of Sciences, San Francisco, California.

Kelsall, J.P. and K. Simpson. 1979. A three year study of the great blue heron in southwestern British Columbia. Proc. Colonial Waterbird Group 3:69-79.

Kelsall, J.P. 1981. Status report on the wolverine, *Gulo gulo*, in Canada in 1981. *In* Committee on the status of endangered wildlife in Canada (COSEWIC), Ottawa. 47 pp.

King County. 1998. Lower Cedar River nonpoint pollution action plan. King County, Department of Natural Resources, Seattle, Washington.

King County. 1998. 1994 King County Comprehensive Plan: complete with amendments through 1998. Updated by King County Office of Regional Policy and Planning, King County, Washington.

Knutzen, J.A. 1997. Evaluation of fish entrainment potential from Chester Morris Lake/Masonary Pool System. Prepared for Seattle City Light Environmental and Safety Division, Seattle, Washington. Foster Wheeler Environmental Corporation, Bellevue, Washington.

Koehler, G.M. 1990. Population and habitat characteristics of lynx and snowshoe hares in north central Washington. Can. J. Zool. 68: 845-851.

Koehler G.M. and J.D. Brittell. 1990. Managing spruce-fir habitat for lynx and snowshoe hare. Journal of Forestry. Vol. 88, No. 10:10-15.

Koehler, G.M., W.R. Moore, and T.W. Koehler. 1990. Marten use of successional forest stages during winter in north-central Washington. Northwestern Naturalist 71:1-4.

Koehler, G.M. and K.B. Aubry. 1994. Chapter 4, Lynx. American Marten, Fisher, Lynx, and Wolverine in the Western United States. The Scientific Basis for Conserving Forest Carnivores. USDA Forest Service. Rocky Mountain Forest and Range Experiment Station. General Technical Report. GTR-RM-254. Fort Collins, Colorado. 184 pp.

Kraemer, C. 1994. Some observations on the life history and behavior of the native char, Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*) of the North Puget Sound Region. WDW. (Draft).

Kunz, T.H. 1982. Ecology of bats. Plenum Press, New York.

Kurta, A. 1995. Mammals of the Great Lakes region. University of Michigan Press, Ann Arbor, Michigan. 376 pp.

Larsen, E.M., E. Rodrick, and R. Milner (eds.). 1995. Management recommendations for Washington's priority species, volume 1: invertebrates. Washington Department of Fish and Wildlife, Olympia, Washington. 82 pp.

Lattin, J.D. 1990. Arthropod diversity in old-growth forests of the Pacific Northwest. Wings 15:7-10.

Lattin, J.D., and A.R. Moldenke. 1992. Ecologically sensitive invertebrate taxa of Pacific Northwest old-growth conifer forests. Report prepared for the northern spotted owl recovery team: Other species and ecosystems committee. USDI Fish and Wildlife Service. Portland, Oregon. 42 pp.

Leary, R.F., F.W. Allendorf and S.H. Forbes. 1993. Conservation genetics of bull trout in the Columbia and Klamath River drainages. Conservation Biology. 7(4): 856-865.

Leary, R.F. and F.W. Allendorf. 1997. Genetic confirmation of sympatric bull trout and Dolly Varden in western Washington. Transactions of the American Fisheries Society 126: 715-720.

Lehmkuhl, J.F., L.F. Ruggiero, and P.A. Hall. 1991 Landscape-scale configurations of forest fragmentation and wildlife richness and abundance in the southern Washington Cascade

Range. Pp 425-442. *in* Wildlife and vegetation of Unmanaged Douglas-fir forests. U.S. Forest Service Gen. Tech. Rept. PNW-285.

Leonard, W. 1985. Inventory of great blue heron nest colonies in southern and western Puget Sound. Unpublished report to Washington Department of Fish and Wildlife, Nongame Program. Olympia, Washington.

Leonard, W.P., H.A. Brown, L.L.C. Jones, K.R. McAllister, and R.M. Storm. 1993. Amphibians of Washington and Oregon. Seattle Audubon Society, Seattle, Washington. 168 pp.

Leonard, W.P. 1997. Oregon spotted frog (*Rana pretiosa*) monitoring at Trout Lake Natural Area Preserve and vicinity, Klickitat and Skamania Counties, Washington. Unpublished Report, Washington Natural Heritage Program, Washington Department of Natural Resources, Olympia. 22 pp.

Levenson, H., and J.R. Koplin. 1984. Effects of human activity on productivity of nesting ospreys. J. Wildl. Manage. 48:1374-1377.

Litch, L.E. 1969. Comparative breeding behavior of the red-legged frog (*Rana aurora aurora*) and the western spotted frog (*Rana pretiosa pretiosa*) in southwestern British Columbia. Canadian J. Zool. 47:1287-1299.

Licht, L.E. 1971. Breeding habits and embryonic thermal requirements of the frogs *Rana aurora aurora* and *Rana pretiosa pretiosa* in the Pacific Northwest. Ecology 52:116–124.

Licht, L.E. 1974. Survival of embryos, tadpoles, and adults of the frogs *Rana aurora aurora* and *Rana pretiosa pretiosa* sympatric in southwestern British Columbia. Canadian Journal of Zoology 52:613–627.

Lindroth, C.H. 1961-1969. The ground beetles (Carabidae excl. Cicindelinae) of Canada and Alaska. Parts 1-6. Opuscula Entomologica xlviii plus 1192 pp.

Lunde, R.E., and A.S. Harestad. 1986. Activity of little brown bats in coastal forests. Northwest Science 60:206-09.

Maj, Mary and E.O. Garton. 1992. Wolverine, Fisher, Lynx : Summary of Distribution Information. Pages 4-12. *in* Butts, T.W. editor. Wolverine (*Gulo gulo*) Biology and Management: A Literature review and Annotated Bibliography. USDA Forest Service. Missoula, Montana.

Maj, Mary and E.O. Garton. 1994. Fisher, Lynx, Wolverine: Summary of Distribution Information. Pages 169-175. *in:* Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. Editors. American Marten, Fisher, Lynx, and Wolverine in the western United States. USDA forest Service. General Technical Report RM-254. September 1994.

Manuwal, D.A. 1991. Spring bird communities in the southern Washington Cascade Range. Pp161- 174 in L.F. Ruggiero, K.B. Aubry, A.B. Carey, and M.H. Huff (tech cords.). *In* Wildlife and vegetation of Unmanaged Douglas-fir forests. U.S. Forest Service Gen. Tech. Rept. PNW-285.

Manuwal, D.A. and M.H. Huff. 1987. Spring and winter bird populations in a Douglas-fir forest. J. Wildl. Manage. 51:586-595.

Manuwal, D.A. and S. Pearson. 1997. Bird Populations in managed forests in the western Cascade Mountains, Washington. *In* Wildlife use of managed forests: a landscape perspective. Vol 2, Westside Research studies. 61pp.

Mark, D.M. 1976. An inventory of great blue herons (*Ardea herodias*) nesting colonies in British Columbia. Northwest Science 50(1):32-31.

Mariani, J.M. 1987. Brown creeper (*Certhia americana*) abundance patterns and habitat use in the southern Washington Cascades. M.S. Thesis. University of Washington, Seattle, Washington. 71 pp.

Marrin, Manuel. 1997. On the behavior of black swifts. Condor. 99(2):514-519.

Marshall, D.B. 1988. Status of the marbled murrelet in North America with emphasis on populations in Washington, Oregon, and California. U.S. Department of the Interior, Fish and Wildlife Service, Biological Report 99(3).

Maser, C., B.R. Mate, J.F. Franklin, and C.T. Dyrness. 1981. Natural history of Oregon coast mammals. Gen Tech. Rep. PNW 133. USDA Forest Service, Pacific Northwest Forest and Range Exp. Sta., Portland, Oregon. 496 pp.

McAllister, K.R. 1995. Distribution of amphibians and reptiles in Washington State. Northwest Fauna 3:81-112.

McAllister, K.R., and W.P. Leonard. 1997. Washington State status report for the Oregon spotted frog. Washington Department of Fish and Wildlife. Olympia, Washington. 38 pp.

McAllister, K.R., W. Leonard, and R.M. Storm. 1993. Spotted frog (*Rana pretiosa*) surveys in the Puget Trough of Washington 1989-1991. Northwest Naturalist 74:10-15.

McCord, C.M. and J.E. Cardoza. 1990. Bobcat and lynx. Pp.728-766 *in* J.A. Chapman and G. A. Feldhamer (eds). Wild mammals of North America. John Hopkins University Press, Baltimore, Maryland.

McGahan, J. 1967. Quantified estimates of predation by a golden eagle population. J. Wildl. Manage. 31:496-501.

McIntosh, B.A., J.R. Sedell, J.E. Smith, R.C. Wissmar, S.E. Clarke, G.H. Reeves and L.A. Brown. 1994. Management History of Eastside Ecosystems: Changes in Fish Habitat Over 50 Years, 1935 to 1992. US Forest Service. PNW-GTR-321.

McPhail, J.D. and J.S. Baxter. 1996. A review of bull trout (*Salvelinus confluentus*) life-history and habitat use in relation to compensation and improvement opportunities. Fisheries Management Report No. 104. Province of British Columbia, Ministry of Environment, Lands and Parks, Fisheries Branch.

Meehan, W.R., and T.C. Bjornn. 1991. Salmonid distributions and life histories. American Fisheries Society Special Publication. Pp. 47-82 *in* Meehan, W. R. (ed.). Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication, V. 19. Bethesda, Maryland.

Mellen, T.K. 1987. Home range and habitat use of pileated woodpeckers, western Oregon. M.S. Thesis. Oregon State University, Corvallis, Oregon.

Mellen, T.K., E.C. Meslow, and R.W. Mannan. 1992. Summertime home range and habitat use of pileated woodpeckers in western Oregon. Journal of Wildlife Management 56(1):96-103.

Meslow, E.C. and H.M. Wight. 1975. Avifauna and succession in Douglas-fir forests of the Pacific Northwest. Pp. 366-271 *in* Proceedings of the symposium on management of forests and range habitats for nongame birds (D.R. Smith ed.). USFS Gen. Tech. Rep. WO-1.

Michael, J.H., Jr. 1980. Repeat spawning of Pacific lamprey. California Fish and Game. 66 (3):186-187.

Michael, J.H., Jr. 1984. Additional notes on the repeat spawning by Pacific lamprey. California Fish and Game. 70 (3)

Mladenoff, D.J., T.A. Sickley, R.G. Haight, and A.P.Wydeven. 1995. A regional landscape analysis and prediction of favorable gray wolf habitat in the northern Great Lakes region. Conservation Biology 9(2): pp. 279-294.

Mongillo, P.E. 1993. The distribution and status of bull trout/Dolly Varden in Washington State-June 1992. Washington Department of Wildlife, Olympia, WA.

Montana Bull Trout Scientific Group. 1996. Assessment of methods for removal or suppression of introduced fish to aid in bull trout recovery. Montana Bull Trout Restoration Team, Helena.

Moyle, P.B. 1976. Inland fishes of California. University of California Press, Berkeley. 405 pp.

Moyle, P.B., R.M. Yoshiyama, J.E. Williams, E.D. Wikramanayake. 1995. Fish species of special concern in California. Second Edition. California Department of Fish and Game. Final Report for Contract 2181F.

Murphy, M.L., J. Heifetz, S.W. Johnson, K.V. Koski, and J.F. Thedinga. 1986. Effects of clear-cut logging with and without buffer strips on juvenile salmonids in Alaskan streams. Canadian Journal of Fisheries and Aquatic Sciences 43: 1521-1533.

Nagorsen, D.W., and R.M. Brigham. 1993. Bats of British Columbia. Royal British Columbia Museum Handbook. University of British Columbia Press, Vancouver, British Columbia. 164 pp.

National Marine Fisheries Service. 2000. Biological opinion, section 10 findings and unlisted species analysis for the proposed issuance of a section 10(a)(1)(A) incidental take permit (permit#: 1235) to the City of Seattle for the Cedar River Watershed Habitat Conservation Plan, National Marine Fisheries Service, Lacey, Washington.

Nehlsen, W., Williams, J.E., and Lichatowich, J.A. 1991. Pacific salmon at crossroads: Stocks at risk from California, Oregon, Idaho, and Washington. Fisheries. 16 (2):4-21.

Nehring, R.B. and R. Anderson 1982. Stream fisheries investigations. Job progress report, Project F-51-R-7. Colorado Division of Wildlife, Fort Colins, Colorado.

Nelson, C.R. 1996. The tree of life web page: Plecoptera. http://www.utexas.edu/courses/capnia/plecoptera/plecoptera.html

Nussbaum, R.A., and C.K. Tait. 1977. Aspects of the life history and ecology of the Olympic salamander, *Rhyacotriton olympicus* (Gaige). The American Midland Naturalist 98(1):176-198.

Nussbaum, R.A., E.D. Brodie, and R.M. Storm. 1983. Amphibians and reptiles of the Northwest. University of Idaho Press, Moscow, Idaho. 332 pp.

Olson, D.M. 1992. The northern spotted owl conservation strategy: implications for Pacific Northwest forest invertebrates and associated ecosystem processes. Final Report to the Northern Spotted Owl EIS Team, U.S. Department of Agriculture Forest Service. Portland, Oregon, 51 pp.

Olson, D.H.(ed.). 1996. Draft survey protocols for Component/Strategy 2 amphibian species. USDA Forest Service, Pacific Northwest Research Station. Portland, Oregon.

Opler, P.A. and J.D. Lattin. 1998. Systematic Compendium of Arthropods and Annelid Worms of Old-growth and Late Successional Conifer Forests, Mature Riparian Woods, and of Coarse Woody Debris Associated Arthropods within the Range of the Northern Spotted

Owl (*Strix occidentalis caurina*). National Biological Survey, Midcontinent Ecological Science Center online publication. http://webmesc.mesc.nbs.gov/pubs/online/artho/systematic_compendium.html

Oregon Department of Fish and Wildlife. 1992. Sensitive vertebrates of Oregon. Portland, Oregon.

Oregon Department of Fish and Wildlife. 1993. Oregon sensitive species list. Oregon Department of Fish and Wildlife. Portland, Oregon. 9p.

Oregon Department of Fish and Wildlife. 1996. Species at risk; sensitive, threatened and endangered vertebrates of Oregon. Second Edition, June 1996. Oregon Department of Fish and Wildlife, Wildlife Diversity Program, Portland, Oregon.

Pacific Coast American Peregrine Falcon Recovery Team (PFRT). 1982. Pacific Coast recovery plan for the American peregrine falcon, *Falco peregrinus alatum*. USDI Fish and Wildlife Service, Denver.

Pagel, J.E. 1991. Management and monitoring of peregrine falcon nest sites in northern California and Oregon. *In*: Memoria de Tercer Congresso Internacional de Recursos naturales y Vida Silvestra, The Wildl. Soc. de Mexico.

Palmisano, J.F, R.H. Ellis, and V.W. Kaczynski. 1993. The impact of environmental and management factors on Washington's wild anadromous salmon and trout. Report prepared for the Washington Forest Protection Association and the Washington Department of Natural Resources. Olympia, Washington. 371 pp.

Parker, J. 1980. Great blue herons (*Ardea herodias*) in northwestern Montana: nesting habitat use and the effects human disturbances. M.S. Thesis. University of Montana, Missoula, Montana.

Parker, D.I. 1996. Forest ecology and distribution of bats in Alaska. M.S. Thesis. University of Alaska, Fairbanks, Alaska.

Partners in Flight. 1999. Land bird conservation plans: westside coniferous forest. http://www.gorge.net/natres/pif/westside_sum.html.

Pearson, O.P., M.R. Koford, and A.K. Pearson. 1952. Reproduction of the lump-nosed bat (*Coryrhynus rafinesque*) in California. J. Mammal. 33:273-320.

Perkins, J.M. 1982. Northwest Oregon bat survey. Contract 82-0-4. Oregon Department of Fish and Wildlife, Nongame Wildlife Prog., Portland, Oregon. 52 pp. plus appendices.

Perkins, J.M. 1983. Bat survey of western Oregon Coos, Lane, Douglas counties in relation to habitat type and age class. Unpubl. Rep., Contract 83-0-08. Oregon Dept. Fish and Wildlife, Nongame Wildlife Prog., Portland, Oregon. 72 pp.

Perkins, J.M., J.M. Barss, and J. Peterson. 1990. Winter records of bats in Oregon and Washington. Northwestern Naturalist 71(2):59-62.

Peterjohn, B.G., J.R. Sauer, and W.L. Wink. 1994. The 1992 and 1993 summary of the North American breeding bird surveys. Bird Populations 2:46-61.

Peterson, R.T. 1990. A field guide to western birds. Houghton Mifflin Company, Boston, Massachusetts. 432 pp.

Phinney, L.A. and P. Bucknell. 1975. A catalog of Washington streams and salmon utilization. Volume 2: coastal region. Washington Department of Fisheries. Olympia, Washington.

Pimental, R.A. 1960. Inter- and intrahabitat movements of the roughskin newt. The American Midland Naturalist 63:470-496.

Platts, W.S., M.T. Hill and I.A. Hopkins. 1995. Historical trends in bull trout abundance in Idaho, Montana, Oregon, and Washington (draft report) Unpubl. Rpt. Intermountain Forest Industry Assoc., Couer d'Alene, Idaho.

Poole, A.F. 1987. Regulation of osprey (*Pandion haliaetus*) populations: the role of nest site availability. Pp. 227-234 *in* B.U. Meyburg and R.D. Chancellor (eds.). Proceedings third world conf. on birds of prey and owls. Eilat, Israel.

Potter, I.C. 1980. Ecology of larval and metamorphosing lampreys. Can. J. Fish. Aquat. Sci., Vol 37:1641-1657.

Powell, R.A. 1982. The fisher, life history, ecology, and behavior. University of Minnesota Press, Minneapolis, Minnesota. 237 pp.

Powell, R.A. 1993. The fisher: life history, ecology and behavior. 2nd ed. University of Minnesota Press, Minneapolis, Minnesota. 237 pp.

Powell, R.A., and W.J. Zielinski. 1994. Fisher. Pp. 38-73 *in* L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L. Jack Lyon, and W.J. Zielinski (eds.). The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. Gen. Tech. Rep. RM-254. USDA Forest Service, Rocky Mountain Forest and Range Exp. Sta., Ft. Collins, Colorado. 183 pp.

Pulliainen, E. 1968. Breeding biology of the wolverine (*Gulo gulo* L.) in Finland. Annales Zoologica Fennici 5:338-344.

Pratt, K.L. 1992. A review of bull trout life history. *In*: P. J. Howell and D. V. Buchanan (eds.). Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon. Pp. 5-9

Pratt, K.L. and J.E. Huston. 1993. Status of bull trout (*Salvelinus confluentus*) in Lake Pend Oreille and the lower Clark Fork River: (draft report) Prepared for the WWPC, Spokane, WA.

Pyle, R.M. 1974. Watching Washington butterflies - an interpretive guide to the state's 134 species, including most of the butterflies of Oregon, Idaho, and British Columbia. Seattle Audubon Society, Seattle, Washington. 109 pp.

Pyle, R.M. 1989. Washington butterfly conservation status report and plan. Prepared for the Washington Department of Wildlife, Nongame Program, Olympia, Washington. 217 pp.

Quigley, T.M., and S.J. Arbelbide, technical editors. 1997. An assessment of ecosystem components in the interior Columbia Basin and portions of the Klamath and Great Basins: Volume III. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, Oregon.

Quinn, N.M.S. and J.E. Thompson. 1987. Dynamics of an exploited Canada Lynx population in Ontario. Journal of Wildlife Management. 51:297-305.

Raedeke, K.J. 1998. Streamside management: riparian wildlife and forestry interactions. Institute of Forest Resources, University of Washington, Seattle, Washington. Contribution No. 59. 277 pp.

Ralph, C.J., G.L. Hunt, M.G. Rapheal, and J.F. Piatt. 1995. Ecology and conservation of the marbled murrelet - an overview. Pp. 3-22 *in* Ralph, C.J., G.L. Hunt Jr., M.G. Rapheal, and J. F. Piatt (eds.). Ecology and conservation of the marbled murrelet. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, California. Gen. Tech. Rep. PSW-152.

Raphael, Martin G., and Lawrence L.C. Jones. 1997. Characteristics of resting and denning sites of American martens in central Oregon and western Washington. Pages 146-165. *in* Martes: taxonomy, ecology, techniques, and management. G Proulx, H.N. Bryant, and P.M. Woodard, editors. Provincial Museum of Alberta, Edmonton, Alberta, Canada.

Renaud, C.B. 1997. Conservation status of Northern Hemisphere lampreys (Petromyzontidae). Journal of Applied Ichthyology. 13 (3):143-148.

Richards, J.E., and Beamish, F.W.H. 1981. Initiation of Feeding and Salinity Tolerance in the Pacific Lamprey (*Lampetra tridentata*). Marine Biology. 63 (1):73-77.

Rieman, B.E., and J.D. McIntyre. 1993. Demographic and habitat requirements of bull trout *Salvelinus confluentus*. General Technical Report INT-GTR-302. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Rieman, B.E., and McIntyre, J.D. 1996. Spatial and temporal variability in bull trout redd counts. North American Journal of Fisheries Management. 16:132-141.

Rieman, B.E., and J.D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions of the American Fisheries Society 124:285-296.

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath River basins. North American Journal of Fisheries Management 17:1111-1125.

Rode, M. 1990. Bull trout, *Salvelinus confluentus* (Suckley), in the McCloud River: status and recovery recommendations. Administrative Report Number 90-15. California Department of Fish and Game, Sacramento, CA.

Roffe, T.J., and Mate, B.R. 1984. Abundances and feeding habits of pinnipeds in the Rogue River, Oregon. Journal of Wildlife Management. 48 (4):1262-1274.

Roy, K.D. 1991. Ecology of reintroduced fishers in the Cabinet Mountains of northwest Montana. M.S. Thesis. University of Montana, Missoula, Montana. 94 pp.

Ruediger, W., and R.H. Naney. 1994. Carnivore committee conservation strategy for the lynx, 1995 Maps. USDA forest Service, North Bend Ranger District. North Bend, Washington.

Ruggiero, L.F., K.B. Aubry, A.B. Carey, and M.M. Huff (coords.). 1991. Wildlife and vegetation of unmanaged Douglas-fir forests. General Technical Report PNW-GTR-285. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 533 pp.

Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. 1994. American Marten, Fisher, Lynx, and Wolverine in the western United States. USDA forest Service. General Technical Report RM-254. September 1994.

Ruggiero, L. F; D.E. Pearson; and S.E. Henry. 1998. Characteristics of American marten den sites in Wyoming. Journal of Wildlife Management 62(2):663-673.

Ruiz-Campos, G., and Gonzalez-Guzman, S. 1996. First freshwater record of Pacific lamprey, *Lampetra tridentata*, from Baja California, Mexico. California Fish and Game. 82 (6):144-146.

Russell, J.E., Beamish, F.W.H., and Beamish, R.J. 1987. Lentic spawning by the Pacific lamprey, *Lampetra tridentata*. Canadian Journal of Fisheries and Aquatic Science. 44 (2):476-478.

Sauer, J.R., J.E. Hines, G. Gough, I. Thomas, and B.G. Peterjohn. 1997. The North American Breeding Bird Survey results and analysis. Version 96.2. Patuxent Wildlife Research Center, Laurel, Maryland.

Schirato, G. 1993. A preliminary status report on harlequin ducks in Washington. Unpublished report. Washington Department of Wildlife. Aberdeen, Washington. 4 pp.

Schowalter, D.B., W.J. Dorward, and J.R. Gunson. 1978. Seasonal occurrence of silver-haired bats (*Lasionycteris noctivagans*) in Alberta and British Columbia. Can. Field-Nat. 92:288-291.

Scott, W.B., and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board. Canada. Bulletin. 14.

Sedgwick, J.A., and F.L. Knopf. 1992. Describing willow flycatcher habitats: scale perspectives and gender differences. Condor 94:720-733.

Seglund, A.E. 1995. The use of resting sites by the Pacific fisher. M.S. Thesis. Humboldt St. University, Arcata, California. 66 pp.

Sharp B.E. 1992. Neotropical migrants on national forests in the Pacific Northwest. USDA Forest Service Publ. No. PB93-12885.

Shepard, B., K. Pratt, and J. Graham. 1984a. Life histories of westslope cutthroat and bull trout in the upper Flathead River basin, Montana. Montana Department of Fish, Wildlife, and Parks. Kalispell, Montana. 85 pp. plus 3 appendices.

Shepard, B., S.A. Leathe, T.M. Weaver, and M.D. Enk. 1984b. Monitoring levels of fine sediment within tributaries to Flathead Lake, and impacts of fine sediment on bull trout recruitment. Proceedings of the Wild Trout III Symposium. Yellowstone National Park, Wyoming. On file at: Montana Department of Fish Wildlife, and Parks, Kalispell, Montana.

Shipe, S.J., and W.W. Scott. 1981. The great blue heron in King County, Washington. Unpublished report to Washington Department of Wildlife, Urban Wildlife Program. Mill Creek, Washington.

Short, H.L., and R.J. Cooper. 1985. Habitat suitability index models: great blue heron. USDI Fish and Wildlife Service, Biological Report 82(10.99), Washington D. C.

Shump, K.A., Jr., and A.U. Shump. 1982. *Lasiurus cinereus*. Mammalian Species 185. Am. Society of Mammalogists, New York. 5 pp.

Sidle, W.B., and L.H. Suring. 1986. Management indicator species for the National Forest lands in Alaska. Tech Pub. R10-TP-2, USDA Forest Service.

Simpson, K. 1984. Factors affecting reproduction in great blue herons (*Ardea herodias*). M.S. Thesis. University of British Columbia, Vancouver, B.C., Canada.

Slater, J.R. 1939. Description and life-history of a new *Rana* from Washington. Herpetologica 1:(145–149).

Smith, M.R., P.W. Mattlocks, Jr. and K.M. Cassidy. 1997. Breeding birds of Washington state: location data and predicted distributions. Vol. 4 *in* Cassidy, K.M., C.E. Grue, M.R. Smith, and K.M. Dvornich (eds.). Washington state gap analysis - final report. Seattle Audubon Society Publication in Zoology No. 1. Seattle, Washington. 538 pp.

Smithsonian Institution Museum of Natural History. 1998. Checklist of the Western Hemisphere Carabeidea (Coleoptera). http://nmnhwww.si.edu/gopher-menus ChecklistoftheWesternHemisphereCarabeideaColeoptera.html

Snow, C. 1973. Golden eagle. USDI Bureau of Land Management Habitat Management Series for Unique and Endangered Species. Rep. 7. USDI Bureau of Land Management, Denver, Colorado.

Sodhi, N.S., L.W. Oliphant, P.C. James, and I.G. Warkentin. 1993. Merlin (*Falco columbarius*). *In* The Birds of North America. No. 44. A. Poole and F. Gill (eds.). The Academy of Natural Sciences, Philadelphia and The American Ornithologists' Union.

Spencer, W.D., and W.J. Zielinski. 1983. Predatory behavior of pine martens. J. Mammal. 64:715-717.

Stark, B.P. 1983. A review of the genus *Soliperla* (Plecoptera: Peltoperlidae). Great Basin Naturalist 43:30-44.

Stebbins, R.C. 1985. Peterson field guides: Western amphibians and reptiles. Houghton Mifflin Co., Boston, MA.

Stewart, D. 1981. Salmon, herring lost to an ancient predator. West. Fish. 102(6):44-47.

Stinson, D.W., and J.C. Lewis. 1998. Draft Washington State status report for the fisher. Washington Department of Fish and Wildlife, Wildlife Management Program. Olympia, Washington. 64 pp.

Streeter, R.G., and C.E. Braun. 1968. Occurrence of pine marten, *Martes americana* (Carnivora: Mustelidae) in Colorado alpine areas. Southwestern Naturalist 13:449-451.

Strickland, M.A., C.W. Douglas, M. Novak, and N.P. Hunziger. 1982. Marten. Pp. 599-612 *in* Chapman, J.A., and G.A. Feldhamer (eds.). Wild mammals of North America: biology, management, economics. Johns Hopkins University Press, Baltimore, Maryland.

Strickland, M.A., Douglas, C.W., Novak, M. and N.P. Hunziger. 1982. Fisher. Pp. 586-598 *in* Chapman, J.A., G.A. Feldhammer (eds.). Wild mammals of North America, biology, management, and economics. The Johns Hopkins University Press; Baltimore, Maryland.

Tabor, R.J., J. Chan, and S. Hager. 1988. Predation of sockeye salmon fry by cottids and other predatory fish in the Cedar River and southern Lake Washington. U.S. Fish and Wildlife Service, Olympia, Washington. 54 pp.

Terres, J.K. 1980. The Audubon Society encyclopedia of North American birds. Alfred A. Knopf, New York. 1109 pp.

Thomas, D.W. 1988. The distribution of bats in different ages of Douglas-fir forests. J. Wildl. Manage. 52:619-626.

Thomas, D.W. and S.D. West. 1991. Forest age successions of bats in the Washington Cascades and Oregon Coast Ranges. Pp. *In* Ruggiero, L.F., K.B. Aubry, A.B. Carey, and M.M. Huff (coords.). 1991. Wildlife and vegetation of unmanged Douglas-fir forests. General Technical Report PNW-GTR-285. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 533 pp.

Thomas, J.W., E.D. Forsman, J.B. Flint, E.C. Meslow, and J. Verner. 1990. A conservation strategy for the northern spotted owl. Interagency Scientific Committee to Address the Conservation of the Northern Spotted Owl. Portland, Oregon. 427 pp.

Underwood, K.D., S.W. Martin, M.L. Schuck, and A.T. Scholz. 1995. Investigations of bull trout (*Salvelinus confluentus*), steelhead (*Oncorhynchus mykiss*), and spring chinook (*O. tshawytscha*) interactions in southeast Washington streams. 1992 final report prepared for Bonneville Power Administration, Portland, Or.

U.S. Department of Agriculture and U.S. Department of the Interior. 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl. Portland, Oregon.

U.S. Department of Agriculture. 1996. Green River watershed analysis. U.S. Forest Service. Mt. Baker-Snoqualmie National Forest, North Bend Ranger District. North Bend, Washington.

U.S. Department of Agriculture. 1998. Final Environmental Impact Statement for the I-90 Land Exchange. Gifford Pinchot, Mount Baker-Snoqualmie, and Wenatchee National Forests.

U.S. Department of Commerce. 1997. Impact of sea lions and seals on Pacific Coast salmonids. National Oceanic and Atmospheric Administration. NOAA-NWFSC Tech Memo 28.

U.S. Department of the Interior and U.S. Department of Commerce. 1996. Endangered species habitat conservation planning handbook. USDI Fish and Wildlife Service and USDC National Marine Fisheries Service. 61 FR 63854. Issued December 2, 1996.

U.S. Department of the Interior. 1995. Alluvium distribution in Lake Mills, Glines Canyon Project, and Lake Aldwell, Elwha Project, Washington. Elwha Technical Series PN-95-4. Bureau of Reclamation, Pacific Northwest Region. Boise, Idaho.

U.S. Fish and Wildlife Service. 1982. Grizzly bear recovery plan. U.S. Department of the Interior, Fish and Wildlife Service, Denver, Colorado. 195 pp.

U.S. Fish and Wildlife Service. 1986. Pacific bald eagle recovery plan. U.S. Department of the Interior, Fish and Wildlife Service, Portland, Oregon. 163 pp.

U.S. Fish and Wildlife Service. 1987. Northern Rocky Mountain wolf recovery plan. USDI Fish and Wildlife Service, Denver, Colorado. 119 pp.

U.S. Fish and Wildlife Service. 1990a. 1990 Status review: northern spotted owl; *Strix occidentalis caurina*. Report to the Fish and Wildlife Service, Portland, Oregon. 95pp.

U.S. Fish and Wildlife Service. 1990b. Formal consultation on the U.S. Forest Service timber sales awarded prior to the Section 18 timber sales schedule. Fish and Wildife Service, Portland, Oregon. 33 pp.

U.S. Fish and Wildlife Service. 1990c. Formal consultation on the U.S. Foest Service timber sales, Section 18 timber sales schedule. U.S. Fish and Wildlife Service, Portland, Oregon. 32 pp.

U.S. Fish and Wildlife Service. 1992. Recovery plan for the northern spotted owl - draft. U. S. Department of the Interior, Portland, Oregon. 662 pp.

U.S. Fish and Wildlife Service. 1993. Grizzly recovery plan (revised). U.S. Department of the Interior, Fish and Wildlife Service, Missoula, Montana. 181 pp.

U.S. Fish and Wildlife Service. 1994. Biological opinion for Alternative 9 of the final supplemental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Fish and Wildlife Service, Portland, Oregon. 52 pp.

U.S. Fish and Wildlife Service. 1995. Species account for the bald eagle (*Haliaeetus leucocephalus*). USDI Fish and Wildlife Service. World Wide Web page: www.fws.gov/r9extaff/biologues/bio_eagl.html.

U.S. Fish and Wildlife Service. 1996a. An Environmental Alternatives Analysis for a 4(d) Rule for the Northern Spotted Owl. U.S. Fish and Wildlife Service. http://www.r1.fws.gov/4deaa/4deaa.html

U.S. Fish and Wildlife Service. 1996b. Intra-Service consultation on the proposed issuance of an incidental take permit (PRT-808398) for northern spotted owl, marbled murrelets, grizzly bears and gray wolves to Plum Creek Timber Company (FWS Ref. 1-3-96-190) and approval of an unlisted agreement for all vertebrate species.

U.S. Fish and Wildlife Service. 1997a. Recovery plan for the threatened marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. USDI Fish and Wildlife Service, Portland, Oregon. 203 pp.

U.S. Fish and Wildlife Service. 1997b. Grizzly bear recovery plan. Supplement: north Cascades ecosystem recovery plan chapter. USDI Fish and Wildlife Service, Missoula, Montana. 35 pp. plus appendix.

U.S. Fish and Wildlife Service. 1997c. Intra-Service memorandum and biological opinion on the proposed issuance of an incidental take permit (PRT-812521) for northern spotted owls, marbled murrelets, gray wolves, grizzly bears, peregrine falcons, Aleutian Canada geese, Columbian white-tailed deer, and Oregon spotted butterfly and the approval of an Implementing Agreement for the Washington State Department of Natural Resources HCP (FWS Ref. 1-3-96-FW-594.

U.S. Fish and Wildlife Service. 1998a. Biological opinion for the Lancaster Timber Sale, Quinault Indian Nation (FWS Ref: 1-3-98-F-0047). Fish and Wildlife Service. Western Washington Office. Lacey, Washington. April 2, 1998.

U.S. Fish and Wildlife Service. 1998b. Reinitiation of the biological opinion and conference opinion on the amendment of an incidental take permit (PRT-812521) for the Washington State Department of Natural Resources' Habitat Conservation Plan to include bull trout (*Salvelinus confluentus*) on the permit (FWS Ref: 1-3-96-FW-594; X-Ref.: 1-3-9-HCP-013). Fish and Wildlife Service. Western Washington Office. Lacey, Washington. December 18, 1998.

U.S. Fish and Wildlife Service. 1998c. Final biological opinion for the Quinault North Boundary Area Unit Management Plan, Quinault Indian Nation (FWS Ref: 1-3-98-F-212). Fish and Wildlife Service. Region 1 Regional Office. Portland, Oregon. January 28, 1998.

U.S. Fish and Wildlife Service. 1998d. Northern goshawk status review. Office of Technical Support, U. S. Fish and Wildlife Service, Portland, Oregon. 152 pp. plus appendices.

U.S. Fish and Wildlife Service. 1999a. Reinitiation of Intra-Service Biological Opinion on the Modification of Plum Creek's Cascades Habitat Conservation Plan to accommodate the Interstate-90 Land Exchange. X-Reference: Incidental Take Permit (PRT-808398) (FWS Reference: 1-3-00-FR-0245; X-Reference: 1-3-96-FW-190; 1-3-98-FR-0357;).

U.S. Fish and Wildlife Service. 1999b. Biological opinion for the Point Roberts Golf Course, NWP #26: 998-4-02226, Yamato Development Canada, Inc.

Van Daele, L.J., and H.A. Van Daele. 1982. Factors affecting the productivity of ospreys nesting in west-central Idaho. Condor 84:292-99.

Van Zyll de Jong, C.G. 1975. The distribution and abundance of the wolverine (*Gulo gulo*) in Canada. Can. Field Naturalist. 89:431-437.

Van Zyll De Jong, C.G. 1979. Distribution and systematic relationships of long-eared *Myotis* in western Canada. Can. J. Zoology 57:987-94.

Van Zyll de Jong, C.G. and Nagorsen. 1994. A review of the distribution of *Myotis keenii* and *Myotis evotis* in British Columbia and adjacent the United States. Draft Manuscript. 26 pp. Plus figures.

Vermeer, K. 1973. Some aspects of nesting requirements of common loons in Alberta. Wilson Bull. 85:429-435.

Vos, K.K., R.A. Ryder, and W.D. Graul. 1985. Response of breeding blue herons to human disturbance in north central Colorado. Colonial Waterbirds 8(1):13-22.

Washington Department of Fisheries. 1948. Report on the condition of spawning tributaries of the Lake Washington watershed. Washington State Archives, Department of Fisheries, Lake Washington: Cedar River, 1927-54, Acc# 72-6-566, Loc. Lo A-1-6, Box 0061-23.

Washington Department Wildlife. 1991. Management recommendations for Washington's priority habitats and species. Rodrick, E., and R. Milner (eds.). Washington Department of Wildlife, Wildlife Management, Fish Management, and Habitat Management Divisions, Olympia, Washington.

Washington Department of Fish and Wildlife. 1991. Band-tailed pigeon. Management recommendations for priority species. Olympia, Washington.

Washington Department of Fisheries, Washington Dept. of Wildlife, Western Washington Treaty Tribes. 1993. 1992 Washington state salmon and steelhead stock inventory. Olympia, Washington. 211pp.

Washington Department of Fish and Wildlife. 1989. Washington Department of Fish and Wildlife, revised instream flow guidelines. Washington Department of Fish and Wildlife, Olympia, Washington.

Washington Department of Wildlife. 1993a. Status of the Larch Mountain salamander (*Plethodon larselli*) in Washington. Unpublished Report. Washington Department of Wildlife, Olympia, Washington.

Washington Department of Wildlife. 1993b. Status of the western pond turtle (*Clemmys marmorata*). Washington Department of Wildlife, Olympia, Washington.

Washington Department of Wildlife. 1993c. Status of the North American Lynx (*Lynx canadensis*). Washington Department of Wildlife, Olympia, Washington.

Washington Department of Wildlife. 1993d. Status of the marbled murrelet (*Brachyramphus marmoratus*) in Washington. Unpublished Report. Washington Department of Wildlife, Olympia.

Washington Department of Wildlife. 1993e. Townsend's big-eared bat (*Plecotus townsendii*). Unpublished draft report. Washington Department of Wildlife, Olympia, Washington.

Washington Department of Fish and Wildlife. 1994a. Draft management recommendations for Washington's priority habitats and species. Unpublished Report, Washington Department of Fish and Wildlife, Olympia, Washington.

Washington Department of Fish and Wildlife. 1994b. Nongame data systems. Priority habitat and species database. Washington Department of Fish and Wildlife, Olympia, Washington.

Washington Department of Fish and Wildlife. 1996a. Priority habitats and species list. Habitat Program, Washington Department of Fish and Wildlife, Olympia, Washington.

Washington Department of Natural Resources. 1996b. Draft environmental impact statement for the draft habitat conservation plan. Prepared for the Washington State Department of Natural Resources. Olympia, Washington. March 22, 1996.

Washington Department of Fish and Wildlife. 1996c. Priority habitats and species program database search. Washington Department of Fish and Wildlife, Olympia, Washington.

Washington Department of Fish and Wildlife. 1997a. Washington state salmonid stock draft inventory: bull trout/Dolly Varden. Washington Department of Fish and Wildlife, Olympia, Washington.

Washington Department of Fish and Wildlife. 1997b. Wild salmonid policy. Final Environmental Impact Statement. September 10, 1997.

Washington Department of Fish and Wildlife. 1997c. Spotted owl site center data set. Washington Department of Fish and Wildlife, Olympia, Washington.

Washington Department of Fish and Wildlife. 1997d. Spotted owl site center data set. Washington Department of Fish and Wildlife, Olympia, Washington.

Washington Department of Fish and Wildlife. 1997e. Historic summary of adult sockeye salmon returns to Lake Washington: Tables 1 and 2. Unpublished data. Olympia, Washington.

Washington Department of Fish and Wildlife. 1997f. WDFW Species of concern: bald eagle. World Wide Web page www.wa.gov/wdfw/wlm/diversty/soc/bald.htm. Accessed 9 June 1998.

Washington Department of Natural Resources. 1997g. Habitat conservation plan. Washington Department of Natural Resources, Olympia, WA. V. 1.

Washington Department of Fish and Wildlife. 1998a. Washington State Threatened Species, designated in Washington Administrative Code 232-12-011.

Washington Department of Fish and Wildlife. 1998b. Salmonid stock inventory: appendix bull trout and Dolly Varden. Olympia, Washington. 437 pp.

Washington Department of Natural Resources. 1999. Forest and Fish Report. Forest Practices Board, Olympia, Washington.

Watson, J.W., K.R. McAllister, D.J. Pierce, and A. Alvarado. 1998. Movements, habitat selection, and population characteristics of a remnant population of Oregon spotted frogs (*Rana pretiosa*). Annual Progress Report. Washington Department of Fish and Wildlife. 19 pp.

Weaver, J. 1993. Lynx, wolverine, and fisher in the western United States. [Unpubl. Rep.] Missoula, MT: Northern Rockies Conservation Cooperative. 132 pp.

Weaver, J.L. and G. Amato. 1999. Lynx surveys in the Cascade Range, Washington and Oregon. Wildlife Conservation Society. 16 pp.

Webb, R.S. and L.S. Forbs. 1982. Colony establishment in an urban site by great blue herons. Murrelet 63(3):91-92.

Weir, R.D. 1995. Diet, spatial organization, and habitat relationships of fishers in South-Central British Columbia. M.S. Thesis. Simon Fraser Univerisity, Burnaby, British Columbia. 139 pp.

Welsh, H.H. 1990. Relictual amphibians and old-growth forests. Conservation Biology 4(3):309-319.

Welsh, H.H., Jr., and L.M. Ollivier. 1992. Effects of sediments on the amphibians of Prairie Creek Redwoods State Park and Redwood National Park. Report to California Department of Transportation.

Welsh, H.H., Jr., and A.J. Lind. 1996. Habitat correlates of the southern torrent salamander, *Rhyacotriton variegatus* (Caudata: Rhyacotritonidae) in northwestern California. J. Herpetol. 30:385-398.

Werschkul, D.F., E. McMahaon, and M. Leitschuh. 1976. Some effects of human activities on the great blue heron in Oregon. Wilson Bull. 88(4):660-662.

Whal, T.R. and D.R. Paulson. 1991. A guide to bird feeding in Washington. T.R. Wahl, Bellingham, Washington.

Whitaker, J.O. Jr., C Maser, and M. Leitschuh. 1977. Food habits of bats of western Oregon. Northwest Science 51:46-55.

Whitaker, John O. Jr. 1980. The Audubon Society field guide to North American Mammals. Alfred A. Knopf, Inc, New York, New York. 744 pp.

Whitaker, J.O. Jr., C Maser, and M. Leitschuh. 1981. Food habits of bats of western Oregon based on stomach and scat analysis. Northwest Science 55:281-292.

Whyte, J.N. C., Beamish, R.J., Ginther, N.G., and Neville, C.E. 1993. Nutritional condition of the Pacific lamprey (*Lampetra tridentata*) deprived of food for periods of up to two years. Canadian Journal of Fisheries and Aquatic Science. 50 (3):591-599.

Wielgus , R.B. F.L. Bunnell, W. Wakkinen, and P. Zager. 1994. Population dynamics of Selkirk Mountains grizzly bears. J. Wildlife. Manage 58 (2):266 - 272.

Williams, R.N., R.P. Evans, and D.K. Shiozawa. 1995. Mitochondrial DNA diversity in bull trout from the Columbia River basin. Idaho Bureau of Land Management Technical Bulletin No. 95-1.

Williams, J.E., J.E. Johnson, D.A. Hendrickson, S. Contreras-Balderas, J.D. Williams, M. Navarro-Mendoza, D.E. McAllister, and J.E. Deacon. 1989. Fishes of North America - endangered, threatened, or of special concern: 1989. Fisheries (Bethesda) 14(6): 2-20.

Wilson, D.E. 1982. Wolverine. Pages 644-652 *in* J.A. Chapman and G.A. Feldhamer, editors. Wild Mammals of North America: biology, management, and economics. John Hopkins University Press, Baltimore, Maryland.

Wydoski, R.S., and R.R. Whitney. 1979. Inland fishes of Washington.. University of Washington Press, Seattle, Washington. 220 pp.

Young, S.P. and E.A. Goldman. 1944. The wolves of North America. Am. Wildlife. Inst., Washington, D.C. 385 pp.

Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White (eds.). 1990. California's Wildlife. Volume II. Birds. California Department of Fish and Game, Sacramento, California. November 1990.

Zielinski, W.J., R.L. Truex, C.V. Ogan, and K. Busse. 1997. Detection surveys for fisher and American marten in California, 1989-1994: Summary and interpretations. Pp. 372-392 *in* Proulx, G., H.N. Bryant, and P.M. Woodard (eds.). *Martes*: taxonomy, ecology, techniques, and management. Provincial Museum of Alberta, Edmonton, Alberta.