Section 4.6 Contents

4.6 Effects of the HCP on Species of Concern

4.6.1 Introduction to Effects Analysis

The federal ESA requires that an applicant for an incidental take permit must ". . . to the maximum extent practicable, minimize and mitigate the impacts of such taking . . ." so that the ". . . taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild . . ." (16 U.S.C. 1539(a)(2)(B)). Previous sections in Chapter 4 of this HCP have presented the conservation and mitigation measures the City proposes to meet the foregoing standards.

The granting of an incidental take permit by the Services requires an analysis of the effects of the HCP as the basis for a biological opinion on each species to be covered by the permit. Section 4.6 summarizes information included in this HCP that is relevant to the biological opinions for the species addressed by this HCP. The Services will use the information in Section 4.6, along with other information presented in this HCP and otherwise available to the Services, to determine whether sufficient information exists to issue an incidental take permit for each of the species addressed in the HCP and the level of incidental take to be allowed under the incidental take permit for each covered species.

Note that the term "take" technically applies only to those species listed under the ESA as endangered, and the take prohibitions described in Section 9 of the ESA apply to endangered species. Take applies to species listed as threatened only if the respective Service publishes a rule to that effect under Section 4(d) of the ESA. The USFWS has a standing rule that the take prohibitions under Section 9 of the ESA apply to any species listed as threatened.

The remaining subsections of Section 4.6 present a description of how the species were grouped for analysis (Section 4.6.2); a tabular summary of the minimization and mitigation measures the City proposes to meet the standards of the ESA (Section 4.6.3); and an analysis of effects of the HCP and activities allowed under the HCP, presented for individual species and groups of species (Section 4.6.4).

Conservation and mitigation strategies are generally organized by biological community types, as described in Section 4.2.2. Habitat and community associations for each species addressed by the HCP are given in Table 4.2-3.

The effects analyses address both City operations covered by the incidental take permit and the conservation and mitigation measures included in the HCP. Both negative and positive effects are described. As described in previous sections of this HCP, the primary activities that could affect the species addressed in the HCP, both positively and negatively, include:

- Construction, use, and maintenance of forest roads, including use of gravel pits and rock sources;
- Operation of the Landsburg Diversion Dam;
- Operation of the Chester Morse Lake reservoir complex to supply drinking water and provide instream flows for fish;
- Regulation of instream flows;
- Operation of the hydroelectric power generation facility at Cedar Falls;
- Activities described in Section 4.2 in the subsection entitled "City Operations and Activities within the Municipal Watershed," including facility maintenance, right-of-way maintenance, the public education program, recreation at specific sites, scientific research (and maintenance of research facilities), habitat projects not associated with the HCP, cultural resource management, construction of an interpretive center at Rattlesnake Lake;
- Conservation and mitigation measures that entail active intervention, such as road improvements and deconstruction, forest habitat restoration (including thinning and planting trees), construction and operation of fish passage facilities at Landsburg, downstream habitat restoration projects, and operation of a sockeye hatchery; and
- Conservation and mitigation measures that involve passive protection.

The general effects of specific measures on the species addressed have been described throughout the previous sections of Chapter 4. Many of these effects were discussed largely on a habitat basis, and were discussed in the context of a single measure or limited set of measures. The purpose of Section 4.6 is to present, in a fairly systematic format, the effects of the HCP as a whole by species or by small groups of species that share habitat associations and common effects.

4.6.2 Grouping of Species for Discussion of Effects

To reduce redundancy, yet still adequately represent the effects of the HCP and City activities on the species addressed by the HCP, some of the species were grouped for the effects analysis. Species were first grouped by community and habitat association (see Table 4.2-3), then subgroups were formed based on shared life history traits, finer similarities and differences in habitat associations, and similarity of the expected effects of minimization and mitigation measures.

Table 4.6-1 Grouping of species for the effects analysis.

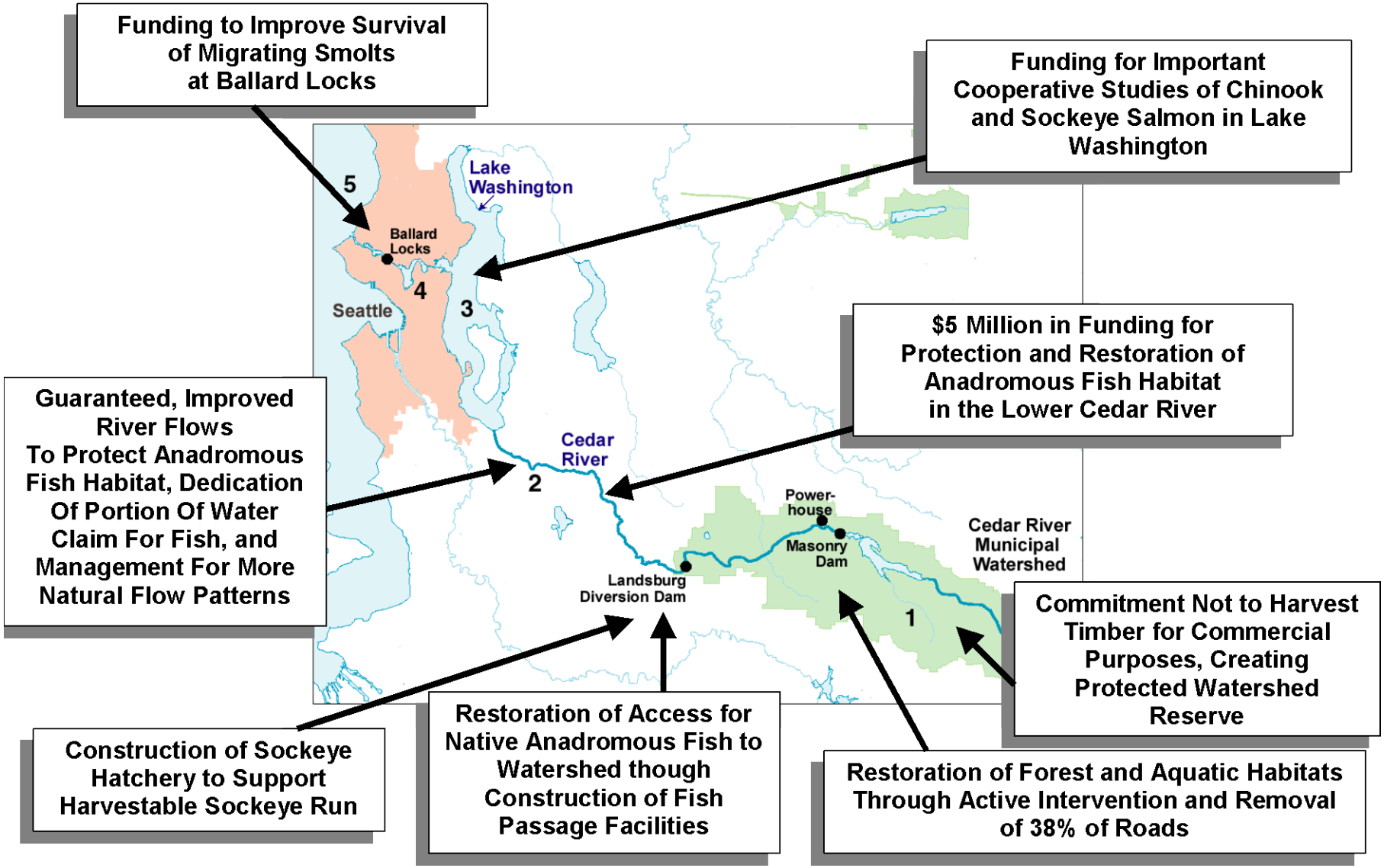
Species	Group Number
Aquatic and Riparian Ecosystem	
Common Loon	**4**
Bull Trout	**5**
Pygmy Whitefish	**6**
Sockeye Salmon	**7**
Chinook Salmon, Coho Salmon, Steelhead Trout	**8**
Bald Eagle	**9**
Harlequin Duck	**13**
Great Blue Heron	**14**
Osprey	**15**
Willow Flycatcher	**16**
Northern Water Shrew, Masked Shrew	**25**
River Lamprey, Pacific Lamprey	**29**
Kokanee	**30**
Cutthroat Trout (sea run)	**31**
Tailed Frog, Pacific Giant Salamander, Cascade Torrent Salamander	**32**
Long-toed Salamander, Roughskin Newt, Northwestern Salamander, Western Toad, Red-legged Frog, Cascades Frog, Oregon Spotted Frog, Western Pond Turtle	**33**
Van Dyke's Salamander	**34**
Papillose Taildropper, Fender's Soliperlan Stonefly, Carabid Beetles (6 species)	**37**
Beller's Ground Beetle, Hatch's Click Beetle, Long-horned Leaf Beetle	**38**
Carabid Beetles (3 species)	**39**
Snail (*Valvata mergella*)	**40**
Late-successional and Old-growth Communities	
Northern Spotted Owl	**1**
Marbled Murrelet	**2**
Northern Goshawk	**3**
Three-toed Woodpecker	**17**
Pileated Woodpecker, Vaux's Swift	**18**
Olive-sided Flycatcher	**19**
Brown Creeper	**20**
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, Townsend's Western Big-eared Bat	**26**
Fisher, Marten, Wolverine	**27**
Canada Lynx	**28**
Western Redback Salamander	**35**
Johnson's (Mistletoe) Hairstreak	**41**
Blue-gray Taildropper, Puget Oregonian, Oregon Megomphix	**42**
Special Habitats	
Peregrine Falcon	**10**
Grizzly Bear	**11**
Gray Wolf	**12**
Band-tailed Pigeon	**21**
Rufous Hummingbird, Western Bluebird	**22**
Golden Eagle, Merlin	**23**
Black Swift	**24**
Larch Mountain Salamander	**36**

4.6.3 Summary of Minimization and Mitigation Measures

INTRODUCTION

This section summarizes the minimization and mitigation measures presented in sections 4.2 through 4.5 of this chapter. Habitat-based measures for the municipal watershed are discussed in detail in Section 4.2.2 (Watershed Management Mitigation and Conservation Strategies) for the Aquatic and Riparian Ecosystem, Late-successional and Old-growth Forest Communities, and Special Habitats. Measures to mitigate for the effects of the Landsburg Diversion Dam on anadromous fish are described in detail in Section 4.3.2. Measures related to management of instream flows to protect habitat for anadromous fish species are described in Section 4.4.2. Species-specific measures are described in detail in the subsection in Section 4.2.2 entitled "Species Conservation Strategies" for the 14 species of greatest concern. Applicable research and monitoring are discussed in Section 4.5. All these measures integrate on a regional basis to provide many benefits for the species addressed by the HCP (Figure 4.6-1).

Figure 4.6-1. Major contributions of HCP to regional fish and wildlife addressed by the HCP.



INTEGRATION OF MINIMIZATION AND MITIGATION MEASURES

The minimization and mitigation measures were developed on a long-term, integrated, landscape basis (Figure 4.6-1). The minimization and mitigation measures for the municipal watershed include site-specific measures to minimize or avoid impacts of City activities and to rehabilitate or restore habitats. On a landscape level, these measures will result in recruitment of additional late-seral forest habitat, acceleration of development of late-successional forest characteristics through silvicultural interventions, and reduction of anthropogenic sediment input to streams through improvement and decommissioning of forest roads. Measures that entail active intervention, including restoration and ecological thinning in forests and culvert replacement at stream crossings, entail some short-term habitat disturbance but will be designed to produce long-term habitat benefits.

With the commitment not to harvest timber for commercial purposes, these measures for the municipal watershed collectively will combine to produce landscape-level habitat improvements that, over the term of the HCP and barring catastrophes, should:

- Compared to current conditions in the municipal watershed, increase the total amount of mature, late-successional, and old-growth forest by a factor of nearly five, increase the total amount of mature and late-successional forest by a factor of thirteen, and increase the amount of mature and late-successional forest at elevations below 3,000 ft elevation by a factor of about forty-one;
- Eliminate early-seral forest habitat (less then 30 years old) created by commercial timber harvest, with early seral habitat being created primarily by natural processes and disturbances;
- Through active silvicultural intervention, accelerate development of late-successional and old-growth forest habitat conditions in about one-fifth of the forest in previously harvested areas;
- Through protection and active intervention, contribute significantly to restoring the natural ecological functions of large areas of riparian forest over time;
- Through protection and active intervention, contribute significantly to improving and restoring stream habitats over time in many areas;
- Restore and improve landscape connectivity for aquatic, riparian, and upland forest habitats through habitat improvements and through elimination or reduction of barriers to movement; and
- Improve water quality, with benefits for aquatic species in the municipal watershed and downstream of Landsburg.

The minimization and mitigation measures applying to the four anadromous salmonids addressed (chinook, sockeye, and coho salmon, and steelhead trout) are presented in three places in Chapter 4, and combine to provide a comprehensive set of conservation measures with multiple landscape-level effects from headwaters to the marine environment.

First, Section 4.2 presents minimization and mitigation measures for the municipal watershed that are also applicable to anadromous fish, especially to native stocks and species, which will be allowed into the protected municipal watershed with construction of fish passage facilities at Landsburg (Section 4.3). Because the municipal watershed contains the headwaters for the major tributary to Lake Washington, its protection is essential to the long-term well being of anadromous fish in the Lake Washington Basin.

Second, Section 4.3 presents comprehensive measures developed to mitigate for the blockage to anadromous fish posed by the Landsburg Diversion Dam. This mitigation will provide:

- Access for chinook, coho, and steelhead, as well as other native anadromous species, to some of the best refuge habitat in the region, with improvements to the Landsburg Diversion Dam and drinking water intake to minimize impacts of these facilities on anadromous fish;
- Interim mitigation for chinook salmon, coho salmon, and steelhead trout that includes funding for either key research on these species or emergency population support measures, if warranted, for one or more of these three species;
- More than $1.6 million in funding for habitat protection and restoration downstream of the municipal watershed within King County jurisdiction;
- Measures that will contribute to maintenance of harvestable populations of sockeye though direct population support provided by a fry-production facility to replace the current interim facility;
- Approximately $3.5 million in funding for monitoring and research related to the sockeye fry-production program to support adaptive management; and
- Collection of information on run sizes, timing, and distribution in the Cedar River that will make possible improved harvest management by the fisheries co-managers (WDFW and the Tribe).

Third, Section 4.4 presents measures related to management of instream flows to protect habitat in the Cedar River, along with other measures to protect and restore habitat for anadromous fish in the mainstem of the Cedar River and other measures related to water management that will provide benefits to anadromous fish and the riverine ecosystem on which they depend. The measures described in Section 4.4 include not only commitments to minimum and supplemental flows for key life stages and species but also:

- Flexible, adaptive management through an oversight commission that can provide improved flows and habitat when environmental conditions permit;
- Improvements to the hydroelectric facilities that will reduce mortality and injury to fish above Landsburg;
- Commitments regarding rate of decrease in flows (downramping) that will protect young fish from stranding during water supply and hydroelectric operations;

- A commitment to manage instream flows to more closely mimic natural patterns of flow that sustain the riverine ecosystem;
- Approximately $3.3 million in funding for habitat protection and restoration downstream of the municipal watershed within King County jurisdiction (in addition to the more than $1.6 million included in Section 4.3); and
- Adequate water for operating the Ballard Locks and funding for projects designed to increase survival of smolts moving through the locks to Puget Sound, a passage now known to be a source of significant mortality.

SUMMARY OF MINIMIZATION AND MITIGATION MEASURES

Consistent with the organization of the Watershed Management Mitigation and Conservation Strategies (Section 4.2), the minimization and mitigation measures are presented in Table 4.6-2 by the community-based strategies described in Section 4.2.2. Short names are given to each group of measures in Table 4.6-2 that apply in concert to produce specific or general effects on particular species or groups of species. Table 4.6-3 summarizes specific measures for each of the 14 species of greatest concern that are *additional* to those summarized in Table 4.6-2.

Please note that the descriptions of minimization and mitigation measures presented in tables 4.6-2 and 4.6-3 are necessarily simplified and incomplete. These tables are presented here to provide, in one place, a better overview of these measures in their totality. The reader is referred to the sections of chapters 4 and 5 cited in the tables for complete, accurate descriptions of all minimization and mitigation measures included in this HCP, as well as discussions of their effects on habitats.

Table 4.6-4 shows how each of the sets of minimization and mitigation measures apply by species or groups of species. Short names for sets of measures are as presented in Table 4.6-2.

Table 4.6-2. Summary of minimization and mitigation measures.

Subsection	Community-based focus	Short name	Major measures included
Section 4.2: Watershed Management Mitigation and Conservation Strategies			
4.2.2: Watershed management mitigation and conservation strategies	Late-successional and old-growth forest communities	Reserve status	• Commitment not to harvest timber for commercial purposes in the municipal watershed Protection through reserve status of: • All old growth forest • Spotted owl CHU • All second-growth outside limited developed areas
	Late-successional and old-growth forest communities	Habitat restoration	To accelerate development of late-successional forest characteristics and increase structural and species diversity, conduct: • Restoration planting • Restoration thinning • Ecological thinning
	Aquatic and riparian ecosystem	Reserve status	• Commitment not to harvest timber for commercial purposes in the municipal watershed Protection through reserve status of: • All streams, open water bodies, and wetlands, with riparian habitat • Inner gorges and headwalls (to prevent erosion and landslides) • Sensitive soils (to prevent erosion and habitat damage) • Wetland complexes
	Aquatic and riparian ecosystem	Habitat restoration	• To reduce sediment loading to streams, deconstruction of about 38% of roads (no longer needed for commercial timber harvest) over about 20 years • To reduce erosion and landslide potential, road improvement (stabilization) • To reduce sediment loading to streams, replacement of stream-crossing structures that are inadequate for peak flows • To restore stream connectivity, replacement of stream-crossing culverts that block fish passage • To reduce erosion into streams, stabilization of streambanks • To restore natural forest structure and function in some previously harvested areas, conifer-underplanting, restoration thinning, and ecological thinning

Subsection	Community-based focus	Short name	Major measures included
			• To improve stream habitats, placement of large woody debris in deficient stream channels
	Aquatic and riparian ecosystem	Management guidelines	• To reduce chance of landslides and erosion, strict standards for road construction, stabilization, and decommissioning • Improved standards for road maintenance and repair • Minimum road construction, and then only with previous geotechnical analysis and under strict standards • No ground-based equipment with in 50 ft of aquatic habitats • No tree cutting with 25 ft of streams, except when needed for restoration projects • No tree cutting within wetlands, except in limited circumstances when needed for restoration projects
	Special habitats	Reserve status	• Commitment not to harvest timber for commercial purposes in the municipal watershed Protection through reserve status of: • Talus and felsenmeer slopes, cliffs, and rock outcrops • Meadows and persistent shrub • Taylor town site (deciduous forest)
	Special habitats	Management guidelines	• Limitations and restrictions on activities within 200 ft of Special Habitats
	All	Public access	• Current closure of watershed to unsupervised public access, providing protection from human disturbance, hunting and fishing mortality, and poaching

Subsection	Community-based focus	Short name	Major measures included
	All	Management guidelines	• Prevention and suppression of forest fires • Watershed assessment prescriptions (Appendix 16) • Guidelines for incidental and catastrophic timber salvage • Reforesting with diverse native tree species • Restrictions on log sales and on use of any net revenues form log sales • Possible certification of forest management program under SmartWood program • No use of herbicides • Use of native seeds and plant materials in revegetation of disturbed areas • Restrictions on activities that could affect habitat and species • Forest thinning *only* for habitat improvement
	All	Species conservation strategies	• See Table 4.6-3 (for 14 species of greatest concern)
	All	Oversight and adaptive management	• Oversight by agencies, public, and outside scientists through HCP Oversight Committee (Chapter 5) • Monitoring and provisions to alter mitigation to better meet conservation objectives (Section 4.5 and Chapter 5)
Section 4.3: Minimizing and Mitigating the Effects of the Anadromous Fish Barrier at the Landsburg Diversion Dam			
4.3.2: Conservation Strategies	Aquatic and riparian (anadromous fish)	Interim: chinook, coho, and steelhead	Either one or a combination of both: • Population studies to support development of best long-term protection and rehabilitation measures • Emergency artificial propagation (if needed for any species)
	Aquatic and riparian (anadromous fish)	Interim: sockeye	• Extended funding of existing interim hatchery (fry-production facility) • Evaluation of short-term rearing of hatchery fry

Subsection	Community-based focus	Short name	Major measures included
	Aquatic and riparian (anadromous fish)	Long-term: chinook, coho, and steelhead	• Fish ladders at dam and pipeline crossing at Landsburg, providing access to 17 miles of protected, refuge habitat in municipal watershed • Fish sorting and holding facilities to allow separation of sockeye from other species and their return downstream. • Downstream passage facilities for adult and juvenile fish at Landsburg Dam • Fish screening and bypass facilities to prevent entrainment of juvenile (newly emerged fry through smolts) and adult salmonids into the water intake at Landsburg Dam • Maintenance and operation of fish passage facilities • Water quality monitoring for effects of salmon carcasses, to supply information allowing either an increase or decrease in number of fish allowed upstream; if a decrease, funding to be provided for alternative mitigation • Monitoring of fish passage and screening facilities • Measures for municipal watershed (under 4.2.2 above) • Instream flow protection between Lower Cedar Falls and Lake Washington, downramping prescriptions, and tailrace barrier at Cedar Falls hydroelectric project (under 4.4.2 below) • More than $1.6 million in funding for habitat protection and restoration on the Cedar River downstream of Landsburg (see funding also under 4.4.2 below)
	Aquatic and riparian (anadromous fish)	Long-term: sockeye	• Funding for construction and operation of fry-production facility • Monitoring and research to determine effectiveness and effects of mitigation program (see Table 4.6-3)
	Aquatic and riparian (anadromous fish)	Oversight and adaptive management	• Oversight committee to advise City on mitigation • Joint decision-making of the City and agencies to adaptively manage hatchery and other mitigation, to ensure conservation objectives are met
Section 4.4: Instream Flow Management Strategy			
4.4.2: Conservation Strategies for Instream Flow Management	Aquatic and riparian (anadromous fish)	Stream flows below Landsburg	• Binding minimum flows in the Cedar River, based on extensive, cooperative studies, that benefit all life history stages of chinook, sockeye, coho, and steelhead as prioritized by interagency Cedar River Instream Flow Committee • Annual instream flow pattern that reflects natural flow patterns and the body of scientific information about Cedar River salmonids

Subsection	Community-based focus	Short name	Major measures included
			• Instream flow regime and adaptive management designed to minimize conflicts among species Minimum flow commitments: • From early October through early August, flow commitments greater than or equal to flows required to provide maximum habitat (WUA) for key species and life history stages • From early August through late September, commitments providing 98-99% of maximum WUA for steelhead rearing • Flows greater than or equal to the level that provides maximum WUA for chinook and sockeye spawning for most of the fall • Winter/spring flows to protect salmon redds from dewatering • Summer block (volume) of water (2,500 acre ft) in all normal years to protect steelhead redds • Summer flows to protect rearing steelhead and coho • Flows during drought years (critical flows) that provide protection for species Supplemental flows: • Additional block of water (3,500 acre-feet) during summer to reduce risk of steelhead redd dewatering in 70% of normal years • Additional normal and critical flows for early spawning chinook and sockeye when overflow dike flashboards are in place • High normal flows in at least 63% of all normal years for increased sockeye cumulative spawning habitat and edge habitat, and higher flows for chinook spawning • Increased flow for outmigrating sockeye fry 70% of time from early February through mid-April in normal years To help maintain the riverine ecosystem: • Management of river flows to achieve more natural patterns, taking into consideration the disturbed nature of channel in lower Cedar River Conserving water for fish: • City efforts to dedicate one-third (100 mgd) of Seattle's water right claim for fish • City commitment to goal of reducing per capita water consumption over a

Subsection	Community-based focus	Short name	Major measures included
			decade by 10% in both Seattle and wholesale service areas Based on 50-year projections of expected, actual river flows below Landsburg: • Cumulative WUA for priority species and life stages greater than under current *or* unregulated conditions in Cedar River
		Stream flows above Landsburg	• Flows near or above levels that provide maximum habitat (WUA) between hydroelectric powerhouse at Cedar Falls and Landsburg Dam. • Flows for rearing salmon and steelhead in (hydroelectric plant) bypass reach between Masonry Dam and powerhouse
		Flow downramping	• Limited allowable flow downramping rates at Landsburg Dam, Cedar Falls Hydroelectric Powerhouse, and Masonry Dam to minimize risk of stranding juvenile salmonids
		Hydro facility improvements	• Emergency bypass capability at Cedar Falls Hydroelectric Facility to minimize impact of shutdowns • Tailrace rack to exclude fish from turbine effluent pipes at Cedar Falls Hydroelectric Facility
		Downstream habitat funding	Total of approximately $3.3 million for downstream habitat, including: • More than $4.6 million in funding for protection and restoration of habitat in the Cedar River below Landsburg (King County jurisdiction) • $270,000 for habitat restoration in the Walsh Lake system, if matched by King County (see also additional $1.6 million under 4.3.2 above, with total funding about $5 million)
		Ballard Locks improvements	• Local match funding for feasibility study and implementation of project to save freshwater, resulting in improved fish survival • Funding for smolt passage improvements to increase survival
		Permanent dead storage evaluation	• Analysis of permanently accessing water below the natural outlet of Chester Morse Lake, potentially allowing both improved instream flows and increased water supply • Bull trout passage assistance plan, which can be used even if Cedar Permanent Dead Storage Project is never built

Subsection	Community-based focus	Short name	Major measures included
		Flow studies	• Studies to improve flow switching criteria • Monitoring of steelhead redds to better protect incubating steelhead • Accretion flow study in the lower Cedar River, with potential adjustment of flows if warranted • $1 million in funding for supplemental studies focussed primarily on chinook salmon in Cedar River and Lake Washington
		Flow oversight and adaptive management	• Cedar River Instream Flow Oversight Commission • Agency participation in flow allocation decisions and response to study results in cooperative management model • Real-time and long-term adaptive management, with cumulative learning and improved decision-making by City and Commission

Table 4.6-3. Summary of specific minimization and mitigation measures included in the individual species conservation strategies for the 14 species of greatest concern (Section 4.2.2) that are additional to those summarized in Table 4.6-2.

Species	Additional species-specific measures
Northern spotted owl	• Protection in reserve status of entire spotted owl CHU, all old-growth forest, and all second-growth forest outside limited developed areas • Restricted activities near active nests • Protection of habitat within reproductive site centers • Baseline survey and annual surveys of reproductive site centers • Habitat quality monitoring
Marbled murrelet	• Protection in reserve status of entire spotted owl CHU, all old-growth forest, and all second-growth forest outside limited developed areas • Occupancy surveys in old growth and second growth forest • Restricted activities near active nests • Protection of potential nest trees • Determination of potential habitat and experimental habitat improvements in second growth • Habitat quality monitoring
Northern goshawk	• Protection in reserve status of entire spotted owl CHU, all old-growth forest, and all second-growth forest outside limited developed areas • Restricted activities near active nests • Habitat quality monitoring
Bull trout	• Public access for fishing prohibited • Major studies: life history, habitat needs, population status, management impacts, success of restoration projects • Bull trout passage assistance plan, which can be implemented even if Cedar Permanent Dead Storage Project is never built • Study results used for adaptive management
Pygmy whitefish	• As for bull trout, except that passage assistance plan not needed
Chinook, coho, and steelhead	• Public access for fishing prohibited within municipal watershed • As in Table 4.6-2
Sockeye salmon	As in Table 4.6-2, with monitoring and research to determine effectiveness and effects of mitigation program, including: • Fish health monitoring at hatchery • Evaluation of short-term rearing of hatchery fry • Marking and evaluation of hatchery fry condition • Genetic and phenotypic studies of adults • Studies to determine relative survival of hatchery vs. wild adults and fry • Studies of straying into Bear Creek and its impacts to facilitate adaptive management • Studies of potential effects of broodstock collection methods on other species
Bald eagle	• Restricted activities near active nests • Restricted activities near active communal roost sites Note that measures to increase anadromous fish populations and provide passage into the municipal watershed will benefit bald eagles

Species	Additional species-specific measures
Common loon	• Restricted activities on reservoir during breeding season • Experimental nest platform project • Annual nesting surveys • Evaluation of future reservoir operating regimes for impact on nesting habitat and food resources
Gray wolf	• Restricted activities near active dens and rendezvous sites • Careful observation of active dens Note that restricted public access and reduction of road system by about 38% will provide significant benefits
Grizzly bear	• Restricted activities near active dens • Careful observation of active dens Note that restricted public access and reduction of road system by about 38% will provide significant benefits
Peregrine falcon	• Restricted activities near active nests • Careful observation of active nests

Table 4.6-4. Applicability of minimization and mitigation measures to species and groups of species.

			Minimization and Mitigation Measures (short names from Table 4.6-2)																				
		Strategy:	Watershed						Fish Mitigation					Instream Flows									
Group Number	Species in Group by Primary Habitat or Community Association	Community or Habitat	Reserve status	Management guidelines	Habitat restoration	Controlled pubic access	Oversight & adaptive management	Species conservation strategies	Interim: chinook, coho, & steelhead	Interim: sockeye	Long-term: chinook, coho, & steelhea	Long-term: sockeye	Oversight & adaptive management	Stream flows below Landsburg	Stream flows above Landsburg	Flow downramping	Hydro facility improvements	Ballard Locks improvements	Downstream habitat funding	Permanent Dead Storage evaluation	Flow studies	Oversight & adaptive management
	Aquatic & Riparian																						
4	Common Loon	lk	k	x	s	x	x	x												pi		
5	Bull Trout	lk, st	k	x	x	x	x	x												pi		
6	Pygmy Whitefish	lk, st	k	x	x	x	x	x												pi		
7	Sockeye Salmon	lk, st	s	s	s			x		x		x	x	x		s	s	x	x	pb	x	x
8	Chinook Salmon, Coho Salmon, Steelhead Trout	st	k	x	x	x	x	x	x		x		x	x	x	x	x	x	x	pb	x	x
9	Bald Eagle	lk,st,rip,mf	k,r	x	x	x	x	x		s	s	s		s	s				s	pi	s	
13	Harlequin Duck	st,rip	k,r	x	x	s	x															
14	Great Blue Heron	st,rip,sh	k,r	x	x	x	x				s											
15	Osprey	st,rip	k,r	x	x	x	x			s	s	s		s	s				s	pi		
16	Willow Flycatcher	rip,sh	k,r	x	x	s	x															
25	Northern Water Shrew, Masked Shrew	st,rip,sh	k,r	x	x	s	x															
29	River Lamprey, Pacific Lamprey	st	k	x	x	s	x							x	x	x			x	pb		
30	Kokanee	lk,st	k	x	x	x	x												x			
31	Cutthroat Trout (sea run)	lk,st	k	x	x	x	x				x		x	x	x	x	x	x	x	pb	x	x
32	Tailed Frog, Pacific Giant Salamander, Cascade Torrent Salamander	st,rip	k,r	x	x	s	x															

			Minimization and Mitigation Measures (short names from Table 4.6-2)																				
		Strategy:	Watershed						Fish Mitigation					Instream Flows									
Group Number	Species in Group by Primary Habitat or Community Association	Community or Habitat	Reserve status	Management guidelines	Habitat restoration	Controlled pubic access	Oversight & adaptive management	Species conservation strategies	Interim: chinook, coho, & steelhead	Interim: sockeye	Long-term: chinook, coho, & steelhead	Long-term: sockeye	Oversight & adaptive management	Stream flows below Landsburg	Stream flows above Landsburg	Flow downramping	Hydro facility improvements	Ballard Locks improvements	Downstream habitat funding	Permanent Dead Storage evaluation	Flow studies	Oversight & adaptive management
	Aquatic & Riparian																						
33	Long-toed Salamander, Roughskin Newt, Northwestern Salamander, Western Toad, Red-legged Frog, Cascades Frog, Spotted Frog, Northwestern Pond Turtle	st,rip,sh	k,r	x	x	s	x																
34	Van Dyke's Salamander	rip,sh,mf	k,r	x	x	s	x																
37	Papillose Taildropper, Fender's Soliperlan Stonefly, Carabid Beetles (6 species)	st,rip,mf	k,r	x	x	s	x																
38	Beller's Ground Beetle, Hatch's Click Beetle, Long-horned Leaf Beetle	rip,sh	k,r	x	x	s	x																
39	Carabid Beetles (3 species)	sh	k	x	x	s	x																
	Late-seral Forest																						
1	Northern Spotted Owl	mf	k,r	x	x	x	x	x															
2	Marbled Murrelet	mf	k,r	x	x	x	x	x															
3	Northern Goshawk	mf	k,r	x	x	x	x	x															
17	Three-toed Woodpecker	mf	k,r	x	x	s	x																
18	Pileated Woodpecker, Vaux's Swift	mf,sh	k,r	x	x	s	x																
19	Olive-sided Flycatcher	mf,sh	k,r	x	x	s	x																
20	Brown Creeper	mf,sh	k,r	x	x	s	x																

			Minimization and Mitigation Measures (short names from Table 4.6-2)																				
		Strategy:	Watershed						Fish Mitigation					Instream Flows									
Group Number	Species in Group by Primary Habitat or Community Association	Community or Habitat	Reserve status	Management guidelines	Habitat restoration	Controlled pubic access	Oversight & adaptive management	Species conservation strategies	Interim: chinook, coho, & steelhead	Interim: sockeye	Long-term: chinook, coho, & steelhead	Long-term: sockeye	Oversight & adaptive management	Stream flows below Landsburg	Stream flows above Landsburg	Flow downramping	Hydro facility improvements	Ballard Locks improvements	Downstream habitat funding	Permanent Dead Storage evaluation	Flow studies	Oversight & adaptive management
	Late-seral Forest																						
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, Western Big-eared Bat	lk,st,rip,sh,mf	k,r	x	x	x	x																
27	Fisher, marten, wolverine	mf,rip,sh	k,r	x	x	x	x																
28	Lynx	mf,rip,sh	k,r	x	x	x	x																
35	Western Redback Salamander	rip,sh,mf	k,r	x	x	s	x																
40	Johnson's (Mistletoe) Hairstreak	mf	k,r	x	x	s	x																
41	Blue-gray Taildropper, Puget Oregonian, Oregon Megomphix, Carabid Beetle (1 species)	mf	k,r	x	x	s	x																
	Special Habitats																						
10	Peregrine Falcon	sh	k	x	s	x	x	x															
11	Grizzly Bear	rip,sh,mf	k,r	x	s	x	x	x															
12	Gray Wolf	rip,sh,mf	k,r	x	s	x	x	x															
21	Band-tailed Pigeon	rip,sh	k	x	x	s	x																
22	Rufous Hummingbird, Western Bluebird	sh,rip	k	x	x	s	x																

			Minimization and Mitigation Measures (short names from Table 4.6-2)																				
		Strategy:	Watershed						Fish Mitigation					Instream Flows									
Group Number	Species in Group by Primary Habitat or Community Association	Community or Habitat	Reserve status	Management guidelines	Habitat restoration	Controlled pubic access	Oversight & adaptive management	Species conservation strategies	Interim: chinook, coho, & steelhead	Interim: sockeye	Long-term: chinook, coho, & steelhead	Long-term: sockeye	Oversight & adaptive management	Stream flows below Landsburg	Stream flows above Landsburg	Flow downramping	Hydro facility improvements	Ballard Locks improvements	Downstream habitat funding	Permanent Dead Storage evaluation	Flow studies	Oversight & adaptive management
	Special Habitats																						
23	Golden Eagle, Merlin	sh,mf	k	**x**	**x**	**x**	**x**																
24	Black Swift	rip,sh,mf	k	**x**	**x**	s	**x**																
36	Larch Mountain Salamander	sh	k	**x**	**x**	s	**x**																

Community or Habitat

lk	lake
st	stream
rip	riparian
mf	mature, late-successional, or old-growth forest
sh	special habitats

Cell entries

k	All key habitat protected through reserve status
r	Habitat recruited (increased) over time
x	Applies in significant fashion
s	Applies to some extent
pb	Potential benefit if project implemented
pi	Potential impact if project implemented
	Shading indicates significant contribution

Strategy

	Section	*Name*
Watershed management	4.2.2	Watershed Management Mitigation and Conservation Strategies
Fish mitigation	4.3.2	Minimizing and Mitigating theEffects of the Anadromous Fish Barrer at the Landsburg Diversion Dam
Instream flows	4.4.2	Instream Flow Management Strategy

4.6.4 Effects of HCP and Activities Allowed under the HCP

SUMMARIES OF EFFECTS

This section presents the results of the effects analyses performed for the species and groups of species identified in Table 4.6-1. Minimization and mitigation measures applicable to each species or group of species are not repeated below, but references are made to tables 4.6-2 and 4.6-3. For each species or group, the following are presented:

- Brief summary of status regionally and in the municipal watershed, primary habitat associations, and activities that could produce impacts;
- Pertinent minimization and mitigation measures;
- Primary beneficial and detrimental effects, including habitat effects, disturbance effects and potential for direct take, population-level effects, and other effects that may occur; and
- Determination of whether the HCP produces net benefits for the species addressed.

LATE-SUCCESSIONAL AND OLD-GROWTH COMMUNITIES

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.

The combination of mitigation and minimization measures committed to in the HCP protects the northern spotted owl population in the municipal watershed. The likelihood of direct injury or death of any northern spotted owls resulting from restoration or

ecological thinning or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting spotted owl pairs. However, any such death, direct injury, or disturbance leading to such injury or death would constitute take under the ESA. A net gain of potential spotted owl habitat (nesting, roosting, foraging, and dispersal) is expected over the 50-year term of the HCP.

The HCP is expected to result in both short-term and long-term benefits to northern spotted owls through: (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 around reproductive site centers with actively nesting pairs.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the northern spotted owl are detailed in Section 4.2.2 of the HCP and summarized in tables 4.6-2, 4.6-3, and 4.6-4.

Primary Beneficial Effects 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 virtually all forest in the municipal watershed is protected 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 that could be used for dispersal.

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.

However, these 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, SPU 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.

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 on 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 of the municipal watershed 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 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: 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 (about 240 miles over the first twenty years, with the potential for additional road removal later), 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 very 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) compliance with Washington Forest Practice Rules [NOTE: the HCP will waive any state rules under WAC-222-16-085, NSO Habitat Protection]; (4) avoidance of construction and other activities near active nests that could disrupt successful nesting; (5) 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 spotted owl pairs and other resident or transient owls; and (6) 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.

Direct Take

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 spotted owl resulting from restoration planting or thinning; ecological thinning; road removal, maintenance, improvement or use, or other operational activities is expected to be extremely low.

Population-level Effects

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 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.

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 and facilitate adjustments needed to make the strategies better achieve these objectives.

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 easternmost 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.

The combination of mitigation and minimization measures committed to in the HCP are expected to protect any marbled murrelets nesting in the municipal watershed. The likelihood of direct injury or death of any marbled murrelet resulting from silvicultural treatments, road management or use, or other operational activities is expected to be extremely low under the HCP, as is the likelihood of disturbance to any actively nesting murrelet pairs. However, any such death, direct injury, or disturbance leading to such injury or death would constitute take under the ESA. A net gain of potential marbled murrelet nesting habitat is expected over the 50-year term of the HCP. The HCP is expected to result in both short-term and long-term benefits to marbled murrelets through: (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; (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) protection of nesting pairs from human disturbance that could disrupt nesting.

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 in tables 4.6-2, 4.6-3, and 4.6-4.

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, 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. 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 0.06 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).

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. 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 nearly a 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); and (4) removal of 38 percent (240 miles) of the forest roads. 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 (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 (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 to young to constitute murrelet nesting habitat. With these mitigation and minimization measures in place, the likelihood of take resulting from habitat loss or disturbance of 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

As was the case for the spotted owl, the 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 road removal (about 240 miles over the first twenty years, with the potential for additional road removal later), 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 marbled murrelets by silvicultural treatments, road management or use, or other operational 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) 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; (2) specific protection of known nesting pairs from human disturbance; (3) prior to ecological thinning, identification of potential habitat in second growth and avoidance of removing potential nest trees; (4) implementation of 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 marbled murrelet pairs; and (5) removal of 38 percent (240 miles) of forest roads, which will reduce the amount of disturbance related to road maintenance, improvement, and use in the watershed over the long-term.

Direct Take

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.

Population-level Effects

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 reserve northeast of the watershed, and U.S. Forest Service efforts to consolidate ownership through land exchanges), the HCP will have a cumulative positive effect on marbled murrelets. This cumulative 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.

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 marbled murrelet are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

Group #3 – Northern Goshawk

Introduction

Northern goshawks are present in the Cedar River Municipal Watershed. Currently, only one northern goshawk nesting territory has been documented within the 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 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 combination of mitigation and minimization measures committed to in the HCP protects northern goshawks nesting in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any northern goshawk resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting goshawk pairs. However, any such death, direct injury, or disturbance leading to such injury or death would constitute take under the ESA. A net gain of potential northern goshawk habitat (nesting, foraging, and dispersal) is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to northern goshawks through: (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.

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 (e.g., 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 in tables 4.6-2, 4.6-3, and 4.6-4.

Primary Beneficial Effects 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 snags, that northern goshawks prefer for nest and roost sites.

With respect to secondary habitat (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 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, especially 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 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. 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 4.2.2).

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 preharvest conditions typical of the region, in which forest openings were created solely by natural events. This more natural and improved habitat distribution will provide a significant benefit to a highly mobile species such as the northern goshawk.

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, 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, with occasionally more; and (7) routine road use.

However, 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; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) compliance with Washington Forest Practice Rules; (4) 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. 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.

Direct Take

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 very low.

Population-level Effects

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 federal late-successional reserve (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.

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 northern goshawk are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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 combination of mitigation and minimization measures committed to in the HCP is expected to protect any three-toed woodpeckers that may nest in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any three-toed woodpeckers resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting three-toed woodpecker pairs. However, any such death, direct injury, or disturbance of three-toed woodpeckers leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, the three-toed woodpecker are similar to those described for the northern goshawk (Group #3). Long-term benefits are expected to accrue to the three-toed woodpecker especially through preservation of old-growth forest and recruitment of mature and late-successional forest, as well as the creation and recruitment of large snags in the upper

watershed. A net gain of potential three-toed woodpecker habitat (nesting, foraging, and dispersal) is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to three-toed woodpeckers that may use the watershed through: (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.

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 (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 three-toed woodpecker are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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 (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 4.2.2).

Based on the three-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 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 that are intended to promote the development of mature and late-successional forest habitat characteristics in second-growth forests. 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 Direct Take

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) compliance with Washington Forest Practice Rules; (4) 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 three-toed woodpeckers resulting from silvicultural treatments, road management, or other operational activities is expected to be very low.

Population-level Effects

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.

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 three- toed woodpecker are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect pileated woodpeckers and Vaux's swifts that nest in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any pileated woodpeckers or Vaux's swifts resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting pileated woodpecker or Vaux's swift pairs. However, any such death, direct injury, or disturbance leading to such injury or death would constitute the equivalent of take for species listed under the ESA. As indicated for the three-toed woodpecker (Group #17), the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, these species are similar to those described for the three-toed woodpecker. Long-term benefits are expected to accrue to the pileated woodpecker and Vaux's swift through preservation of old-growth forest, the recruitment of mature and late-successional forest in the watershed over time, and through the retention, creation, and recruitment of large snags. A net gain of potential habitat (nesting, foraging, and dispersal) for these species is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to pileated woodpeckers and Vaux's swifts that may use the watershed through: (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.

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 (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 pileated woodpecker and Vaux's swift are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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 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; in contrast, however, 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 (Section 4.2.2). 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 Direct Take

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 (occasionally 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 (including virtually all log

hauling) from the watershed; (3) compliance with Washington Forest Practice Rules; (4) 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 pileated woodpeckers or Vaux's swifts resulting from silvicultural treatments, road management, or other operational activities is expected to be very low.

Population-level Effects

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.

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 pileated woodpecker and Vaux's swift are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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 combination of mitigation and minimization measures committed to in the HCP is expected to protect olive-sided flycatchers nesting in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any olive-sided flycatcher resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting olive-sided flycatcher pairs. However, any such death, direct injury, or disturbance leading to such injury or death would constitute an impact equivalent to take as applied to listed species under the ESA. As indicated for the three-toed woodpecker

(Group #17), the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, the olive-sided flycatcher are most similar to those described for the northern goshawk (Group #3). Long-term benefits are expected to accrue for this species through the protection of old-growth forest, forested wetlands, and natural open habitats, and also through the recruitment of mature and late-successional forest in the watershed. A net gain of potential olive-sided flycatcher habitat (nesting, foraging, and dispersal) is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to this species primarily through: (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.

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 in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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 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.

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 portion of the watershed within the CHU. Coniferous forest in these older age classes is the most likely to have developed the structural characteristics that olive-sided flycatchers prefer for nest, roost, and foraging sites.

As is the case for the northern goshawk, two areas in particular – the CHU/Rex River Basin and the Chester Morse and Taylor Creek basins – are also important to the olive-sided flycatcher on both a short- and long-term basis. The CHU, including the upper Rex

River Basin, currently contains the majority of the old-growth forest remaining in the watershed, interspersed with large areas of earlier 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, primarily as a result of maturation of younger forest. Relative to the CHU and Rex River Basin, the Chester Morse and Taylor Creek basins contain a much smaller amount of old-growth forest and, in contrast, have a substantial portion of basin area currently in older young and mature forest stages. However, these second-growth forests will all mature within the term of the HCP to provide considerable more mature and late-successional habitat in these basins for the olive-sided flycatcher.

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 4.2.2).

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.

As indicated for the goshawk, habitat protection (especially of 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 preharvest conditions typical of the region, in which forest openings were created solely by natural events. This more natural and improved habitat distribution will provide a significant benefit to olive-sided flycatchers.

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 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 Direct Take

Disturbance effects and the potential for direct take of the olive-sided flycatcher are generally as described for the other species presented that are associated with late-successional and old-growth forest. The primary activities that may result in

disturbance, and possibly take, of olive-sided flycatchers in the watershed under the HCP 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 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.

The likelihood of disturbance to any actively nesting olive-sided flycatchers 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 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) compliance with Washington Forest Practice Rules; (4) 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; and (6) 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.

Population-level Effects

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.

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 olive-sided flycatchers are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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 combination of mitigation and minimization measures committed to in the HCP is expected to protect brown creepers nesting in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any brown creepers resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting brown creeper pairs. However, any such death, direct injury, or disturbance leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, the brown creeper are generally as described for the other species groups presented, especially avian species, that are associated with late-successional and old-growth forest. Long-term benefits are expected to accrue to this species through the preservation of old-growth forest, the recruitment of mature and late-successional forest, and the protection of forested wetlands in the watershed. A net gain of potential brown creeper habitat (nesting, foraging, and dispersal) is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to this species primarily through: (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.

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 (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 brown creeper are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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 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.

Major habitat effects on the brown creeper 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, goshawk, 3-toed woodpecker, pileated woodpecker, Vaux's swift), and in particular, the olive-sided flycatcher (Group #19). The brown creeper, similarly to the olive-sided flycatcher, utilizes mature to old-growth forest, including forested wetlands; however, in contrast, the brown creeper is not known to utilize natural open habitats.

As is the case for the other species groups presented that are closely associated with late-successional and old-growth forest, two areas in particular – the CHU/Rex River Basin and the Chester Morse and Taylor Creek basins – are also important to the brown creeper on both a short- and long-term basis. The CHU, including the upper Rex River Basin, currently contains the majority of old-growth forest remaining in the watershed. Relative to the CHU and Rex River Basin, the Chester Morse and Taylor Creek basins contain a much smaller amount of old-growth forest and, in contrast, have a substantial portion of basin area currently in older young and mature forest stages. However, these second-growth forests will all mature within the term of the HCP to provide considerable more mature and late-successional habitat in these basins for the brown creeper.

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 4.2.2).

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.

Because no commercial timber harvest will be conducted in the municipal watershed, all forests outside limited developed areas, including all forested wetlands, are in reserve status. As a result, this type of key habitat (forested wetland) for brown creepers is also protected. In addition, by virtue of placing forests adjacent to forested wetlands in reserve status, sensitive wetland recharge areas are also protected.

Disturbance Effects and Direct Take

Disturbance effects and the potential for direct take of the brown creeper are generally as described for the other species associated with late-successional and old-growth forest. The primary activities that may result in disturbance, and possibly take, of brown creepers 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) 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.

The likelihood of disturbance to any actively nesting brown creepers 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 known active brown creeper nest sites from human disturbance; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) compliance with Washington Forest Practice Rules; (4) 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.

As is the case for the other species groups presented that are closely associated with late-successional and old-growth forest, the likelihood of disturbance to, direct injury to, or death of brown creepers resulting from silvicultural treatments, road management, or

other operational activities in the watershed is very low because of the specific mitigation and minimization measures committed to in the HCP. 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.

Population-level Effects

Population-level effects on the brown creeper are generally as described for the other species groups presented, especially avian species, that are closely associated with late-successional and old-growth forest as discussed above. The amount of key habitat 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.

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 brown creeper are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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, Western 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. Although each bat species in Group #26 has slightly different habitat requirements, key habitats for the group in the municipal watershed are generally 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, reservoirs, open wetlands, large streams) and over meadows and persistent shrub communities.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect bats breeding, roosting, and foraging in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any bats resulting from silvicultural treatments, road management, or other operational activities is expected to

be very low under the HCP, as is the likelihood of disturbance to any breeding bats. However, any such death, direct injury, or disturbance leading to such injury or death would constitute an impact equivalent to take as applied to those species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to bat species are generally as described for the other species groups presented that are associated with late-successional and old-growth forest. A net gain of potential habitat (breeding, roosting, and foraging) for bats is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to these species primarily through: (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.

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 (e.g., through effects on habitat such as 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 in tables 4.6-2 and 4.6-4.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the watershed, 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.

Major habitat effects on bat species in Group #26 are generally as described for the other species groups presented that are closely associated with late-successional and old-growth forest. 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 4.2.2). 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 utilize 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 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. These artificial structures may also increase potential roosting habitat for bats in this species group.

In addition to the reserve status of watershed forests, which also 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, within the watershed, 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 Direct Take

Disturbance effects and the potential for direct take of bats in species Group #26 are generally as described for the other species groups presented that are closely associated with late-successional and old-growth forest. The primary activities that may result in disturbance, and possibly take of bats (Group #26) in the watershed under the HCP include any operations that involve human activities on roads, or in or adjacent to 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) 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.

The likelihood of disturbance to any actively roosting or hibernating bats in the watershed is expected to be very low and short-term in nature, however, 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) compliance with Washington Forest Practice Rules; (4) 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; (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; and (6) management guidelines limiting silvicultural and operational activities in and/or near both aquatic habitats and Special Habitats.

As is indicated for the other species groups presented that are closely associated with late-successional and old-growth forest, the likelihood of disturbance to, direct injury to, or death of bats included in Group #26 as a result of silvicultural treatments, road management, or other operational activities in the watershed is expected to be very low because of the specific mitigation and minimization measures committed to in the HCP. 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.

Population-level Effects

Population-level effects on the species of bats in Group #26 are generally as described for the other species groups presented that are closely associated with late-successional and old-growth forest. 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.

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 bats are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

Group #27 – Fisher, Marten, Wolverine

Introduction

No comprehensive surveys to determine the presence or absence of the fisher, 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, 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, marten are typically found at higher elevations than fisher. 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 in other areas 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, 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.

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 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.

The combination of mitigation and minimization measures committed to in the HCP protects any fisher, marten, or wolverines that may occur in the municipal watershed. The likelihood of direct injury to, or death of, any individual of these species resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low under the HCP, as is the likelihood of disturbance to any actively denning individual or adult with offspring. However, any such death, direct injury, or disturbance leading to such injury or death would constitute an impact equivalent to take as applied to those species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, the fisher, marten, and wolverine are, in general, as described for the other species groups addressed by the HC P that are associated with late-successional and old-growth forest. A net gain of potential habitat of all three species and a reduction in the effects of human disturbance are expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to fisher, marten, and wolverine through: (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.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for fisher, marten, and wolverine 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

Because no commercial timber harvest will be conducted in the watershed, 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, 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 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 (Section 4.2.2). 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, however, is expected to provide habitat of equal quality for fisher, 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 (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.

In addition, the HCP will benefit fisher, 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, 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.

In contrast to the fisher and 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, and the City believes that the HCP will have a net positive effect on habitat for the wolverine.

Disturbance Effects and Direct Take

Wolverines and fishers, in particular, are known to be sensitive to disturbances caused by human activities. Disturbance effects and the potential for direct take of the fisher, marten, and wolverine are, in general, as described for the other species addressed by the HCP that are associated with late-successional and old-growth forests. The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of fishers, 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.

However, the likelihood of disturbance to any actively breeding fishers, martens, or wolverines 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) compliance with Washington Forest Practice Rules; (4) 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 (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 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.

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, 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.

Thus, the primary activities under the HCP that may result in disturbance, and possibly take, of fisher, marten, and wolverine 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 individuals of these three species 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 near known active dens; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access (including no access for 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 animals; 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. For marten and wolverine, road removal, particularly in the upper municipal watershed (within the CHU), and closure of roads to public use is important for three reasons: (1) animals 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.

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 fishers, martens, or wolverines resulting from silvicultural treatments, road management, or other operational activities is expected to be very low.

Population-level Effects

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, 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.

The large block of older forest at higher elevations in the CHU will benefit marten and wolverine, and to a lesser extent fisher, by providing connectivity with lands in the federal late-successional reserve system in the Cascades. This landscape connectivity may further benefit populations of these three species 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).

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 fisher, marten, and wolverine are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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. In recent years, 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 indicating that lynx utilize a wide range of habitat types including 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 established in ecosystems (e.g., northern and east slope of Cascades) that are substantially different from those present within the municipal watershed. 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 and a broader prey base, and, therefore, less reliance 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. Therefore, 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 similar to that used in other regions and ecosystems of Washington, however, 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. 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 ridgeline 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 ridgeline 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, and excessive trapping has, in some cases, been a significant 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 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) 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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any Canada lynx that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any lynx resulting from

silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any breeding lynx. However, any such death, direct injury, or disturbance leading to such injury or death would constitute an impact equivalent to take as applied to those species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

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.

Under the HCP, all key habitat will be protected, and a net gain of Canada lynx habitat may occur over the 50-year term as a result of extensive road decommissioning that will cause a reduction in the level and effects of human disturbance in many areas. The HCP is expected to result in both short- and long-term benefits to Canada lynx through: (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 ridgeline 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.

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 in tables 4.6-2 and 4.6-4.

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.

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 above 3,000 ft elevation, key habitat for Canada lynx, will occur 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 realized 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 ridgeline 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 habitat potential 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 millenium, 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 habitats 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 outer extent 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 unmanaged 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 populations typically often respond accordingly.

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 mature and naturally functioning coniferous forest ecosystem. This change in conditions is important because a primary purpose of the ESA is to conserve the ecosystems on which threatened or endangered species depend. Within the 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 potentially benefit the lynx through the creation of more favorable travel corridors and better habitat for its prey.

Restoration of more natural riparian ecosystem functioning (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 Direct Take

Disturbance effects and the potential for direct take of the Canada lynx are generally as described for the other species addressed by the HCP that are 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). The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, 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) compliance with Washington Forest Practice Rules; (4) 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 (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 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. Restriction 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.

Population-level Effects

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). The City expects that the habitat carrying capacity of the watershed for the lynx should increase over time and that the HCP will have an overall net positive effect on the lynx population in the Cascades. The City does not expect, however, that Canada lynx will become resident on any consistent basis within the watershed in the near future, and lynx may not even occupy suitable habitat within the 50-year term of the HCP. Under the HCP, however, 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

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 critically important 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).

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 Canada lynx are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

Group #35 – Western Red-backed Salamander

Introduction

The western red-backed salamander is present and 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 streamside areas), is considered of secondary importance.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any western red-backed salamanders that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any western red-backed salamanders resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. However, any such death or direct injury of western red-backed salamanders would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Long-term benefits are expected to accrue to the western red-backed salamander, especially through protection of mature, late successional, and old-growth forest in reserve status and the recruitment of additional mature and late-successional forest over time. All key non-forested habitat (talus/felsenmeer slopes and rock outcrops) will also be protected within reserve forest. A net gain of potential western red-backed salamander habitat is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to the western red-backed salamander

through: (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.

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 in tables 4.6-2, 4.6-3, and 4.6-4.

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, 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.

Major habitat effects on the western red-backed 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. 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 4.2.2). 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. 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/felsenmeeer 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 watershed operations near any talus/felsenmeer slopes or rock outcrops a 200-foot zone, in which activities will be restricted, will be established to minimize the potential for habitat impacts or disturbance to western red-backed salamanders.

Disturbance Effects and Direct Take

The primary activities under the HCP that may result in direct take 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 direct take occurring at a level that may compromise the viability of western red-backed salamander populations in the watershed is expected to be very 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) compliance with Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads which will reduce the potential for take 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 western red-backed salamanders resulting from silvicultural treatments, road management, or other operational activities is expected to be very low in any given year, although occasionally, individual western red-backed salamanders may be injured or killed inadvertently by vehicles when they attempt to cross watershed roads while dispersing.

Population-level Effects

Population-level effects on the western red-backed salamander are, in general, as

described for other species addressed by the HCP that are associated with late-successional and old-growth forest. 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.

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 western red-backed salamander are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

Group #41 – Johnson's (Mistletoe) Hairstreak

Introduction

No comprehensive surveys to determine the presence or absence of the Johnson's (mistletoe) hairstreak 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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any Johnson's (mistletoe) hairstreaks that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any Johnson's (mistletoe) hairstreaks resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any breeding individuals. However, any such death, direct injury, or disturbance leading to such injury or death would constitute an impact equivalent to take as applied to those species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, the Johnson's (mistletoe) hairstreak are generally as presented for other species associated with late-successional and old-growth forest. The HCP is expected to result in long-term benefits to the Johnson's (mistletoe) hairstreak through protection of old-growth forest and recruitment of a substantial amount of mature and late-successional forest over time. A net gain of potential habitat (breeding, foraging, and dispersal) for the Johnson's (mistletoe) hairstreak is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to individuals of this species that may use the watershed through: (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; (6) removal of 38 percent of watershed roads; (7) monitoring and research; and (8) protection of identified breeding sites from human disturbance.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures pertinent to the Johnson's (mistletoe) hairstreak 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

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 (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.

Major habitat effects on the Johnson's (mistletoe) hairstreak are generally as described for the other species presented that are associated with late-successional and old-growth forest. Many of these species utilize higher elevation forests or forests over a broad range of elevations. In contrast, the Johnson's (mistletoe) hairstreak apparently utilizes primarily low-elevation (below 3,500 feet) mature to old-growth forest and requires the presence of dwarf mistletoe (*Arceuthobium*) to serve as the main food source during the caterpillar stage. 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 Direct Take

Disturbance effects and the potential for direct take of the Johnson's (mistletoe) hairstreak are generally as described for the other species presented that are associated with late-successional and old-growth forests. The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take of individuals of this 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); and (7) routine road use.

The likelihood of disturbance to any actively breeding Johnson's (mistletoe) hairstreaks in the watershed is expected to be very low and short-term in nature, however, because of the specific mitigation and minimization measures committed to in the HCP: (1) interdisciplinary team site evaluations and protection of occupied 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) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which further minimizes the risk of disturbance to breeding, resident, or transient individuals; 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 Johnson's (mistletoe) hairstreaks resulting from silvicultural treatments, road management, or other operational activities is expected to be very low.

Population-level Effects

Population-level effects on the Johnson's (mistletoe) hairstreak are generally as described for the other species associated with mature, late-successional, and old-growth forests. 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.

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 Johnson's (mistletoe) hairstreak are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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 areas including riparian habitat corridors. Other seral-stage, closed canopy coniferous forest, deciduous forest, and non-forested habitats are considered of secondary importance.

The combination of mitigation and minimization measures committed to in the HCP is

expected to protect blue-gray taildroppers, Puget Oregonians, and Oregon megomphix that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any of these species resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any breeding individuals of these species. However, any such death, direct injury, or disturbance leading to such injury or death would constitute an impact equivalent to take as applied to those species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, the blue-gray taildropper, Puget Oregonian, and Oregon megomphix are similar, in general, to those described for other species addressed by the HCP that are associated with late-successional and old-growth forests. Long-term benefits are expected to accrue to these species of mollusks, especially through protection of mature, late-successional, and old-growth forest in reserve status, protection of riparian corridors included in reserve status forests, and the recruitment of additional mature and late-successional forest in the watershed over time. A net gain of potential habitat (breeding, foraging, and dispersal) for these species is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to individuals of these species that may use the watershed through: (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; and (8) monitoring and research.

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 in tables 4.6-2 and 4.6-4.

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 (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.

Major habitat effects on the blue-gray taildropper, Puget Oregonian, and Oregon megomphix are similar, in general, to those described for other species addressed by the HCP that are associated with late-successional and old-growth forest. 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 4.2.2). As discussed for Group #34, the amount of mature, late-successional, and old-growth forest in the riparian zone will also increase nearly fivefold.

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 including 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.

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.

Disturbance Effects and Direct Take

Disturbance effects and the potential for direct take of the blue-gray taildropper, Puget Oregonian, and Oregon megomphix are generally as described for other species addressed by the HCP that are associated with late-successional and old-growth forests. 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.

However, the likelihood of disturbance to any blue-gray taildroppers, Puget Oregonians, and Oregon megomphix 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 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) compliance with Washington Forest Practice Rules; (4) 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; 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 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 very low.

Population-level Effects

Population-level effects on blue-gray taildroppers, Puget Oregonians, or Oregon megomphix are similar to those described for other species addressed by the HCP that are associated with late-successional and old-growth forest. 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.

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.

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 Group #42 species are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

AQUATIC AND RIPARIAN ECOSYSTEM

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).

The combination of mitigation and minimization measures committed to in the HCP is expected to protect the common loon population in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any common loons resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting common loon pairs. The likelihood of direct injury to, or death of, any common loons resulting from reservoir operations is also expected to be very low in most years under the HCP, as is the likelihood of disturbance to any actively nesting common loon pairs, with the exception discussed below that eggs may be lost to some pairs in occasional years. However, any such death, direct injury, or disturbance of common loons leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Long-term benefits are expected to accrue to the common loon, especially through protection of all large lakes and associated riparian habitat, as well as restrictions of human activities on the reservoir during the breeding season. Protection of, and improvements in, water quality (e.g., reduced sediment, lower temperature) and lakeside habitat are of particular importance to support foraging and reproduction for this species, and 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). A net gain in both the quality of potential key aquatic habitat and the quantity and quality of key riparian habitat for the common loon is expected over the 50-year term of the HCP. The HCP is expected to result in both short-term and long-term protection and benefits to common loons through: (1) 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; (2) protection of nesting pairs from human disturbance; (3) protection in reserve status of the reservoir, all other large lakes, and all lakeshore habitat, which will support reproduction and foraging; (4) 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); (5) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of disturbance, both to habitat and to nesting birds; (6) 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; (7) stream habitat restoration projects, reestablishing more natural stream function and potentially increasing the availability of some prey fish species; (8) streambank stabilization projects to reduce sediment input to streams and lakes; (9) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams and lakes; (10) guidelines and prescriptions designed to reduce sediment production during watershed management activities; (11) removal of 38 percent of watershed roads, reducing the potential for human disturbance; (12) overall expected improvement in water quality; (13) closure of the municipal watershed to unsupervised public access, reducing the levels of human disturbance on nesting loons; and (13) monitoring and research related specifically to common loons.

Common loons could be negatively affected by reservoir operations, silvicultural treatments, road management, or other operational activities in or near streams and lakes. Such effects could be direct (e.g., 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 in tables 4.6-2, 4.6-3, and 4.6-4.

Primary Beneficial Effects and Detrimental Effects of the Proposed HCP

Habitat Effects

A direct threat to common loons in Washington is the loss of lakeshore habitat, including some form of vegetative cover and potential nesting substrate or structures at the existing waterline (emergent vegetation, logs, and on rare occasions, rock). Effects on shoreline vegetation can occur as a result of reservoir operation and land management activities.

Land management can also affect the quality of loon foraging habitat through effects on water quality and on populations of prey fish in the large lakes that migrant loons use for foraging during migration and that pairs and juveniles use during the breeding season prior to migrating in late fall.

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 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 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 City 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 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, natural maturation of riparian forest, and silvicultural intervention to accelerate develop of natural riparian forest functions and late-successional forest characteristics should collectively, over the long term, lead to an overall improvement of conditions for potential nesting on the deltas, compared to current conditions, by producing higher rates of recruitment of trees that could eventually serve as adequate nesting substrate and, presumably, by redevelopment of dense willow thickets as nesting cover.

Implementation of the Cedar Permanent Dead Storage Project 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). Implementation of the Cedar Permanent Dead Storage Project would require a plan amendment under Section 12.2 of the Implementation Agreement (Appendix 1).

Disturbance Effects and Direct Take

Disturbance and the potential for direct take 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 Disturbance Effects of Land Management

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of common loons that may occur 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) compliance with Washington Forest Practice Rules; (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 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 4.2.2) 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. Based on observations of common loons on Rattlesnake, however, the City believes that this disturbance is highly unlikely to result in the equivalent of take, or in take should the common loon be listed under the ESA as threatened or endangered.

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. 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. It is possible, however, that 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, excessive wind, storms) to which platform nests are vulnerable under some deployment 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. Eggs from some nests may be lost during some years, as described above, but the City believes that this type of loss is infrequent and would not have significant population-level consequences.

Implementation of the Cedar Permanent Dead Storage Project could affect the extent, duration, and timing of reservoir fluctuations and thus impact nesting loons during the common loon nesting season from April through mid-June. The Cedar Permanent Dead Storage Project would alter 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. Although the Cedar Permanent Dead Storage Project may have potential negative effects on the common loon, including disturbance effects, 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).

Population-level Effects

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 City 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 pressure 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.

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).

Group #5 – Bull Trout

Introduction

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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any bull trout within the municipal watershed. The likelihood of direct injury to, or death of, any bull trout resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. Some bull trout, however, may be killed or injured by entrainment through the intakes of the Cedar Falls Hydroelectric Project and through the Overflow Dike separating Chester Morse Lake and Masonry Pool, which regulates flow into the Pool when reservoir elevation is below 1550 ft. Some eggs or alevins could be adversely affected by inundation during the incubation period in spring, and there may be some degree of impedance of upstream migrating bull trout resulting from uncommon occurrences of reservoir drawdown during severe droughts. Any death or direct injury of bull trout would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The mitigation and minimization measures of the HCP are expected to maintain the natural processes important for creating and maintaining habitat for bull trout in the

watershed. The HCP is expected to result in short- and long-term benefits to bull trout as compared to the current conditions by implementing: (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; (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.

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 (e.g., 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 (e.g., stream habitat restoration projects, silvicultural treatments in riparian areas, road maintenance, road use, and road decommissioning).

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the bull trout are detailed in the Section 4.2.2 and Section 4.5.6, and summarized in tables 4.6-2, 4.6-3, and 4.6-4.

Primary Beneficial Effects and Detrimental Effects of the HCP

Habitat Effects

The effects of the HCP on bull trout habitat are of two types: (1) the effects of land management and (2) the effects of reservoir operation. 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 Direct Take.” Effects of land management 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.

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 bull trout 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 bull trout. 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 deficient streams. 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.

The City believes that instream habitat improvement and rehabilitation must be accompanied by upslope protection and restoration that will reduce impacts of upslope conditions or activities on stream habitat. For example, efforts to stabilize stream banks or add large woody debris to streams may not be effective in the long run if road failures occur that result in large inputs of coarse sediment to streams upstream of such projects. Thus, these kinds of activities will be coordinated under the HCP.

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 and the reservoir complex, as well as protecting all wetlands associated with streams, along with their recharge areas. In addition, maturation of protected forest in riparian corridors near streams and the reservoir complex 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, increasing food production for fish, and maintaining cooler water temperatures.

Development of mature and late-successional forest significantly contributes to the reestablishment of a more naturally functioning ecosystem, thus benefiting bull trout. 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 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 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. 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.

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 such activities in riparian areas will also help minimize any such impacts on bull trout. 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, 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.

Disturbance Effects and Direct Take

Potential disturbance effects of the HCP on bull trout are of two types: (1) the effects of land management and (2) the effects of reservoir operation, which is directly related to instream flow management. The potential effects of land management would most likely be from use of watershed roads, active intervention for the purpose of habitat rehabilitation and restoration, and general watershed management operations. The

primary disturbance effects 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 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 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.

Disturbance Effects Related to Land Management

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of bull trout 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); and (8) routine road use.

The likelihood of direct take of bull trout from land management activities 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 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) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which minimizes potential mortality from fishing; and (5) removal of 38 percent of forest roads, which will reduce the potential for take 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 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 in any given year.

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.

Disturbance 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 City 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, 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.

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 sustained for more than one-half of the 13-week bull trout spawning period. 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 extremely 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 only part 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 City believes that the new HCP flow regime will probably have little additional impact 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 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 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 ameliorate effects of lake level fluctuations on impedance to bull trout passage at river delta fans during annual upstream spawning migration.

Disturbance 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 bull trout spawning habitat is inundated varies among years, depending on 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:

- 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.

- During the period March through the end of incubation (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.

- 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, and because most redds in the Cedar River have been located upstream of the zone of inundation during most years of observation, 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 and is believed to be in good condition now.

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 water 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 City 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.

Disturbance Effects Related to Entrainment

There may be some loss to the bull trout population 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 any potential 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 because any 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).

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 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-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 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.

Population-level Effects

The City 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 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 the bull trout population.

The City believes that the HCP will have an overall positive effect on the watershed bull

trout population over the long term for the following reasons:

- The watershed adfluvial bull trout population is believed to be in good condition;
- Incremental adverse effects of reservoir operations under the HCP on bull trout are expected to be minimal;
- It is likely that juvenile rearing habitat, not spawning habitat, is the limiting factor for bull trout (Section 3.5.6); and
- 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 relative 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 City believes that the potential for take as described in the paragraphs above does not constitute a threat to the bull trout population in the municipal watershed. The City 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 any present or future potential negative impacts of the City's operations on bull trout during the term of the HCP.

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, 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).

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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect pygmy whitefish within the municipal watershed. The likelihood of direct injury or death of any pygmy whitefish resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. Some pygmy whitefish, however, may be killed or injured by entrainment through the intakes of the Cedar Falls Hydroelectric Project and through the Overflow Dike separating Chester Morse Lake and Masonry Pool, which regulates flow into the Pool when reservoir elevation is below 1550 ft. There may also be some disturbance (e.g., run timing, impedance) to upstream migration of some pygmy whitefish resulting from reservoir drawdown during severe droughts, however, no direct observations to date indicate that such disturbance actually has occurred or what the extent of such disturbance might be if it were to occur in the future. Any death or direct injury of pygmy whitefish would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The mitigation and minimization measures of the HCP are expected to maintain the natural processes important for creating and maintaining habitat for pygmy whitefish in the watershed. The HCP is expected to result in short- and long-term benefits to pygmy whitefish as compared to the current conditions by implementing: (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.

Pygmy whitefish 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 complex. 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 riparian vegetation). Pygmy whitefish 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 the pygmy whitefish are detailed in the Section 4.2.2 and Section 4.5.6, and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects and Detrimental Effects of the HCP

At an estimated population in excess of 51,000 (Section 3.5.7), pygmy whitefish are the most abundant native salmonid species in Chester Morse Lake and are present, though in low abundance, in Masonry Pool (R2 Resource Consultants, in preparation). This species is an important prey item of bull trout in Chester Morse Lake. Relatively little is known about pygmy whitefish spawning behavior, incubation, and early life history in the municipal watershed. Large aggregations of sexually mature fish move into the Cedar River, Rex River, and Boulder Creek during early December (Map 7). Preliminary searches in some other accessible tributary streams along selected beach areas (e.g., small stream deltas) during the same time period revealed no pygmy whitefish. Detailed studies to investigate whether or not lake spawning occurs in Chester Morse Lake or Masonry Pool have not been conducted.

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 prevail (Section 4.5.6). Because this potential effect of reservoir operations would involve some form of disturbance, it is discussed below under "Disturbance Effects and Direct Take." 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.

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 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, pygmy whitefish 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 holding pools, that are important to pygmy whitefish.

The City believes that instream habitat improvement and rehabilitation must be accompanied by upslope protection and restoration that will reduce impacts of upslope conditions or activities on stream habitat. For example, efforts to stabilize stream banks or add large woody debris to streams may not be effective in the long run if road failures occur that result in large inputs of coarse sediment to streams upstream of such projects. Thus, these kinds of activities will be coordinated under the HCP.

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 and the reservoir complex, as well as protecting all wetlands associated with streams, along with their recharge areas. In addition, maturation of protected forest in riparian corridors near streams and the reservoir complex 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, increasing food production for fish, and maintaining cooler water temperatures.

Development of mature and late-successional forest significantly contributes to the reestablishment of a more naturally functioning ecosystem, thus benefiting 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 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 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.

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 pygmy whitefish 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 some level of erosion and sediment release into streams or the reservoir.

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 such activities in riparian areas will also help minimize any such impacts on pygmy whitefish. 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, 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 Direct Take

Potential disturbance 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 related to instream flow management. The potential effects of land management would most likely be from use of watershed roads, active intervention for the purpose of habitat rehabilitation and restoration, and general watershed management operations. The primary disturbance 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.

For reasons discussed below, the City does not believe that there will be any effects on pygmy whitefish from egg inundation during spring reservoir refill, such as is discussed for bull trout (Group #8).

Disturbance Effects Related to Land Management

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of pygmy whitefish 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); and (8) routine road use.

The likelihood of direct take of pygmy whitefish from land management activities 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 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) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which minimizes potential mortality from fishing; and (5) removal of 38 percent of forest roads, which will reduce the potential for take 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 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.

Disturbance 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. 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. Exposure of

several feet of the steep faces of the delta fans may present either a partial or a complete barrier to migrating pygmy whitefish, 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 pygmy whitefish.

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 City 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 pygmy whitefish 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, 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 pygmy whitefish is thought to be the most likely to occur.

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 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 City 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.

The restriction of 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 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.

Because of specific mitigation and minimization measures committed to in the HCP, as listed above, the City believes that the likelihood of disturbance to, direct injury to, or death of individuals as a result of reservoir operations that could impede upstream migration of pygmy whitefish is expected to be very low, and that any such adverse effects would be substantially outweighed by beneficial effects accruing from the conservation and mitigation measures in the HCP.

Disturbance Effects Related to Inundation of Redds

For the reasons described below, it is very 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.

- 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.

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

- 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).

Because of the above-cited reasons, the City believes that the likelihood of disturbance to, direct injury to, or death of individuals as a result of reservoir operations during reservoir refill that could affect pygmy whitefish eggs is expected to be extremely low. For a discussion of potential impacts of inundation on bull trout redds, please see the effects analysis for Group #8.

Disturbance Effects Related to Entrainment

There may be some loss to the pygmy whitefish population 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 any potential 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 any 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.

Population-level Effects

The City 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. As discussed above, the potential effects of land management activities are also expected to be minimal.

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 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 the pygmy whitefish population.

The City believes that the HCP will have an overall positive effect on the watershed pygmy whitefish population over the long term for the following reasons:

- The watershed pygmy whitefish population is believed to be in good condition;
- Incremental adverse effects of reservoir operations under the HCP on pygmy whitefish are expected to be minimal; and
- 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 City believes that the potential for take as described in the paragraphs above does not constitute a threat to the pygmy whitefish population in the municipal watershed. The City also believes that the substantial measures in this HCP for the protection of pygmy whitefish and pygmy whitefish habitat, the implementation of an extensive monitoring and research program, and the incorporation of an adaptive management strategy are sufficient mitigation for any present or future potential negative impacts of the City's operations on pygmy whitefish during the term of the HCP.

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.

Group #7 – Sockeye Salmon

Introduction

Conservation measures for sockeye salmon were developed to: i) avoid, minimize and mitigate the impacts of the City's water supply facilities and operations on the Cedar River; ii) comply with Washington State law as codified in R.C.W. 75.52; iii) comply with the direction provided by the Cedar River Sockeye Policy and Technical Committees established by the Washington State Legislature; and iv) complement other salmon recovery efforts in the Lake Washington watershed by helping to protect and

restore upland, riparian and aquatic habitat and the ecological processes that shape and maintain habitat within the Cedar River basin. The Lake Washington basin has been substantially altered since the late 19th century by a variety of anthropogenic activities. Many of the basin's natural features and processes have been modified resulting in a reduction in the capacity of the system to support naturally reproducing populations of a number of animal species, including sockeye salmon. Conservation measures for Group #7 species have been developed in a manner that will help preserve remaining functional elements of the ecosystem and help rehabilitate those that are presently impaired.

Sockeye are present in the lower 21.8 miles of the mainstem and associated tributaries outside of the municipal watershed and downstream of the Landsburg Dam. The Landsburg Dam prevents the passage of this species into over 17 stream miles (12.4 miles of the mainstem plus 4.9 miles in tributaries) of habitat between Landsburg and the natural anadromous fish barrier formed by lower Cedar Falls. All sockeye migrate through Lake Washington and the Ballard Locks as juveniles and adults. Habitat associations for sockeye salmon in the Cedar River basin are described in detail in Section 3.6 and are summarized below.

Life stage	Primary habitats	Secondary habitats	Important habitat elements
Adult migration	All areas of the mainstem channel with sufficient depth and suitable velocity.	Hold and mature for up to several months during the summer in deep areas of Lake Washington below the thermocline. May also hold for short periods in deep runs and pools in the river just before spawning in the fall.	Cool, high quality water in the lake and river and sufficient instream flow to allow upstream passage in the fall.
Spawning	Mainstem areas with gravel substrate that is relatively free of sand and silt.	Also spawn in tributaries, groundwater-fed side channels and ponds with beaches exhibiting substantial upwelling flow. Some limited beach spawning occurs in suitable habitat along near-shore areas of the lake.	Clean, un-compacted gravel substrate with substantial subsurface water flow. Sufficient stream flow to provide depths 0.3 to 2.5 feet and velocities of 0.3 to 3.3 feet per second over suitable substrate. Incubation survival in mainstem can be significantly influenced by peak flow events.
Juvenile rearing	Graze on zooplankton primarily in limnetic areas of the lake.	Newly emerged fry may rear in littoral areas of the lake for several weeks prior to moving into offshore areas. A very small number of fish may rear for short periods during the spring and early summer in backwater and off-channel areas located near the mainstem.	Of the anadromous species present in the basin, only sockeye are specifically adapted to rear as juveniles for an extended period in the limnetic area lake.
Juvenile migration	All areas of the mainstem with tendency to seek high velocity areas.	Newly emerged fry tend to hold in near-shore areas for several weeks before	Although not well quantified, in-river emigration survival

Life stage	Primary habitats	Secondary habitats	Important habitat elements
		migrating to limnetic areas to rear. During emigration, smolts move onshore and migrate along shorelines to the locks.	appears to be higher during period s of elevated flow in the spring. Smolts are typically large and well adapted to migration through the lake.

The combination of mitigation and minimization measures provided by the HCP is expected to protect Group #7 species in the Cedar River basin. The principal mitigation and minimization measures for sockeye salmon under the HCP include: (1) water quality protection, and habitat protection and restoration measures in the municipal watershed which will help protect and improve water quality and habitat conditions in river downstream of the municipal watershed and in Lake Washington; (2) continued funding of the interim sockeye fry hatchery to reduce the present rate of population decline and provide additional information on the factors limiting sockeye production; (3) the construction and operation of a replacement hatchery facility capable of producing up to 34 million sockeye fry to replace the lost production capacity upstream of the Landsburg Dam; (4) funding for habitat protection and restoration in the lower Cedar River, downstream of the municipal watershed; (5) provision of the HCP instream flow management regime to improve habitat conditions in the lower river; (6) funding for projects at the Ballard Locks designed to increase survival of emigrating smolts; and (7) monitoring and research. These measures are expected to provide short-term protection for sockeye salmon habitat and enhance the long-term production of both natural and hatchery runs of sockeye in the basin. The benefits that may be derived from the mitigation measures result primarily from improved spawning, incubation, and emigration conditions in the river; increased fry recruitment; improved downstream passage conditions at the Ballard Locks; and improved understanding of the factors affecting sockeye salmon survival in the Lake Washington Basin.

Sockeye can be negatively affected by alterations in stream flow associated with water management activities that can potentially affect various sockeye life stages and their associated mainstem habitat downstream of the Landsburg Diversion Dam. If selected, some types of habitat restoration projects in the lower river could also result in short term impacts through increased sediment delivery and other associated disturbances. However, the likelihood of injury or death of any sockeye salmon as a direct result of the City's HCP instream flow management regime or habitat restoration is expected to be very low. Potential indirect effects associated with the HCP artificial propagation program could negatively impact sockeye in the basin. The potential risks associated with artificial propagation and the measures provided to avoid and minimize these risks are discussed in detail in section 4.3.2 and later in this section. The proposed conservation measures for sockeye salmon, including extensive monitoring and research activities and flexibility to adapt the program, are expected to result in net gains for Group #7 species over the 50-year term of the HCP.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for sockeye are detailed in the section entitled "Species Conservation Strategies" (Section 4.2.2). Additional measures that benefit

Group #7 species are included in the Conservation Strategies for Minimizing and Mitigating the Effects of the Anadromous Fish Migration Barrier a the Landsburg Diversion Dam (Section 4.3.2), the conservation strategies for Instream Flow Management (Section 4.4.2), Watershed Management Mitigation and Conservation Strategies (Section 4.2), and Anadromous Fish Monitoring and Research (Section 4.5.3). Mitigation and minimization measures for Group #8 species are summarized in tables 4.6-2, 4.6-3, and 4.6-4.

Primary Beneficial Effects and Detrimental Effects of the HCP

Effects of the Watershed Management Program

The Cedar River basin is the largest sub-basin in the Lake Washington watershed and provides approximately 50 percent of the total annual flow into the lake. Conservation measures in the municipal watershed, which comprises the upper 2/3 of the Cedar River sub-basin, are expected to deliver substantial water quality benefits to aquatic habitat within the municipal watershed, in the mainstem of the river downstream of the municipal watershed, and in Lake Washington. Migration corridors as well as spawning, incubation, and rearing habitat for sockeye salmon in the Lake Washington basin are expected to benefit from the provision of high quality water from the municipal watershed.

Effects of the Artificial Propagation Program

Because the presence of large numbers of spawning carcasses creates an unacceptable risk to drinking water quality and public health (Appendix 5), an artificial propagation program is provided as an alternative solution to mitigate for the lost sockeye salmon production capacity upstream of the Landsburg Dam. The City will construct a hatchery with the capacity to produce up to 34 million emergent sockeye fry per year. The program will employ recently developed sockeye culture techniques, as further refined during prototype testing at the Landsburg interim hatchery, to help ensure the production of robust, disease-free fish.

The artificial propagation program for sockeye salmon will provide an incubation refuge, increase fry recruitment from the river, and help ensure that adequate numbers of adult fish return to spawn naturally in the river. This restored fry production capability will increase the capacity of the population to maintain itself when challenged with adverse environmental conditions, while avoiding and minimizing risks to naturally reproducing salmonids.

The benefits that may be derived from a sockeye fry hatchery result primarily from increases in egg to fry survival. This increased survival will help compensate for the lost sockeye production capacity upstream of the Landsburg Diversion Dam. In addition, incubating sockeye are particularly vulnerable to mortality resulting from increased bedload scour during high flow events. During high flow events, the largely confined channel in the lower river results in increased water velocity, increased energy, and subsequent increases in bedload movement. Egg to fry survival in the Cedar River subsequent to the 2-year flood event is typically much lower than 10 percent (Seiler and Kishimoto 1997). In contrast, egg to fry survival within a hatchery can exceed 90 percent. Because egg to fry survival is an important factor that contributes to fish productivity early in the life history, the difference in survival rates means a hatchery can

increase the overall productivity of the stock. However, as out-of-kind mitigation, the proposed sockeye hatchery program entails certain risks not encountered in other forms of mitigation.

A number of sources have detailed the problems associated with the misapplication of artificial propagation in the past and have cautioned against the continued misuse of this approach in the future (Hard et al. 1992; Hilborn 1992; National Research Council 1996; Reisenbichler 1997; WDFW 1997b). In many years, the number of fry released from the hatchery will represent a significant portion of the total sockeye fry produced in the Lake Washington Basin. Clearly, the artificial propagation program should not be viewed in isolation from the many rehabilitative features of the HCP. Nor should the risks associated with a relatively high-energy technological approach be dismissed.

Recently developed fish culture techniques have been used in Alaska since the early 1980s to successfully produce healthy, high quality sockeye fry (McDaniel et al. 1994). Prototype testing with the interim hatchery since 1991 has demonstrated that these same techniques can be successfully applied in the Cedar River. Data from the 1997 returns will provide the first substantial body of information on the relative performance and behavior of the hatchery fry when they return as adults. This recently collected data is still being analyzed and will require corroboration with data collected in subsequent years to adequately address a number of the uncertainties associated with the sockeye fry production program.

The City recognizes that, while the sockeye fry production program offers potential benefits for the population, it also entails a level of uncertainty and risk. As part of the sockeye mitigation program, the City intends to implement measures to manage risk and uncertainty first, through rigorous pre-project planning and operational guidelines, and second, through implementation of an effective monitoring and adaptive management program (see Kapuscinski and Miller 1993; Kapuscinski 1997). These provisions will minimize genetic risks to the naturally reproducing, introduced population of sockeye in the Cedar River. The Bear Creek sockeye population in north Lake Washington has been classified as a provisional Evolutionarily Significant Unit (ESU) by NMFS and is not presently considered at risk of extinction (Gustafson et al. 1997). In the absence of specific information for potential interactions of Cedar River hatchery sockeye with Bear Creek sockeye, NMFS considers the proposed hatchery program to pose a moderate level of genetic risk to the Bear Creek population (Waples 1998). The City, in consultation with NMFS and the CRAFC, will strive to minimize the genetic risk to Bear Creek sockeye by i) establishing thresholds for the rate at which Cedar River hatchery sockeye stray into the Bear Creek system, ii) monitoring the actual incidence of spawning Cedar River hatchery fish in Bear Creek and, if necessary, iii) implementing corrective measures such as reduced production levels and improved fry release strategies to reduce straying. By including HCP signatories, other stakeholder groups and technical experts in the Cedar River Anadromous Fish Committee, the City expects to bring to bear the best available science to adaptively manage risk and uncertainty associated with the artificial production program.

Instream Flow Management: Effects on Weighted Usable Area (WUA)

Stream flow can affect sockeye salmon production in the Cedar River by its influence on spawning habitat availability, incubation conditions, and downstream migration conditions for fry. The instream flow regime under the HCP influences each of these

factors that can in turn affect the sockeye population

The HCP guaranteed and supplemental flow regime is summarized in Table 4.4-1. The relationships between guaranteed flows, the existing non-binding IRPP minimum flows and the flows that provide maximum weighted usable area (WUA) for key species and life stages as determined by collaborative PHABSIM analyses are summarized in Figures 4.4-2 through 4.4-5. Expected actual flows will often exceed guaranteed and supplemental flows during the fall, winter and spring because: i) inflows to the basin often exceed amounts required to meet the guaranteed flows and municipal water supply demands; ii) surface runoff in the lower 57 percent of the basin enters the Cedar River naturally and is not influenced by the water storage reservoir; and iii) flood storage capacity in the reservoir is relatively limited. Expected actual flows under the HCP instream flow management regime, under the existing IRPP regime, and under natural unregulated conditions are summarized in Appendix 36. Appendix 37 provides habitat duration analyses for expected actual flows under the HCP, IRPP and natural flow regimes using PHABSIM output for target species and life stages.

For most of the year, HCP guaranteed flows are higher than existing IRPP minimum flows and higher than the flows required to provide maximum WUA for key species and life stages. Although these higher flows result in a reduction in WUA when compared to the flows that maximize WUA, they will help ensure that the guaranteed regime more closely mimics natural basin hydrology and will provide a variety of important overriding biological benefits that are discussed later in this section. The effects of the proposed HCP flow regime on WUA for sockeye and associated target species are outlined below. The discussion begins with late summer and early fall flows, then proceeds sequentially throughout the remainder of the year.

Instream flows under the HCP are designed to improve sockeye spawning conditions throughout the fall. The first adult sockeye begin to enter river and spawn in early to mid-September. During the first two weeks of September, HCP guaranteed flows are slightly below the level that provides maximum WUA. At this time, HCP guaranteed flows provide 99 percent of maximum WUA. By September 16, with approximately 11 percent of the sockeye run typically in the river, HCP flows increase to a level that is slightly above the level required to provide maximum WUA for sockeye spawning. Although this results in a slight reduction in WUA, guaranteed flows during the third week in September still provide more than 98 percent of maximum WUA. By the last week of September, with approximately 20 percent of the run in the river, guaranteed flows increase to a level that provides 85 percent of maximum WUA. On October 8, with approximately 38 percent of the sockeye run in the river, flows increase further to either low normal or high normal levels, depending on existing hydrologic conditions in the basin. In an effort to maximize WUA for spawning chinook (see Group #8 Species Effects Analysis) and provide potential ancillary benefits to spawning sockeye, both low normal and high normal flows remain well above the levels required to provide maximum WUA throughout the remainder of the sockeye spawning season. From October 8 through December 30, low normal flows provide between 56 percent and 71 percent of maximum WUA for sockeye spawning. High normal flows provide between 51 percent and 61 percent of maximum WUA during this same period.

Although significant amounts of sockeye spawning habitat are lost at these higher flows, the losses in static habitat are partially offset by increases in potential cumulative sockeye spawning habitat. Flow increases that begin in late September will tend to

encourage newly entering fish to spawn in new, previously unsuitable habitat away from areas that are already seeded. This stepped approach to flow regulation also accommodates the theory that edge spawning habitat is less vulnerable to damaging scour during subsequent peak flow events.

Additional Effects of the Instream Flow Management Regime

During the collaborative instream flow studies and development of the HCP instream flow management regime, the interagency Cedar River Instream Flow Committee viewed the extensive PHABISM analyses conducted on the Cedar River as a foundation for an instream flow management regime rather than as a prescriptive tool for determining preferred flows at any give time during the year. While the City believes that PHABSIM analyses are an important tool in developing effective instream flow management practices, anadromous salmonid biology is complex and habitat requirements for these species are not completely described by standard PHABSIM analyses. Additional information is helpful in prioritizing species and life stages during particular times of the year; addressing aspects of their biology not typically analyzed in standard PHABISM investigations; and understanding the complex relationships between hydrologic variation and natural ecological processes in the aquatic environment. During the course of collaborative studies and subsequent development of the HCP instream flow regime, a broad array of information was used in an effort to establish management provisions that would provide comprehensive protection for all life stages of anadromous fish and the habitat upon which they depend. These management provisions address key biological considerations determined to be of particular importance to Cedar River sockeye salmon by the Cedar River Instream Flow committee and include:

- Limits on the rate at which stream flows can be reduced as a result of City's water management activities to reduce the risk of fish stranding and better reflect natural rates of stream flow recession;
- Increased guaranteed flows during the fall to recruit additional sockeye spawning habitat along the margins of the stream and potentially reduce sockeye redd scour vulnerability during subsequent winter peak flow events;
- Increased guaranteed flows during sockeye incubation season in the fall, winter and spring to reduce the risk of redd dewatering;
- Increased guaranteed flows during the late winter and early spring to provide improved emigration conditions for sockeye fry;
- Higher guaranteed flows into Lake Washington for more flexibility to provide beneficial fish passage conditions at the Ballard Locks; and
- A number of commitments that will result in stream flows that better reflect natural hydrologic patterns including: i) relocation of the flow compliance point 20 miles upstream to Landsburg; ii) supplemental guaranteed flows linked to real time hydrologic conditions; and iii) collaborative management of flows above guaranteed levels to support important natural ecological processes and provide benefits to fish.

The spawn timing of sockeye salmon make their redds especially vulnerable to fluctuating stream flows associated with late fall and early winter freshets. Under the

current IRPP flow regime with the measurement point in Renton, sockeye eggs deposited near the margins of the stream are at risk of desiccation during periods when local inflows are elevated in the lower river. With a measurement point 20 miles downstream at Renton, the City can substantially reduce releases at Landsburg and still meet IRPP flow targets during periods of normal to high inflows in the lower river. Therefore, any redds established near the margins of the stream in the upper portions of the river near Landsburg are subject to a significant risk of dewatering and eventual egg desiccation. By relocating the flow measurement 20 miles upstream at Landsburg, the HCP substantially reduces this risk and helps promote more natural variations in stream flow throughout the lower river.

To further reduce the risk of redd dewatering throughout the river, the HCP guaranteed flows remain elevated during the winter and early spring to reduce the risk of redd dewatering. HCP guaranteed flows remain well above existing IRPP flow targets throughout the entire winter and spring sockeye incubation season.

Recent information suggests that newly emerged sockeye fry can experience significant mortality during their 1- to 2-day migration downstream to Lake Washington. Preliminary investigations with hatchery fry releases just above the present upstream limit of sockeye migration and spawning suggest that fry may experience significantly higher emigration survival during periods of elevated flow (Seiler 1994, 1995; Seiler and Kishimoto 1996, 1997a).

The exact quantitative relationship between stream flow and the survival of emigrating wild sockeye fry is not presently known. Nevertheless, HCP guaranteed flow commitments during the period of sockeye fry emigration are significantly higher than under the existing IRPP regime. In addition, the proposed HCP flow regime contains provisions for 40 percent higher minimum flows at least 70 percent of the time during the peak of sockeye emigration from early February through mid-April.

Effects of the Adaptive Features of the Instream Flow Management Regime

Although a substantial amount of information was assembled over the last 10 years to guide the development of the HCP instream flow regime, the City anticipates that additional information will become available as the science of fluvial systems and strategies for managing stream flows in altered channels continue to evolve. In addition to well-defined, binding, instream flow management commitments, the City acknowledges the need to provide sufficient flexibility to adapt and improve instream flow management strategies, as new information becomes available. Therefore, the HCP provides substantial commitments to limit the City's future diversions from the Cedar River to ensure sufficient flexibility to meet additional needs for instream resources should such needs arise. In addition, the HCP provides over $ 3.4 million for further studies to: i) monitor natural and regulated stream flows throughout the basin; ii) better quantify the effects of natural local inflows on stream flow in the mainstem of Cedar River downstream of municipal watershed; iii) improve the ability of stream flow switching criteria to accurately reflect natural hydrologic conditions; iv) improve our understanding of key aspects of the biology of chinook salmon and other salmonids in the Cedar River; and v) better understand the effects of stream flow management on fish habitat in altered fluvial systems. Finally, the HCP establishes an Instream Flow Commission (Section 4.4.2 and Appendix 27) that will make use of the information

gathered during future studies to guide the management of stream flows over and above the HCP guaranteed levels to provide additional benefits for instream resources.

Other Effects

The HCP provides nearly $5 million to implement habitat protection and restoration projects in the lower river downstream of the municipal watershed. The Cedar River below Landsburg has been impacted by urban development, channel modifications, reduction and harvest of riparian zones, and peak flow management practices (King County 1998). Mainstem and side-channel habitat quantity and quality have been reduced substantially compared to pristine conditions. In addition, these changes have increased the frequency of scour events that could negatively affect sockeye redds. Habitat restoration and protection projects downstream of the Landsburg Diversion Dam can help reverse this trend and provide further benefits to Group #7 species.

A range of habitat protection and restoration projects has been identified as candidates for future implementation in the Lower Cedar River (King County 1998). Likely projects include riparian habitat acquisition and protection, and reestablishment of groundwater- fed side channels and ponds in the floodplain. If groundwater-fed channels and ponds are included as the preferred measures, spawning and incubation conditions for sockeye are likely to improve significantly. These types of restoration and enhancement projects take advantage of the available groundwater by digging channels, modifying old stream meanders or side channels, or adding clean graded gravel (Althauser 1985). An important feature of groundwater-fed spawning channels is the protection of redds from scouring flows (Althauser 1985).

Habitat protection and restoration directly in or along the mainstem may provide less direct benefits for sockeye, but would nevertheless help protect structural and functional habitat elements that are used by sockeye for upstream migration and for spawning. Protection and restoration projects in tributaries can also provide direct and indirect benefits for sockeye, however the benefits of these projects are more difficult to predict and will vary depending upon the type and location of each particular project.

The Ballard Locks have been identified as a significant source of mortality to emigrating anadromous salmonids. The HCP provides funds to support implementation of passage improvement measures currently under consideration by the ACOE. The ACOE estimates that full implementation of these measures will substantially increase passage survival (Army Corps of Engineers 1997). The increased survival of smolts passing through the Ballard Locks will increase the productivity of sockeye salmon within the Cedar River and throughout the Lake Washington Basin.

The HCP contributes funds for fish passage improvements and improvements to the salt-water drain at the locks (or other measures to conserve freshwater). The saltwater drain is designed to help manage and reduce the accumulation of salt water that passes into Lake Union during normal operation of the locks. This system uses a considerable amount of freshwater to manage saltwater intrusion. These improvements are expected to save approximately 6,000 acre-feet of fresh water each year, which could then be allocated for other beneficial uses, such as to improve fish passage flows at the locks.

Disturbance Effects and Direct Take

National Marine Fisheries Service considers the sockeye salmon stock from the Cedar

River to be introduced from outside the Lake Washington and does not recognize this stock as an Evolutionarily Significant Unit (Fed. Reg. Vol. 63, No. 46, March 10, 1998). Therefore, the purpose of the following discussion regarding habitat degradation or sources of mortality is to further disclose the likely outcomes of the HCP, but impacts to Cedar River sockeye are not considered "take" under the ESA, because this sockeye is not eligible for listing .

Although the instream flow regime is designed to improve spawning conditions for sockeye salmon as well as reduce the likelihood of mortality of incubating eggs and alevins during winter flood events, some level of redd scour and related mortality during incubation are normal parts of salmon life history. Because of the constrained nature of the lower Cedar River and the fact that the Masonry Dam has limited storage capacity and only captures runoff from the uppermost 43 percent of the basin, water management under the HCP will not eliminate all redd scour resulting from flood flows. Variability in sockeye incubation survival in the river can be substantial, varying with the magnitude of peak flows during incubation. Any such death, direct injury, or disturbance largely the result of natural hydrologic events. The actions of the HCP do not exacerbate these natural effects. To the contrary, the proposed artificial production program and downstream habitat protection and restoration commitments provide the potential to significantly off-set the damaging effects of natural peak flow events on incubating sockeye in the mainstem of the river.

Sockeye salmon are the most numerous naturally reproducing salmonids in the basin and, in years of high abundance, the population has supported a significant Tribal treaty harvest and one of the largest sport fisheries in the state (Fresh 1994). Sport, Tribal, and marine commercial harvest directly increase mortality and can thereby influence population, abundance, and reproductive potential. Although sport and Tribal harvests in Lake Washington are typically well controlled to ensure that adequate numbers of fish return to streams to spawn, Cedar River sockeye can be vulnerable to over-harvest, as demonstrated during the 1996 season when insufficient numbers of fish returned to meet escapement goals after substantial sport and Tribal harvests in the lake (WDFW 1997, unpublished data).

One of the major objectives of the City's mitigation plan is to contribute to the development of a viable Tribal and sport fishery in Lake Washington. Current sockeye production levels provide for a fishery 1 out of 4 years or fewer because run sizes are insufficient to meet escapement goals. The broad array of conservation measures provided by the HCP significantly increases the likelihood that the population of returning adults will more frequently exceed the escapement goal of 350,000 fish. Therefore, the HCP will likely increase the frequency of Tribal and sport fisheries in Lake Washington.

Under the HCP, all Cedar River sockeye are considered a single stock with a productivity level that includes a composite egg to fry survival rate from both hatchery and naturally reproducing fish. Therefore, a mixed-stock fishery only occurs when these fish are present in harvest areas containing other stocks originating from outside the Cedar River Basin, such as those in tributaries draining to the north end of Lake Washington. Mixed-stock fisheries have the risk of overexploiting weaker stocks when harvest rates are set for targeting a more productive stock.

Cedar River fish harvests are co-managed by the WDFW and Muckleshoot Indian Tribe.

Although the mitigation in the City's HCP is expected to improve the likelihood of future harvests, harvest management falls under the jurisdiction of the co-managers. The State of Washington's Wild Salmonid Policy (WDFW 1997b), which has not been agreed to by the Muckleshoot Tribe, indicates that in areas of mixed stock, harvest rates will be targeted for the rate appropriate to the wild stock. Harvest management techniques such as area and timing restrictions can allow for substantial separation of the stocks within Lake Washington. Past restrictions have included limiting sport harvest to areas south of the State Route 520 bridge. Experience suggests that this management regime is quite effective in preventing incidental over-harvest of north-end sockeye. Overall, the City expects the negative effects of harvest to north Lake Washington stocks will be minimized as a result of the implementation of an appropriate harvest management strategy by WDFW and the Muckleshoot Indian Tribe.

Population-level Effects

Multiple age classes will be maintained through the sockeye hatchery program, habitat restoration efforts, and instream flow management regime specifically designed to improve spawning, incubation and emigration conditions for sockeye salmon. Management of the Cedar River by the City will be designed to protect all riverine life history stages of sockeye salmon. The combination of instream flow protection, habitat rehabilitation, and hatchery production measures will provide substantial population resilience to other adverse environmental conditions (i.e., floods, drought) that may occur. The City believes that disturbance effects as described in the paragraphs above do not pose significant risks to the sockeye salmon population of the Lake Washington Basin and are substantially outweighed by beneficial effects accruing from the HCP.

Group #8 – Chinook Salmon, Coho Salmon, and Steelhead Trout

Introduction

Conservation measures for chinook salmon, coho salmon, and steelhead trout were developed to: (1) avoid, minimize and mitigate the impacts of the City's water supply facilities and operations on the Cedar River; (2) to address key limiting factors for these species; and (3) complement other salmon recovery efforts in the Lake Washington watershed by helping to protect and restore upland, riparian and aquatic habitat and the ecological processes that shape and maintain habitat within the Cedar River basin. The Lake Washington basin has been substantially altered since the late nineteenth century by a variety of anthropogenic activities. Many of the basin's natural features and processes have been modified resulting in a reduction in the capacity of the system to support naturally reproducing populations of a number of animal species, including chinook, coho, and steelhead. Conservation measures for Group #8 species have been developed in a manner that will help preserve remaining functional elements of the ecosystem and help rehabilitate those that are presently impaired.

Chinook, coho, and steelhead are present in the lower 21.8 miles of the mainstem and associated tributaries outside of the municipal watershed and downstream of the Landsburg Dam. The Landsburg Dam prevents the passage of these species into over 17 stream miles (12.4 miles of the mainstem plus 4.9 miles in tributaries) of formerly occupied habitat between Landsburg and the natural anadromous fish barrier formed by lower Cedar Falls. All species migrate through Lake Washington and the Ballard Locks as juveniles and adults. Habitat associations in the Cedar River basin are described in

detail in Section 3.6 for all Group #8 species and are summarized below.

Species/ life stage	Primary habitats	Secondary habitats	Important habitat elements
Steelhead			
Adult migration	All areas of the mainstem channel with sufficient depth and suitable velocity	May hold for short periods in deep pools. Also may use the lake for final maturation during migration	
Spawning	Mainstem areas, with small cobble and gravel substrate that is relatively free of sand and silt. Frequently, but not always, spawn in areas closely associated with cover.	Limited spawning may occur in tributaries and groundwater-fed side channels.	Clean, uncompacted substrate with substantial subsurface water flow. Sufficient stream flow to provide depths of at least 0.5 feet and velocities of 1.0 to 3.5 feet per second over suitable substrate. Incubation success can be significantly influenced by susceptibility of redd location to dewatering during declining summer hydrograph.
Juvenile rearing	Mainstem areas with suitable velocities. Often, though not always, associated with cover provided by riparian structure, large woody debris, cobble and boulder substrate.	May use backwater areas, and off-channel areas located near the mainstem, and lower reaches of tributary streams; especially during period of elevated stream flow.	Most fish typically found in areas with velocities of 0.0 to 3.0 feet per second. Sub-yearlings and yearlings tend to prefer higher velocity than other salmonids. Newly emerged fish are often closely associated with cobble substrate in shallow areas of the stream.
Juvenile migration	All areas of the mainstem with tendency to seek high velocity areas	Must swim through approximately 19 miles of slack water in Lake Washington and the ship canal	Steelhead smolts are typically larger than of all other anadromous salmonid smolts are perhaps best able to avoid predators in the river and best suited to migration through the lake.
Chinook			
Adult migration	All areas of the mainstem channel with sufficient depth and suitable velocity	May hold for short periods in deep pools. Also may use the lake for final maturation during migration	Sufficient depth over key shallow riffle areas early in the fall migration. Peak chinook entry into Lake Washington occurs in mid- to late August when surface water temperatures in the lake are typically at their highest levels of the year
Spawning	Mainstem areas, often similar to those used by steelhead, with small cobble and gravel substrate that is relatively free of sand and silt.	Minor amounts of spawning may take place in larger tributaries such as Rock Creek.	Clean, uncompacted substrate with substantial subsurface water flow. Sufficient stream flow to provide depths of 1.0 to 3.4 feet and velocities of 1 to 3.5 feet per second over suitable substrate. Incubation success significantly influenced by magnitude of

Species/ life stage	Primary habitats	Secondary habitats	Important habitat elements
			late fall and winter peak flows in the mainstem.
Juvenile rearing	Mainstem areas with suitable velocity. Often, though not always, associated with cover provided by riparian structure, large woody debris, cobble and boulder substrate.	May use backwater areas, and off-channel areas located near the mainstem, and lower reaches of tributary streams; especially during period of elevated stream flow.	Most fish typically found in areas with velocities of 0.0 to 1.9 feet per second. Newly emerged fish are often closely associated with cobble substrate in shallow areas along stream margins.
Juvenile migration	All areas of the mainstem with tendency to seek high velocity areas	Must migrate as relatively small fish through approximately 19 miles of slack water in Lake Washington and the ship canal	Most downstream migration in the river believed to occur at night. Potentially most vulnerable of group #8 species to predation in the river and lake and perhaps least well-adapted to migration through the lake. Considerations for in-river and in-lake rearing complicate considerations for migration
Coho			
Adult migration	All areas of the mainstem channel and accessible tributaries with sufficient depth and suitable velocity	May hold for short periods in deep pools. Also may use the lake for final maturation during migration	
Spawning	Spawn primarily in tributaries to the mainstem. May also used groundwater-fed side channels where available	Limited spawning may occur in the mainstem	Clean, uncompacted substrate with substantial subsurface water flow. Sufficient stream flow to provide depths of 0.4 to 3.4 feet and velocities of 0.25 to 3.4 feet per second over suitable substrate. Incubation success can be significantly influenced by peak flow events in tributaries.
Juvenile rearing	Tributary areas with suitable velocities. Usually associated with cover and prefer low velocity pool areas Make extensive use of backwater areas, groundwater fed-channels and other off-channel features.	May use shallow areas over gravel and cobble substrate in the mainstem.	Most fish typically found areas with velocities of 0.0 to 1.9 feet per second. Newly emerged fish are often closely associated with large woody debris and other types of in-channel structure.
Juvenile migration	All areas of the mainstem with tendency to seek high velocity areas	Must migrate through approximately 19 miles of slack water in Lake Washington and the ship canal	Subject to predation in the river, but larger size likely makes them less vulnerable than chinook. Due to larger size, migration through Lake Washington perhaps less of an impact than for chinook.

The combination of mitigation and minimization measures provided by the HCP is expected to protect any Group #8 species that may occur in the Cedar River Municipal Watershed or in the Cedar River downstream of Landsburg. The HCP is expected to result in both short- and long-term benefits for group #8 species through: (1) construction of fish passage and protection facilities at Landsburg Diversion Dam to allow the three species access to historic habitat; (2) water quality protection, and habitat protection and restoration measures which will improve habitat conditions in the municipal watershed; (3) funding for interim mitigation before the fish passage facilities are built, which may include funding for studies or emergency supplementation; (4) provision of the HCP instream flow management regime to improve habitat conditions in the lower river; (5) funding for habitat protection and restoration in the lower Cedar River, downstream of the municipal watershed; (6) funding for projects at the Ballard Locks designed to increase survival of emigrating smolts; and (7) monitoring and research. These measures collectively are expected to provide immediate protection to chinook, coho and steelhead habitat and provide the opportunity for increased long-term production of Group #8 species in the Cedar River basin.

Until the fish passage facilities are constructed at the Landsburg Diversion Dam, Group #8 species could be affected by the blockage posed by the dam. After the fish passage facilities are constructed, Group #8 species could be negatively affected by silvicultural treatments, road management, or other operational activities in riparian or upland areas within the municipal watershed. 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). Group #8 species could also be negatively affected by management actions that contribute sediment to streams (e.g., stream habitat restoration projects, silvicultural treatments in riparian areas, road maintenance, use, and decommissioning). Group #8 species could be also negatively affected by alterations in stream flow associated with water management activities that could potentially affect various life stages of Group #8 species and their associated mainstem habitat downstream of the historic anadromous fish barrier at Lower Cedar Falls. In addition, some aspects of the HCP mitigation measures for Group #7 species, sockeye salmon, could potentially affect some Group #8 species.

The likelihood of direct injury or death of any Group #8 species resulting from silvicultural treatments, road management, water management or other operational or mitigation activities is expected to be low under the HCP. However, any such death or direct injury of Group #8 species would constitute take for chinook or an impact equivalent to take, as applied to species listed under the ESA, for coho or steelhead. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for chinook, coho, and steelhead are detailed in the section entitled “Species Conservation Strategies” (Section 4.2.2). Additional measures that benefit Group #8 species are included in the Conservation Strategies for Minimizing and Mitigating the Effects of the Anadromous Fish Migration Barrier a the Landsburg Diversion Dam (Section 4.3.2), the conservation strategies for Instream Flow Management (Section 4.4.2), Watershed Management Mitigation and Conservation

Strategies (Section 4.2), and Anadromous Fish Monitoring and Research (Section 4.5.3). Mitigation and minimization measures for Group #8 species are summarized in tables 4.6-2, 4.6-3, and 4.6-4.

Primary Beneficial Effects and Detrimental Effects of the HCP

General Habitat Effects

The provision of fish passage and protection facilities at the Landsburg Diversion Dam is of particular importance to Group #8 species. These facilities will allow Group #8 species to recolonize their formerly occupied habitat upstream of the Landsburg Diversion Dam. Because a significant period of time will be required to complete final design, permitting, and construction of long-term mitigation facilities, the City will begin providing interim conservation measures as directed by the parties to the Landsburg Mitigation Agreement, with advice from Cedar River Anadromous Fish Committee, immediately in HCP year 1 in an effort to help halt the decline of anadromous fish populations in the basin.

Fish passage facilities are expected to be completed by the end of HCP year 3, subject to the City's ability to gain the necessary permits and complete the SEPA/NEPA review process. The City will provide up to $90,000 per year to fund interim mitigation measures until all fish passage facilities are in operation. These funds would be used to: (1) fund the implementation of life history, genetic, demographic, and/or ecological studies to fill critical information gaps facilitating efforts to protect and restore habitat in the Lake Washington Basin; (2) implement emergency supplemental production programs designed to help sustain and rebuild the populations in a manner that helps ensure their long-term reproductive fitness and capacity to adapt to changing environmental conditions (a population support measure); and/or (3) fund other measures deemed appropriate by the parties to the Landsburg Mitigation Agreement to achieve the objectives of the Landsburg Mitigation Agreement.

Upstream and downstream fish passage facilities and new intake screens at the Landsburg Diversion Dam will be constructed to provide passage and protection for coho salmon, chinook salmon, and steelhead trout. These facilities are expected to open 12.4 miles of the mainstem Cedar River and 4.9 miles of associated tributary streams (Rock Creek, Taylor Creek, William Creek, and Steele Creek) in the protected municipal watershed for the spawning and rearing of these three species.

The proposed watershed management prescriptions for the municipal watershed, including the commitment to eliminate commercial timber harvest and associated habitat protection and restoration measures described in Section 4.2, confer a very high level of protection on all habitats in the municipal watershed by placing all lands outside limited developed areas in reserve status.. As a result of these commitments, all key habitat for Group #8 species within the municipal watershed (i.e., rivers, streams, ponds, lakes, wetlands, and riparian habitat) 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 #8 species clearly depend on a naturally functioning complex of aquatic, riparian, and upland habitats.

Short-term and long-terms gains in the quality of stream, wetland, and riparian habitats are expected under the HCP as a result of the natural maturation of younger seral stage

forest in riparian areas. Maturation of protected forest in riparian forests near streams will help restore more natural ecological functioning in the riparian/aquatic ecosystem as a whole.

The HCP also includes management actions designed to improve and help restore aquatic, riparian, and upland forest habitats within the municipal watershed. 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 is 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. Restoration of a more naturally functioning aquatic ecosystem will benefit Group #8 species over the long term. However, over the short term, these management interventions may cause some localized decline in habitat function. To mitigate for such short-term, localized impacts, 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. 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 #8.

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. Because no harvest for commercial purposes will occur in the municipal watershed, however, any potential impacts associated with commercial timber harvest are eliminated. The comprehensive suite of Watershed Assessment Prescriptions (Appendix 16) and other guidelines (Section 4.2.2) included in the HCP will serve to minimize the probability of erosion and mass wasting associated with roads. These prescriptions and guidelines, along with the programs to improve watershed roads, to improve road maintenance, and to decommission about 38 percent of the road system, will collectively serve to reduce the rate of sediment loading to aquatic systems and help maintain and improve water quality.

Watershed management prescriptions, are expected to provide direct benefit for Group #8 species and their spawning, incubation and rearing habitat within the municipal watershed upstream of the Landsburg Diversion Dam once fish passage facilities are complete. The kinds of benefits described for Group #5 species (bull trout) upstream of the Chester Morse Reservoir will also apply to Group #8 species in the lower portion of municipal watershed downstream of Chester Morse Reservoir. This area encompasses some of the last remaining undeveloped lowland habitat in the Lake Washington basin and will provide important spawning, incubation and rearing habitat for all three species. Watershed Management Conservation and Mitigation Measures (Section 4.2.2) are expected to protect and restore upland, riparian and aquatic habitat and maintain the natural processes important for creating and maintaining complex stream channels that provide a diversity of fish habitats within the municipal watershed. In addition, the restriction of public access into the municipal watershed will provide benefits for all Group #8 species. Inside the municipal watershed, adult and juvenile fish will be protected from harvest and disturbances associated with angling and other activities in or near the river.

The Cedar River basin is the largest sub-basin in the Lake Washington watershed and provides approximately 50 percent of the total annual flow into the lake. Conservation measures in the municipal watershed, which comprises 2/3 of the Cedar River sub-basin, are expected to deliver substantial water quality benefits to aquatic habitat within the municipal watershed, in the mainstem of the river downstream of the municipal watershed, and in Lake Washington. Migration corridors as well as spawning, incubation, and rearing habitat for Group #8 species in the Lake Washington basin are expected to benefit from the provision of high quality water from the municipal watershed.

The lower Cedar River downstream of the municipal watershed has been impacted by urban development, channel modifications, riparian zone disturbance, and peak flow management practices (King County 1998). Mainstem and side-channel habitat quantity and quality have been reduced substantially in the lower river when compared to pre-development conditions. The HCP provides $4.6 million in funding to implement habitat protection and restoration projects in the river basin downstream of the City's ownership boundary in the Lower Cedar River. If matched by contributions from King County, the HCP will provide an additional $270,000 for habitat restoration in the Walsh Lake sub-basin both within and downstream of the City's ownership boundary.

A range of habitat protection and restoration projects has been identified as candidates for future implementation in the Lower Cedar River (King County 1998). Likely projects include riparian habitat acquisition and protection, and reestablishment of groundwater- fed side channels and ponds in the floodplain. If groundwater-fed channels and ponds are included as the preferred measures, spawning and rearing conditions for coho salmon are likely to improve significantly. Off-channel habitats and wall-based channels provide valuable habitat for coho salmon spawning, rearing, and over-winter habitat in other watersheds of the Pacific Northwest. It is likely that the confined nature of much of the lower Cedar River has resulted in a significant loss of what was once considered prime coho salmon habitat. Habitat protection and restoration directly in or along the mainstem may provide less direct benefits for coho, but would nevertheless help protect structural and functional habitat elements that are used by coho for upstream and downstream migration and, to a more limited extent, for spawning and rearing.

Benefits of groundwater-fed features for chinook and steelhead may be somewhat less direct than for coho. Although adult spawners may not make substantial use of off-channel and wall-based habitats, rearing juveniles will likely benefit to some degree from an increase in this type of habitat. Habitat protection and restoration in or along the mainstem can serve to protect important structural features and functional elements of riparian and aquatic habitat and can be expected to provide benefits to steelhead and chinook, which tend to select mainstem areas for spawning and rearing.

The provision of beneficial instream flows downstream of the City's water management facilities on the Cedar River is critical to the success of City's composite efforts to conserve Group #8 species. The HCP instream flow management regime is based upon over 10 years of collaborative scientific analysis and is expected to provide a variety of benefits to Group #8 species including: 1) guaranteed and supplemental flow assurances that better mimic the shape of the natural hydrograph, that are typically greater than the flows required to provide maximum weighted usable area (WUA) for key species and life stages and that are better tailored to meet the needs of anadromous salmonids; 2) limits on the City's future annual diversions, implementation of a monitoring program,

and oversight by an interagency Commission providing flexibility and commitment to shape flows above guaranteed levels for greater ecological benefit; 3) downramping prescriptions to moderate the rate at which stream flows can be reduced to limit the risk of fish stranding; 4) relocation of the flow compliance point 20 miles upstream for improved operating precision, improved protection of the upper portions of the lower river and to encourage more natural patterns of flow variation throughout the lower river; 5) the provision of guaranteed flows in the bypass reach between Masonry Dam and the Cedar Falls powerhouse that will improve conditions for Group #8 species once they are passed upstream of the Landsburg Dam; 6) an increase in the guaranteed amount of water that flows into Lake Washington during the period of maximum water use at the Ballard Locks between June 15 and September 30 for more flexibility to provide beneficial fish passage conditions through the locks facilities; 7) nearly $5 million for habitat protection and restoration in the lower river downstream of the City's ownership boundary; and 8) nearly $2 million for fish passage improvements and water conservation at the Ballard locks. The effects of particular provisions of the instream flow management regime on the various life stages of each of the Group #8 species are discussed below.

Instream Flow Management: Effects on Weighted Usable Area (WUA)

The HCP guaranteed and supplemental flow regime is summarized in Table 4.4-1. The relationships between guaranteed flows, the existing non-binding IRPP minimum flows and the flows that provide maximum WUA for key species and life stages as determined by collaborative PHABSIM analyses are summarized in Figures 4.4-2 through 4.4-5. Expected actual flows will often exceed guaranteed flows during the fall, winter and spring because: (1) inflows to the basin often exceed amounts required to meet the guaranteed flows and municipal water supply demands; (2) surface runoff in the lower 57 percent of the basin enters the Cedar River naturally and is not influenced by the water storage reservoir; and (3) flood storage capacity in the reservoir is relatively limited. Expected actual flows under the HCP instream flow management regime, under the existing IRPP regime, and under natural unregulated conditions are summarized in Appendix 36. Appendix 37 provides habitat duration analyses for expected actual flows under the HCP, IRPP and natural flow regimes using PHABSIM output for target species and life stages.

For most of the year, HCP guaranteed flows are higher than existing IRPP minimum flows and higher than the flows required to provide maximum weighted usable area for key species and life stages. Although these higher flows result in a reduction in WUA when compared to the flows that maximize WUA, they will help ensure that the guaranteed regime more closely mimics natural basin hydrology and will provide a variety of important overriding biological benefits that are discussed later in this section. The effects of the proposed HCP flow regime on WUA for all target species and life stages throughout the year are outlined below. The discussion begins with late summer and early fall flows, then proceeds sequentially throughout the remainder of the year.

Although guaranteed flows are generally higher than the levels that provide maximum WUA for most of the year, in the late summer and early fall they are not. Guaranteed flows in August and the first two weeks of September, the typical period of lowest natural inflow, are slightly below the levels that provide maximum WUA for rearing steelhead and coho. At this time of year, guaranteed flows provide 98 to 99 percent of maximum WUA for juvenile coho and steelhead rearing. Habitat duration analyses

summarized in Appendix 37 demonstrate that, for this period as a whole, expected flows under the HCP regime provide more WUA for juvenile steelhead rearing than expected flows under the existing IRPP regime or expected flows that would occur under natural conditions without the presence of water storage and diversion facilities.

In the fall, spawning conditions for salmon become a key biological consideration. The first returning adult chinook salmon begin to enter the river and spawn in early September. Guaranteed flows at this time are also below the level required to provide maximum WUA for chinook spawning. However, by September 15 with approximately 5 percent of the chinook run typically in the river, guaranteed flows increase to a level that provides 77 percent of maximum WUA. By September 23, with approximately 16 percent of the run in the river, guaranteed flows increase to a level that provides 95 percent of maximum WUA. By October 8, with 50 percent of the run typically in the river, guaranteed flows increase to a level that is equal to or greater than the level required to provide 100 percent of maximum WUA. For the rest of the chinook spawning season, low normal flows remain at the level that provides maximum WUA for chinook spawning.

In an effort to provide more edge spawning habitat for sockeye salmon and potentially reduce subsequent sockeye redd scour vulnerability, high normal guaranteed flows may be provided after October 7. High normal flows exceed the levels required to provide maximum WUA for chinook spawning for the duration of the spawning period, but still provide between 95 percent and 98 percent of maximum WUA for chinook spawning. Habitat duration analyses summarized in Appendix 37 demonstrate that, for the chinook spawning period as a whole, expected flows under the HCP regime will provide more WUA for chinook spawning than expected flows under either the existing IRPP regime or the natural flow regime.

Coho salmon begin to enter the river and spawn in mid-October and continue to spawn into February. Coho spawning is believed to be concentrated in tributaries, but limited spawning may occur in the mainstem. HCP guaranteed normal flows are well above the flows required to provide maximum WUA for coho spawning and higher than the existing IRRP minimum flows throughout the entire coho spawning period. Guaranteed flows during this period provide between 64 percent and 75 percent of maximum WUA for coho spawning. Considerations for coho spawning during this period are secondary to considerations for a number of other important biological factors. Elevated guaranteed flows at this time are designed to provide: (1) increased WUA for chinook spawning; (2) increased edge habitat for sockeye spawning; (3) improved incubation protection for chinook, coho and sockeye; and (4) improved emigration conditions for sockeye fry. Habitat duration analyses based on expected flows, rather than guaranteed or minimum flows, demonstrate that, for the coho spawning period as a whole, the HCP regime provides more WUA for coho spawning than expected natural flows and about the same amount as provided by expected flows under the IRPP regime (See Appendix 37).

Steelhead begin to enter the river and spawn in early March and continue to spawn into early June. HCP guaranteed normal flows are well above the flows required to provide maximum WUA for steelhead throughout their entire spawning period and greater than IRPP flows for most of the period. Guaranteed flows during this period provide between 75 percent and 98 percent of maximum WUA for steelhead spawning. Elevated flows during the steelhead spawning season can encourage steelhead to spawn in less suitable

areas that are more vulnerable to dewatering during the later portion of the incubation period as stream flows drop to normal base flow conditions. This concern is heightened during the later portion of the steelhead spawning period. After mid-May, HCP flows drop slightly below IRPP minimum flows but remain above the levels that provide maximum WUA. This drop in flows substantially increases WUA for spawning steelhead and provides the opportunity to reduce the risk of subsequent redd dewatering for the most vulnerable portion of the population. Habitat duration analyses based on expected flows, rather than guaranteed or minimum flows, demonstrate that, for the steelhead spawning period as a whole, expected flows under the HCP regime provide more WUA for steelhead spawning than expected flows under natural flow conditions or expected flows under the IRPP regime (see Appendix 37).

Concerns for steelhead spawning during this time are balanced with efforts to maintain higher flows to protect incubating salmon, improve conditions for emigrating sockeye fry and provide beneficial conditions for rearing chinook and coho. The generally elevated levels in guaranteed flows during this period result in a reduction in WUA for rearing chinook and coho salmon. Flows during this period provide gradually increasing levels of WUA for juvenile coho and chinook rearing that range from 58 percent of maximum WUA at the start of the period to 78 percent of maximum at the end of the period.

From mid-June through the end of July, incubating steelhead become a primary concern for instream flow management. As mentioned previously, steelhead redds can be vulnerable to dewatering when stream flows drop to normal summer base levels. The flexible HCP guaranteed flow regime, coupled with a real-time steelhead redd monitoring program provide key information and management flexibility that will allow full protection of all steelhead redds in most years. Flows during this period will generally be greater than existing IRPP minimum flows but typically less than expected natural flows. HCP guaranteed flows are generally well above the levels that provide maximum WUA for coho, chinook, and steelhead rearing during this period. Flows during this period provide between 76 percent and 84 percent of maximum rearing WUA for these three species.

Additional Effects of the Instream Flow Management Regime

During the collaborative instream flow studies and development of the HCP instream flow management regime, the interagency Cedar River Instream Flow Committee viewed the extensive PHABISM analyses conducted on the Cedar River as a foundation for an instream flow management regime rather than as a prescriptive tool for determining preferred flows at any give time during the year. While the City believes that PHABSIM analyses are an important tool in developing effective instream flow management practices, anadromous salmonid biology is complex and habitat requirements for these species are not completely described by standard PHABSIM analyses. Additional information is helpful in prioritizing species and life stages during particular times of the year; addressing aspects of their biology not typically analyzed in standard PHABISM investigations; and understanding the complex relationships between hydrologic variation and natural ecological processes in the aquatic environment. During the course of collaborative studies and subsequent development of the HCP instream flow regime, a broad array of information was used in an effort to establish management provisions that would provide comprehensive protection for all life stages of anadromous fish and the habitat upon which they depend. These management provisions address key biological considerations determined to be of particular importance to Cedar River anadromous fish

by the Cedar River Instream Flow committee and include:

- Limits on the rate at which stream flows can be reduced as a result of City's water management activities to reduce the risk of fish stranding and better reflect natural rates of stream flow recession;
- Increased guaranteed flows during the fall to recruit additional sockeye spawning habitat along the margins of the stream and potentially reduce sockeye redd scour vulnerability during subsequent winter peak flow events;
- Increased guaranteed flows during the chinook and sockeye incubation season in the fall, winter and spring to reduce the risk of redd dewatering;
- Increased guaranteed flows during the late winter and early spring to provide improved emigration conditions for sockeye fry;
- Steelhead redd monitoring program and flexible blocks of supplemental water during the summer for increased flows to reduce the risk of steelhead redd dewatering;
- Higher guaranteed flows into Lake Washington for more flexibility to provide beneficial fish passage conditions at the Ballard Locks; and
- A number of commitments that will result in stream flows that better reflect natural hydrologic patterns including: i) relocation of the flow compliance point 20 miles upstream to Landsburg; ii) supplemental guaranteed flows linked to real time hydrologic conditions; and iii) collaborative management of flows above guaranteed levels to support important natural ecological processes and provide benefits to fish.

Effects of the Adaptive Features of the Instream Flow Management Regime

Although a substantial amount of information was assembled over the last 10 years to guide the development of the HCP instream flow regime, the City anticipates that additional information will become available as the science of fluvial systems and strategies for managing stream flows in altered channels continue to evolve. In addition to well-defined, binding instream flow management commitments, the City acknowledges the need to provide sufficient flexibility to adapt and improve instream flow management strategies, as new information becomes available. Therefore, the HCP provides substantial commitments to limit the City's future diversions from the Cedar River to ensure sufficient flexibility to meet additional needs for instream resources should such needs arise. In addition, the HCP provides over $ 3.4 million for further studies to: i) monitor natural and regulated stream flows throughout the basin; ii) better quantify the effects of natural local inflows on stream flow in the Cedar river downstream of municipal watershed; iii) improve the ability of stream flow switching criteria to accurately reflect natural hydrologic conditions; iv) to improve our understanding of key aspects of the biology of chinook salmon and other salmonids in the Cedar River; and v) better understand the effects of stream flow management of fish habitat in altered fluvial systems. Finally, the HCP establishes an Instream Flow Commission (Section 4.4.2 and Appendix 27) that will make use of the information gathered during future studies to guide the management of stream flows over and above

the guaranteed levels to provide additional benefits for instream resources.

The use of this adaptive approach is particularly important in addressing the early life history of Cedar River chinook. Ocean-type juvenile chinook, such as those found in the Cedar River, typically express a tendency toward two early life history patterns. In one pattern, newly emerged juvenile chinook migrate directly downstream to the estuary where they rear for up to several months before moving into continental shelf waters. In the second pattern, juvenile chinook emerge from their redds and rear for up to three months in their natal stream before moving downstream to the estuary where they rear for shorter periods of time before moving into continental shelf waters (Healey, 1991).

Preliminary investigations conducted by WDFW suggest that substantial portions of the juvenile chinook population in the Cedar River display both of these early life history patterns (WDFW 1999, unpublished data). However, in the case of the Cedar River fish, young chinook no longer have ready access to an estuary. Because the Cedar River was rerouted into Lake Washington during the early 1900s, all juvenile chinook from the Cedar River must now swim through approximately 19 miles of slack water that supports a wide variety of native and introduced predators before reaching the marine environment. As they enter the marine environment, juvenile chinook must pass through the Ballard locks and cope with a highly modified marine/freshwater interface that has relatively little resemblance to a natural estuary. This hydrologic configuration is very atypical for ocean-type chinook in general. There are few, if any, examples of newly emerged, ocean-type chinook fry rearing and migrating through a large natural lake system en route to the marine environment. In particular, this configuration is foreign to native Cedar River chinook that historically migrated only a very short distance in the Duwamish River between the Cedar River and the Duwamish Estuary. It is not clear to what degree, Cedar River chinook have been able to adapt to this rather dramatic alteration of their environment. Nor is it clear to what degree either of the two early life history patterns contributes to the production of returning adults and overall survival of the population.

If, for example, juvenile chinook that migrate immediately out of the Cedar River contribute to the majority of the smolt production in the system, then spring juvenile rearing conditions in the river are less of a concern and spring in-river emigration conditions become a greater concern. Alternatively, if young chinook that rear in the river for three months in the Cedar before migrating through the lake survive better than fish that enter the lake as newly emerged fry, then juvenile rearing conditions in the river during the spring are a very important consideration.

Much of the Cedar River downstream of the Landsburg Dam is confined by levees. The average width of the active channel is now estimated to be approximately one half the width of the active channel in the mid-1800s prior to the impacts of development (King County 1998). During periods of high stream flow, the availability of suitable fry rearing and refuge habitat in this confined and narrowed channel can be substantially reduced. Preliminary studies conducted by WDFW indicate that large numbers of chinook fry emigrate from the river during high flow events in the spring. If high spring flows induce chinook fry to migrate to the lake, and these fish survive at a significantly lower rate than fish that rear in the river, then high spring flows could reduce overall smolt production. However, if fry that rear in the lake survive at a greater rate than fry in the river, then high spring flows may increase overall smolt production. The Cedar River constitutes one of the best opportunities in the region to protect and rehabilitate juvenile

rearing habitat for chinook. Given that Lake Washington is completely surrounded by urban development, caution is advisable regarding changes to river flows during the chinook spring emigration period, particularly when other species are also considered.

Water management decisions on the Cedar River are very complex during the spring. Managers must consider the needs of (1) incubating salmon and steelhead, (2) spawning steelhead, (3) rearing juvenile steelhead, coho and chinook, (4) emigrating sockeye and chinook fry, and (5) emigrating chinook, coho and steelhead smolts in the lower river. In addition to protection of anadromous fish, decision makers must also consider (1) flood management, (2) refilling Chester Morse Lake in a manner that protects nesting loons and incubating bull trout and (3) continuing to provide a safe and reliable municipal water supply.

To make good instream flow management decisions, mangers must be supplied with accurate and reliable information. As mentioned above, such information on the early life history of chinook salmon is not presently available. To address this information gap and support instream flow management decisions, the HCP provides $1 million dollars specifically earmarked for studies that address the early life history of chinook salmon and other key life stages of anadromous salmonids in the Cedar River (Section 4.5.2). We expect that study results will be used by the Cedar River Instream Flow Commission to help make well informed and balanced instream flow management decisions during the spring and other key periods of the year.

In summary, the adaptive approach to instream flow management provided by the HCP is expected to improve our understanding of the complex biological requirements of anadromous salmonids in altered fluvial systems. This improved understanding, combined with the flexibility provide by the HCP, will support a more robust management framework that is expected to improve conditions for Group #8 species and help protect and restore ecological processes that shape and maintain aquatic habitat in the lower Cedar River.

Disturbance Effects

Instream flow management strategies have been designed to provide benefits to all Group #8 species during key life stages while avoiding and minimizing potential interspecies conflicts. Because individuals of different species at various life stages are simultaneously present in the river and often express different habitat preferences, it is not possible to optimize conditions for all species in the river at a given point in time. Therefore, key life history stages are given preference during certain periods of the year. For example, flows provided under the HCP in October, during the period of peak salmon spawning, are designed to provide maximum benefits for spawning chinook and sockeye. These flows are well above the levels that provide maximum WUA for rearing juvenile steelhead and coho. Resulting reductions in a rearing WUA are, however, relatively small and are offset by the substantial benefits of allowing flows to follow the shape of the natural hydrograph and providing more WUA for spawning chinook and more edge spawning habitat for spawning sockeye.

Similarly, HCP guaranteed flows during the coho and steelhead spawning season are designed to provide added protection for incubating chinook and sockeye as well as emigrating sockeye. The elevated flows during this period result in a reduction in WUA for spawning steelhead and coho. Elevated streamflows continue through July to provide

added protection for incubating steelhead. These flows, designed to protect steelhead redds result in a reduction in WUA for rearing juvenile chinook, coho, and steelhead. However the reductions in WUA are relatively small and are believed to be of secondary importance to steelhead incubation protection.

These potential effects that result from interspecies tradeoffs associated with instream flow management are not believed to constitute a significant impact. Further, these effects will be offset by the full range of benefits provided by the (1) comprehensive instream flow management regime for key life stages of all Group #8 species, (2) the provision of access to 17 miles of high quality habitat upstream of Landsburg and associated watershed management provisions in the municipal watershed, (4) investments in habitat protection and restoration in the lower river downstream of the City's ownership boundary, and (5) the City's commitments to monitoring and adaptive management.

Interspecies conflicts can potentially also occur when implementing mitigation measures for the effects of the Landsburg Dam on Group #7 (sockeye salmon) and Group #8 species. The need to sort sockeye from upstream migrating chinook and coho as they pass over through upstream fish passage facilities in the future may result in increased handling stress for adult sockeye that must be captured and transported back downstream.

An increase in sockeye fry production due to the proposed sockeye mitigation program could potentially lead to an increase in potential predator populations in the river that may also prey upon chinook and coho fry which overlap with sockeye in their emergence timing. Conversely, short-term increases in sockeye fry abundance could serve to overwhelm predators during parts of the year and thus reduce predation rates on other species. An increase in sockeye fry abundance could also result in an increase in the forage base for yearling steelhead and coho and thus provide benefits to these species. An increase in the number of spawning sockeye could potentially affect spawning chinook. This potential effect is expected to be minimal because, chinook are larger than sockeye, tend to select somewhat different spawning habitat and generally bury their eggs deeper in the gravel than do sockeye. An increase in the number of adult steelhead returning to spawn could result in the disruption of a larger number of chinook and sockeye redds late in the incubation season. Since chinook tend to complete incubation in April, well before the completion of sockeye incubation, spawning steelhead are more likely to disturb incubating sockeye than incubating chinook.

The proposed mitigation for sockeye salmon (Group #7) includes measures to collect sockeye broodstock for the proposed artificial production program. The sockeye broodstock collection program has two primary objectives: (1) to capture an adequate number of adult sockeye salmon in a manner that provides a representative subset of the entire Cedar River sockeye population and (2) to avoid and minimize any potential detrimental impacts the program may have on naturally reproducing salmonids in the Cedar River. The City is not aware of any definitive information demonstrating that ongoing broodstock collection activities at the interim facilities have had significant detrimental impacts on salmonid reproduction in the Cedar River. However, past experience with the prototype sockeye hatchery program has demonstrated the need for a thoughtful and well-founded approach to broodstock collection.

The City believes that the potential risks associated with installation, operation and

removal of the interim and long-term broodstock collection facilities can be minimized and avoided through the development of rigorous broodstock collection protocol and implementation of improved broodstock collection practices beginning in Year 1 of the HCP. As part of the HCP, the City will commit $200,000 specifically earmarked for research to support the development and implementation of effective sockeye broodstock collection facilities and practices to minimize the risk of detrimental effects on naturally reproducing salmonids in the Cedar River.

As with the instream flow management regime, potential incidental impacts of the proposed mitigation measures for the migration barrier at the Landsburg Dam are expected to be more than offset by the broad array benefits provided to all Group #8 species by the HCP as a whole.

Direct Take

The primary activities under the HCP that may result in disturbance, and possibly take or the equivalent of take, of Group #8 species include (1) management of river flows and (2) operation of fish passage facilities at Landsburg, and (3) operation of the broodstock collection facilities for the sockeye mitigation program. Once Group #8 species have access to the municipal watershed, activities under the HCP that may result in disturbance, and possibly take or the equivalent of take, of Group #8 species will 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.

Although the HCP instream flow regime is designed to reduce the likelihood of mortality of incubating eggs and alevins during winter flood events, some level of redd scour and related mortalities during incubation are a normal part of salmon life history. Because of the constrained condition of the Cedar River and the fact that the Masonry Dam has limited storage capacity and only captures runoff from the uppermost 43 percent of the basin, water management under the HCP will not eliminate all flood flows. Peak flow management practices are not expected to be affected by implementation of the HCP. Egg to fry mortality in the river during very large flood events can be substantial, varying with the magnitude of peak flows during incubation. Any such death, direct injury, or disturbance would not constitute take under the ESA, as the measures included in the HCP do not exacerbate these natural impacts.

Rapid reductions in stream flows due natural causes and the City's water management activities on the Cedar River can potentially strand and kill fish. Downramping prescriptions, which constrain the rate at which the City may reduce stream flows as a result of its water management practices, are expected to avoid and minimize risks associated with stranding to levels that would occur under natural, unregulated conditions. Any residual risk of stranding that might occur would by offset by the array of benefits provided by the HCP to Group #8 species as a whole.

As a result of handling and/or structures, it is also possible that injury or death of a small

number of fish each year could occur during operation of the fish passage facilities at the Landsburg Diversion Dam and the broodstock collection facilities for the sockeye mitigation program. This small potential level of take, however, will be more than offset by the conservation and mitigation value of the facilities themselves along with other measures included in the HCP.

Within the municipal watershed, the likelihood of direct take occurring at a scale that may compromise the viability of Group #8 species populations 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 #8 species habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which greatly reduces the risk of mortality from public fishing; and (5) removal of 38 percent of forest roads, which will reduce the potential for take 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 disturbance to, direct injury to, or death of individuals as a result of City activities is expected to be very low in any given year.

Population-level Effects

The City believes that the potential for disturbance and take as described above does not constitute a threat to Group #8 species. On the contrary, the City believes that the substantial measures in this HCP for the protection of Group 8 species and their habitats, implementation of an extensive monitoring and research program, and the incorporation of an adaptive management strategy will result in a substantial net population benefit for these species. The City believes that these measures will provide sufficient mitigation for any potential negative impacts of the City's operations on chinook, and coho salmon and steelhead trout during the term of the HCP.

Other Effects

The Ballard Locks have been identified as a significant source of mortality to emigrating anadromous salmonids. The HCP provides funds to support implementation of passage improvement measures currently under consideration by the ACOE. The ACOE estimates that full implementation of these measures will substantially increase passage survival (Army Corps of Engineers 1997). The increased survival of smolts passing through the Ballard Locks will increase the productivity of anadromous stocks within the Cedar River and throughout the Lake Washington Basin.

The HCP contributes funds for fish passage improvements and improvements to the salt-water drain at the locks (or other measures to conserve freshwater). The saltwater drain is designed to help manage and reduce the accumulation of salt water that passes into Lake Union during normal operation of the locks. This system uses a considerable amount of freshwater to manage saltwater intrusion. These improvements are expected to save approximately 6,000 acre-feet of fresh water each year, which could then be allocated for other beneficial uses, such as to improve fish passage flows at the locks.

One of the major objectives of the City's mitigation plan for sockeye salmon is to

contribute to the development of a viable tribal and sport fishery in Lake Washington. As described under the sockeye salmon effects section, the HCP has the potential for the greatly increased adult sockeye returns available for harvest. The potential problems associated with a mixed-species fishery for sockeye (see Section 4.3.2) are not considered a concern for coho salmon and steelhead trout because significant numbers of adult fish are not present in Lake Washington during the period in which sockeye salmon harvests are conducted. Some portion of the chinook run is present in the lake during the sockeye harvest. However, many chinook enter the lake after the period during which sockeye harvests are traditionally conducted. Harvest reports from past sockeye sport fisheries in Lake Washington indicate that very few, if any, chinook have been harvested. In addition, gear restrictions and mandatory release requirements can be imposed to further limit the effects of any incidental chinook capture.

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 combination of mitigation and minimization measures committed to in the HCP is expected to protect any bald eagles that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury to, or death of, any bald eagle resulting from silvicultural treatments, road management, or other operational activities is expected to be low under the HCP, as is the likelihood of disturbance to any actively nesting eagles. However, any such death, direct injury, or disturbance leading to such injury or death would constitute take under the ESA.

Long-term benefits are expected to accrue to the bald eagle, especially through protection of mature, late successional, and old-growth forest, and the recruitment of additional mature and late-successional forest over time. A net gain of potential bald eagle habitat (for nesting, roosting, and foraging) is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to bald eagles through: (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.

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 (e.g., 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 in tables 4.6-2, 4.6-3, and 4.6-4.

Primary Beneficial Effects 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 utilization 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 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, and, in order to eliminate or minimize any short-term impacts to bald eagle 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 and no tree removal that has the potential to reduce streambank 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 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. 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, however. 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 Direct Take

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 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 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) compliance with Washington Forest Practice Rules; (4) 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 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.

Population-level Effects

Population-level effects on the bald eagle are, in general, as described for other species addressed by the HCP that are associated with mature, late-successional, and old-growth forest, and for those species associated with aquatic and riparian habitats. 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 below under "Other effects."

The City believes that the HCP will have an overall positive effect on the regional bald eagle population.

Other Effects

Two 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).

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 bald eagle are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any harlequin ducks that may nest in the Cedar River Municipal Watershed. The likelihood of direct injury or death of, any harlequin ducks resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting harlequin duck pairs. However, any such death, direct injury, or disturbance of harlequin ducks leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Long-term benefits are expected to accrue to the harlequin duck, especially through protection of all stream and riparian habitat and all mature, late successional, and old-growth forest in reserve status, as well as the recruitment of additional mature and late-successional forest over time. The HCP is expected to result in both short- and long-term benefits to the harlequin duck through: (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.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for harlequin ducks are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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, 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.

Major habitat effects on the harlequin duck are similar, in general, to those described for other species addressed by the HCP that are closely associated with streams and riparian habitats. All key habitat as well as potential habitats are protected. Protection of and improvements in water quality and streamside habitat are of particular importance for nesting and foraging harlequin ducks.

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 harlequin ducks. 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 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 and no tree removal that has the potential to reduce streambank 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 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 Direct Take

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 very 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) compliance with Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads, which will reduce the potential for take 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 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 impacts will likely be rare.

Population-level Effects

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.

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 harlequin ducks are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any great blue herons that may occur in the Cedar River Municipal

Watershed. The likelihood of direct injury to, or death of, any great blue herons resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting great blue heron pairs. However, any such death, direct injury, or disturbance of great blue herons leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, great blue herons are similar to those described for other species addressed by the HCP that are closely associated with aquatic and riparian habitats. Long-term benefits are expected to accrue to the great blue heron, especially through protection of all streams, open water, wetlands, and riparian habitat and all mature, late successional, and old-growth forest in reserve status, as well as by the recruitment of additional mature and late-successional forest over time. Protection of, and improvements in, water quality (e.g., reduced sediment and lower temperature) and streamside habitat are of particular importance to support foraging and reproduction for this species.

A net gain in the quality and quantity of key and secondary habitat for the great blue heron is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to great blue herons that may use the watershed through: (1) protection of all key aquatic and riparian habitat, including streams, lakes, ponds, wetlands, and riparian forest to support reproduction and foraging; (2) protection of all old growth and recruitment of a substantial amount of mature and late-successional forest over time, increasing the availability of nesting structures (tall trees and snags); (3) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of disturbance, both to habitat and to nesting birds; (4) 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; (5) stream habitat restoration projects, reestablishing more natural stream function and potentially increasing the availability of aquatic prey species; (6) streambank stabilization projects to reduce sediment input to streams; (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; (9) overall improvements in water quality; (10) removal of 38 percent of watershed roads, reducing the potential for human disturbance; and (11) monitoring and research.

Great blue herons 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 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). Great blue herons could also be negatively affected on a short-term basis by any management actions that contribute sediment to streams (e.g., stream restoration projects, silvicultural treatments in riparian areas, and road maintenance, use, and decommissioning).

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 Effects 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, 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.

Major habitat effects on great blue herons are similar, in general, to those described for other species addressed by the HCP that are closely associated with aquatic and riparian ecosystems. 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 (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 benefiting 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 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 could result in short-term negative impacts on streamside habitat and/or water quality. 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, 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. Also, 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. 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 (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. Implementing 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 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 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.

Habitat effects related to mature, late-successional, and old-growth forest are generally as described for other species addressed by the HCP that are associated with those habitats. 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 great blue herons, especially in riparian corridors, 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).

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 City 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 Direct Take

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 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 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) compliance with Washington Forest Practice Rules; (4) 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. In addition, the City will manage operational activities to minimize disturbance in the vicinity of active rookeries that might decrease nesting success.

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 great blue herons as a result of silvicultural treatments, road management, or other operational activities is expected to be very low. While an occasional nest could be destroyed inadvertently as a result of management actions near riparian or aquatic habitats, this is very unlikely because of the high degree of visibility of heron nests (often in colonies), and because site evaluations will be conducted prior to intervention.

Population-level Effects

Population-level effects on the great blue heron are, in general, as described for other species addressed in the HCP that are closely associated with aquatic and riparian habitats. 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 great blue heron prey populations of fish and amphibians. Any short-term, local impacts to great blue herons resulting from restoration activities in aquatic and riparian areas will be more than offset by long-term, landscape-level benefits. In addition, measures in the HCP that reduce human activity levels will protect any 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. Overall, the City expects that population-level effects on the great blue heron will be positive.

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 great blue heron are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any ospreys that may nest in the municipal watershed. The likelihood of direct injury to, or death of, any ospreys resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting osprey pairs. However, any such death, direct injury, or disturbance of ospreys leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to the osprey are similar, in general, to those described for other species addressed by the HCP that are associated with late-successional and old-growth forests and with aquatic and riparian habitats. Long-term benefits are expected to accrue to the osprey, especially through protection of mature, late-successional, and old-growth forest in reserve status, protection of riparian corridors through reserve status, and the recruitment of additional mature and late-successional forest in the watershed over time by natural processes and by active silvicultural intervention. A net gain of potential nesting habitat for ospreys is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to ospreys that nest and forage in the watershed through: (1) protection in reserve status of all key aquatic and riparian habitat (including lakeshore); (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) protection of all old-growth forest and recruitment of substantial mature and late-successional forest over time, increasing the availability of suitable nesting trees and perch sites; (4) silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests; (5) retention, creation, and recruitment of large snags through silvicultural treatments, maintaining and increasing the availability of potential nesting and perching sites; (6) protection and improvement of water quality and other habitat

conditions for prey species through measures to reduce sediment loading to streams; (7) stream habitat restoration projects, potentially resulting in increased availability of prey fish; (8) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams; (9) passage of all native anadromous fish species above the Landsburg Diversion Dam, when the fish ladders are constructed; (10) changes in management of instream flows under the HCP and other flow-related measures that will improve conditions for fish that are prey of osprey; (11) guidelines and prescriptions designed to reduce sediment production during watershed management activities; and (12) protection of nesting pairs from human disturbance.

Ospreys could be negatively affected by silvicultural treatments, road management, or other operational activities, especially in riparian areas and upland forests near open water bodies. Such effects could be direct (e.g., through physical injury to or death of individuals) or indirect, through influences on habitat or behavior, such as direct destruction of active nests, removal of potential nest trees, alteration of habitat structure, or disturbance leading to nest abandonment. Ospreys can also be negatively affected by management activities (such as silvicultural treatments and road construction, maintenance, and use) that contribute sediment to streams, thereby reducing water quality and potentially affecting populations of prey fish.

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 Effects and Detrimental Effects of the HCP

Habitat Effects

The general habitat requirements of the osprey and the bald eagle (Group #9) are very similar, with the exception that eagles use stream corridors more extensively for foraging, rely on carrion seasonally as a food resource, and roost communally during winter. Therefore, the beneficial and detrimental effects of the HCP on habitat are considered generally to be the same or similar for ospreys as for bald eagles.

Because no commercial timber harvest will be conducted in the municipal watershed, 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.

Major habitat effects on the osprey are similar, in general, to those described for other species addressed by the HCP that are associated with late-successional and old-growth forests and with aquatic and riparian habitats. 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 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 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 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 impacts on streamside 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 osprey 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 and no tree removal with 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 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. 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, however. 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 Direct Take

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 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 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) compliance with Washington Forest Practice Rules; (4) 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. 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.

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 ospreys as a result of silvicultural treatments, road management, or other operational activities is expected to be very low.

Population-level Effects

Population-level effects on the osprey are, in general, as described for other species addressed by the HCP that are associated with mature, late-successional, and old-growth forest, with the addition of this species' closer association with aquatic habitats for foraging. 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.

Other Effects

Two groups of measures will benefit osprey by improving habitat conditions for fish that are 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.

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 osprey are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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, persistent shrub communities, natural forest openings, and meadow complexes, primarily within the western hemlock zone, at lower

elevations. The 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 combination of mitigation and minimization measures committed to in the HCP is expected to protect any willow flycatchers that may nest in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any willow flycatchers resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting willow flycatcher pairs. However, any such death, direct injury, or disturbance of willow flycatchers leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The HCP is expected to result in both short- and long-term benefits to willow flycatchers that may use the watershed, primarily through: (1) protection through reserve status of all key stream, pond, and wetland habitat, all wetland complexes (includes forested area), all persistent shrub communities, 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.

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 habitat created artificially by commercial timber harvest could 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 in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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, all key habitat for the willow flycatcher within the municipal watershed is protected through reserve status. No appreciable changes in acreage of potential key habitat for willow flycatchers will occur under the HCP, but the quality of some habitats may improve, and the habitats may

develop more natural characteristics as forest adjacent to open habitats matures. In addition, overall habitat quality for the willow flycatcher is expected to improve through the decrease in human activity throughout the watershed, 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. Some short-term and long-terms 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 Direct Take

The primary activities under the HCP that may result in disturbance to, and possibly the equivalent of take of, willow flycatchers 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 willow flycatcher pairs 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 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; (3) compliance with Washington Forest Practice Rules; (4) 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 very low.

Population-level Effects

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 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, 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. Rather, the 50-year commitments in the HCP should produce an overall population benefit for the willow flycatcher in the long term. Given that about 65 percent of the 90,546-acre municipal watershed is below an elevation of 3,000 ft and that a more natural habitat distribution will develop across the watershed landscape during the term of the HCP, it may be that the municipal watershed is particularly important for willow flycatchers on a regional basis, especially in view of the current and expected high rate of development of lands at lower elevations in the Puget Sound region.

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 willow flycatcher are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect the two species of shrews in Group #25 that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury to, or death of, any Group #25 shrews resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. However, any such death or direct injury of Group #25 shrews would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service

publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, the northern water shrew and masked shrew are generally as described for other species addressed by this HCP that are closely associated with streams, wetlands, riparian habitats, and mature, late successional, and old-growth forest. Long-term benefits are expected to accrue to the Group #25 species, especially through protection in reserve status of all wetlands, streams, and riparian habitat, and all mature, late successional, and old-growth forest, as well as the recruitment of additional mature and late-successional forest over time. The HCP is expected to result in both short- and long-term benefits to the Group #25 shrews through: (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 .

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 (e.g., 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 in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the watershed, 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, including harlequin ducks.

Major habitat effects on the Group #25 shrews are similar, in general, to those described for other species addressed by the HCP that are associated with aquatic and riparian habitats and with mature, late successional, and old-growth forest. 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 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 Group #25 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 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 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.

Major habitat effects on Group #25 shrews 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 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 Direct Take

The primary activities under the HCP that may result in direct take of Group #25 shrews 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. 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.

The likelihood of direct take occurring at a level which may compromise the viability of any Group #25 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 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) compliance with Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads, which will reduce the potential for take related to 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 very 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.

Population-level Effects

Population-level effects on the masked shrew and northern water shrew populations are, in general, as described for other species addressed by the HCP that are associated with streams and riparian habitats and with mature, late successional, and old-growth forest. 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. The City believes that the HCP will have an overall positive effect on the regional Group #25 shrew populations.

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 harlequin ducks are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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.

No comprehensive surveys to determine the presence or absence of Pacific or river lamprey have been conducted within the Cedar River Watershed and no incidental observations of either species have been documented to date upstream of Landsburg. River lamprey have been observed in the Cedar River system downstream of Landsburg and Pacific lamprey have been observed at the Ballard Locks. There has been one report of a dead Pacific lamprey found below Landsburg Dam. It is possible that both species are currently able to pass above the Landsburg Diversion Dam, as a variety of lamprey species are known to pass beyond barriers that other fishes cannot pass. For the purposes of this effects analysis, the City assumes that both 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.

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 ammocoetes, 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.

The combination of mitigation and minimization measures committed to in the HCP for watershed management is expected to protect lamprey within the municipal watershed (Section 4.2.2). Additional benefits will be provided by the instream flow regime (Section 4.4.2), funding for protection and restoration of habit downstream of Landsburg (Section 4.4.2), and construction of fish passage facilities at Landsburg (Section 4.3.2). The likelihood of direct injury to, or death of, any lamprey resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. Some lamprey larvae, however, could be injured or killed during cleaning operations for the water intake forebay at Landsburg or by impingement on the water intake screens. Any such death or direct injury of lamprey would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

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. The HCP is expected to result in short- and long-term benefits to lamprey as compared to the current conditions 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 all 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; and

(13) monitoring and research.

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 (e.g., 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, and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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 WDOE 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, even more than this 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.

The City believes that instream habitat improvement and rehabilitation must be accompanied by upslope protection and restoration that will reduce impacts of upslope conditions or activities on stream habitat. For example, efforts to stabilize stream banks or add large woody debris to streams may not be effective in the long run if road failures occur that result in large inputs of coarse sediment to streams upstream of such projects. Thus, these kinds of activities will be coordinated under the HCP.

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 Direct Take

Operation of facilities has inherent potential to affect 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 Cedar River Instream Flow Oversight Commission to advise the City in managing available flows that are over and above guaranteed levels. Once Pacific and river lamprey are able to cross the Landsburg Diversion Dam during upstream migration, if they cannot do so now, any potential effects of management of the municipal watershed would apply to these species.

Disturbance effects 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.

Disturbance 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 to fine sediment habitat available naturally for Pacific and river lamprey. Should lamprey larvae be present within this reach during cleaning, the City 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. Forebay cleaning typically occurs in February or March, when air and water temperatures are relatively cool and precipitation is received frequently. Since juvenile lamprey may be present year around, this timing reduces the risk to the juveniles compared to warmer and drier periods of the year.

Some lamprey larvae could also be injured as a result of impingement on the water intake screens at Landsburg. Improvements for fish protection, however, include new screens designed to minimize such impacts (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 City 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.

Disturbance 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. 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.

Because of the above mitigation and minimization measures committed to in the HCP, the City believes the likelihood of disturbance to, direct injury to, or death of individuals as a result of flow downramping operations is expected to be very low in any given year.

Disturbance Effects Related to Land Management in the Municipal Watershed

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of Pacific and river lamprey that may occur in the municipal 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. It should be noted that only a portion of each of the above activities will occur within the lower municipal watershed.

The likelihood of direct take of Pacific and river lamprey from land management activities 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 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) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which minimizes potential disturbance overall; and (5) removal of 38 percent of forest roads, which will reduce the potential for take 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 disturbance to, direct injury to, or death of individual Pacific or river lamprey as a result of silvicultural treatments, road management, or other operational activities in streams and associated riparian areas is expected to be very low.

Population-level Effects

For several reasons, the City believes that the HCP will have an overall positive effect on Pacific and river lamprey populations 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) 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 protection of key habitat through reserve status, improvements and substantial decommissioning of forest roads, and 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.

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 Pacific or river lamprey are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

Group #30 – Kokanee

Introduction

Kokanee, the land-locked form of sockeye salmon, typically occur in deep, cool freshwater lakes. Adults spawn in tributaries to these lakes, and fry return, upon emergence, to mature over a period of about 4 years (Section 3.6.2). Their spawning requirements are similar to those of sockeye salmon, except that, because they are smaller fish, kokanee prefer relatively smaller-sized gravels for spawning. Some kokanee in Lake Washington have been known to spawn in gravel along parts of the lakeshore.

Kokanee have recently been documented in Walsh Lake, and spawning activity has been confirmed in Webster Creek, the main tributary to Walsh Lake (Appendix 23). It is unknown whether this population is native to the lake or is the result of plant(s) sometime during the last several decades. Although kokanee were not collected during a 1977 University of Washington fish survey (Congelton et al. 1977) and were not mentioned in water quality reports from the 1920s, the sampling methods in these efforts may not have been satisfactory to support a conclusion that kokanee were absent at those times.

The quality of stream habitat for spawning kokanee depends on water temperature, water quality, and habitat complexity, including availability of pools, substrate structure, and cover (e.g., woody debris). Such habitat conditions depend, at least in part, on the condition of riparian vegetation and the extent of sediment loading from anthropogenic sources. Potential key habitat for kokanee in the municipal watershed include Walsh Lake and its tributaries, as well as riparian habitat associated with the lake and its tributaries.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any kokanee within the municipal watershed. The likelihood of direct injury to, or death of, any kokanee resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. Any death or direct injury of kokanee would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The mitigation and minimization measures committed to in the HCP are expected to maintain the natural processes important for creating and maintaining habitat for kokanee in the watershed. The HCP is expected to result in short- and long-term benefits to kokanee as compared to the current conditions by implementing: (1) protection of all key habitat (Walsh Lake and its tributaries, and associated riparian habitat); (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 Walsh Lake 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 within the Walsh Lake subbasin; (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.

Kokanee could be negatively affected by silvicultural treatments, road management, or other operational activities in riparian or upland areas that could affect Walsh Lake or its tributaries. 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 riparian vegetation). Kokanee 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 the kokanee are detailed in the Section 4.2.2 and Section 4.5.6, and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects and Detrimental Effects of the HCP

Habitat Effects

Lands within the upper portion of the Walsh Lake Basin, including land around and above the lake, are owned completely by the City. Any effects of the HCP on kokanee habitat within the municipal watershed would be associated with land management. 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; (2) construction and use of hundreds of miles of forest roads, which has increased sediment loading to streams through erosion and mass wasting (landslides); and particularly within the Walsh Lake Basin, (3) a history of homesteading and the existence of a mining and manufacturing community (Taylor) within the basin, which impacted forest and riparian vegetation, and water quality in the area (prior to City acquisition of the land). 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 kokanee within the municipal watershed (i.e., Walsh Lake 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 kokanee. In the short term, kokanee will benefit by increased levels of habitat protection and by active intervention to increase habitat complexity, such as streambank stabilization projects to reduce the frequency of bank failures. In the long term, kokanee 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 that are important to kokanee, including clean gravels for spawning.

The City believes that instream habitat improvement and rehabilitation must be accompanied by upslope protection and restoration that will reduce impacts of upslope conditions or activities on stream habitat. For example, efforts to stabilize stream banks or add large woody debris to streams may not be effective in the long run if road failures occur that result in large inputs of coarse sediment to streams upstream of such projects. Thus, these kinds of activities will be coordinated under the HCP.

Short-term and long-terms 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 and Walsh Lake, as well as protecting all wetlands, and their recharge areas, associated with streams. In addition, maturation of protected forest in riparian forests near streams and the Walsh Lake wetland complex 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, increases in food production for fish, and cooler water temperatures. Development of mature and late-successional forest significantly contributes to the

reestablishment of a more naturally functioning ecosystem, thus benefiting kokanee in the Walsh Lake Basin.

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 kokanee 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 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 kokanee 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 impacts on kokanee. 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. 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 kokanee.

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 Direct Take

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of kokanee that 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); and (8) routine road use. It should be noted that only a small portion of each of the above activities will occur within the Walsh Lake subbasin.

The likelihood of direct take of kokanee resulting from land management activities 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 kokanee habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which minimizes potential mortality from fishing; and (5) removal of 38 percent of forest roads, which will reduce the potential for take 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 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 in any given year. The restriction of public access into the municipal watershed will provide benefits for kokanee by reducing potential disturbance and direct take that might result from fishing, although it is likely that trespassers fishing in Walsh Lake annually take a few kokanee.

Population-level Effects

The HCP provides a number of distinct benefits to kokanee 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 restoration of stream and riparian habitats over the long term to more natural conditions (see above). Any short-term, local impacts to kokanee from these restoration activities in streams and riparian areas will be more than offset by long-term, landscape-level benefits. Habitats are managed to protect all life history stages of kokanee. Increases in the quantity and quality of accessible habitat, in both stream and riparian areas, will benefit the kokanee population in the municipal watershed. Thus, the City believes that the HCP will have an overall positive effect on the watershed kokanee population over the long term.

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 kokanee are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

Group #31 – Sea-run Coastal Cutthroat Trout

Introduction

Sea-run cutthroat trout are not found in the Cedar River Municipal Watershed above the Landsburg Diversion Dam, although resident cutthroat are present in high numbers within the watershed below the Lower Cedar Falls. Additionally, it is not known what proportion of the Cedar River cutthroat trout population downstream of the Landsburg Diversion Dam is the anadromous sea-run cutthroat trout. There are no records indicating that sea-run cutthroat trout use the fish ladder at the Ballard Locks. However, large cutthroat trout have been observed in the Cedar River downstream of the Landsburg Diversion Dam, which suggests that some fish may have an anadromous or potentially adfluvial life history.

In general, adult sea-run cutthroat trout tend to spawn in the extreme upper reaches of small streams, ascending above the areas utilized by other anadromous salmonids. For this reason, it is likely that anadromous cutthroat at one time, prior to the time the Cedar River was re-routed into Lake Washington, ascended into stream basins between Landsburg and Lower Cedar Falls (e.g., the Williams Creek, Rock Creek, and Steele Creek subbasins). These subbasins are now dominated by stream-resident cutthroat trout, suggesting that accessible reaches may have been used by sea-run cutthroat trout prior to construction of the Landsburg Dam. The quality of stream habitat for spawning cutthroat depends on water temperature, water quality, and habitat complexity, which in turn depend, at least in part, on the condition of riparian vegetation. Potential key habitat in the municipal watershed for sea-run cutthroat trout includes all habitat currently used by resident cutthroat trout that is located below natural barriers to upstream migration (Map 7). Thus, key habitat includes streams in the lower municipal watershed and their associated riparian habitat. As described below, habitat in the Cedar River below Landsburg that is influenced by City management of instream flows may also be important.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect sea-run cutthroat trout within the municipal watershed (Section 4.2.2). Additional benefits will be provided by the instream flow regime (Section 4.4.2), funding for protection and restoration of habit downstream of Landsburg (Section 4.4.2), and construction of fish passage facilities at Landsburg (Section 4.3.2). The likelihood of direct injury to, or death of, any sea-run cutthroat trout resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, although some fry or juvenile sea-run cutthroat trout could be stranded during flow downramping events, and some juveniles be injured by impingement on the water intake screens at Landsburg, should any spawning occur above Landsburg. Any such death or direct injury of sea-run cutthroat trout would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The mitigation and minimization measures committed to in the HCP are expected to maintain the natural processes important for creating and maintaining habitat for sea-run cutthroat trout in the municipal watershed and downstream, to the extent the City can influence downstream habitat. The HCP is expected to result in short- and long-term benefits to sea-run cutthroat trout as compared to the current conditions 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 and including protection of redds;

(3) protection of juveniles fish from stranding during flow downramping events;

(4) funding for habitat protection and restoration downstream of Landsburg;

(5) funding to improve survival of smolts passing through the Ballard Locks to Puget Sound;

(6) adaptive management of river flows, though the Cedar River Instream Flow Oversight Commission;

(7) protection of all key habitat in the municipal watershed (streams and associated riparian habitat between Lower Cedar Falls and Landsburg);

(8) elimination of timber harvest for commercial purposes within the watershed, reducing the overall level of habitat disturbance;

(9) 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;

(10) silvicultural treatments designed to accelerate the development of natural functions in riparian forests and late-successional structural characteristics in second-growth forests;

(11) stream restoration projects, which are expected to improve microhabitat conditions in many reaches;

(12) road improvements and decommissioning, and improved road maintenance, reducing sediment loading to streams and other aquatic habitats;

(13) guidelines and prescriptions designed to reduce sediment production during watershed management activities; and

(14) monitoring and research.

Sea-run cutthroat trout could be negatively affected by impingement on water intake screens at Landsburg (after fish ladders begin operating), management of instream flows, silvicultural treatments, road management, or other operational activities in riparian or upland areas that could affect streams or riparian habitats in the municipal watershed (also after fish ladders begin operating). 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 riparian vegetation). Sea-run cutthroat trout 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 sea-run cutthroat trout are detailed in the sections 4.2.2, 4.3.2, 4.4.2, and Section 4.5.6, and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects and Detrimental Effects of the HCP

Habitat Effects

If there are currently sea-run cutthroat trout in the Cedar River, they can be expected to colonize the habitat above the Landsburg Diversion Dam after fish passage facilities are provided under the HCP. Access to the upstream habitat will contribute significant benefits for sea-run cutthroat trout if other factors outside the watershed do not limit the population. Anadromous sea-run cutthroat will have access to the mainstem Cedar River below Lower Cedar Falls and the lower portions of Rock, Williams, and Steele Creek sub-basins. Juveniles typically rear for about one year in their small, natal streams, then move into larger streams for several years before emigrating to salt water.

It is most likely that sea-run cutthroat trout would spawn and rear in tributaries to the Cedar River, not the mainstem, but some juveniles could utilize the mainstem. General field observations indicate that rainbow trout strongly predominate in the mainstem Cedar within the municipal watershed at present, with a ratio of about 99 rainbow to 1 cutthroat observed during trapping in the 1970s (Casne 1975). The mainstem would be used for migration by all adults and smolts, however, and it could be used by a small number of adults for spawning and by some juveniles for rearing. Construction of fish passage facilities at Landsburg will substantially increase the availability of protected, high quality habitat for spawning adults and rearing juveniles.

The primary provisions in the HCP that will enhance conditions in the Cedar River Basin for sea-run cutthroat trout include: (1) proposed guaranteed flows and change of the 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 protection and restoration projects, potentially including groundwater-fed spawning channels and the protection and/or purchase 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 any sea-run cutthroat trout present in the municipal watershed once fish passage is restored. These measures are expected to provide immediate protection of sea-run cutthroat trout habitat and provide opportunity for increased production in the basin.

Habitat Effects Related to Instream Flow Management

The instream flow regime under the HCP will protect any sea-run cutthroat 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). Insofar as any sea-run cutthroat trout may spawn in the mainstem Cedar River, 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 sea-run cutthroat trout redds that may occur in these mainstem areas, particularly because sea-run cutthroat trout spawning broadly overlaps with the spawning period for steelhead (Wydoski and Whitney 1979). Continuation of the steelhead redd monitoring program under the HCP will provide information that can be used to establish flow regimes that protect incubating steelhead, as done currently, and would be expected to offer similar protection to anadromous (and resident) cutthroat trout.

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 sea-run cutthroat trout, although most adults and juveniles would more likely use smaller tributaries that are still vulnerable to land management activities.

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 $4.6 million for habitat protection and improvement downstream of Landsburg, 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 sea-run cutthroat trout. New groundwater-fed side channels would provide perennial habitat protected from channel scour associated with peak flows in the main channel of the Cedar River, and some could be used by sea-run cutthroat trout.

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 by 55 percent, and at least 5 miles of new, highly protected tributary habitat would be also available. The several tributary streams that enter the Cedar River between Lower Cedar Falls and Landsburg have high-quality habitat conducive to sea-run cutthroat trout spawning and rearing.

Improved access is expected to provide the opportunity for increased long-term natural production of sea-run cutthroat trout in the municipal watershed, if they are present, and result in an overall net increase in habitat available to anadromous sea-run cutthroat trout.

It should be noted, however, that the tributaries of the mainstem Cedar in the lower part of the municipal watershed are currently occupied by large numbers of resident cutthroat trout, some rainbow trout, and hybrids in some areas, which will compete with any sea-run cutthroat trout that enter the municipal watershed. It should also be noted that, if the cumulative impact of the HCP program results in large numbers of anadromous salmon within the municipal watershed, the resulting influx of marine-derived nutrients would enhance stream productivity and provide more favorable conditions for growth and survival of species like anadromous cutthroat that rear in the lower Cedar River or tributary streams in the municipal watershed for some portion of their lives. Resident salmonid populations will undoubtedly re-equilibrate with the dynamic ecosystem conditions resulting from reintroduction of anadromous species to the municipal watershed.

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 sea-run cutthroat trout 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 sea-run cutthroat trout. In the short term, sea-run cutthroat trout 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. In the long term, sea-run cutthroat 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 that are important to this species, such as woody debris that provides cover and creates pools.

The City believes that instream habitat improvement and rehabilitation must be accompanied by upslope protection and restoration that will reduce impacts of upslope conditions or activities on stream habitat. For example, efforts to stabilize stream banks or add large woody debris to streams may not be effective in the long run if road failures occur that result in large inputs of coarse sediment to streams upstream of such projects. Thus, these kinds of activities will be coordinated under the HCP.

Short-term and long-terms 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. 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 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 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 sea-run cutthroat 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 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 sea-run cutthroat trout 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 sea-run cutthroat trout. 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 habitats for sea-run cutthroat trout.

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 Direct Take

Juvenile sea-run cutthroat trout are vulnerable to stranding during events in which river stage decreases rapidly, and all adults moving upstream and juveniles or smolts moving downstream must cross the Landsburg Diversion Dam and pass the water supply intake. Once fish ladders are operational and sea-run cutthroat trout are able to cross the Landsburg Diversion Dam during upstream migration, any potential effects of management of the municipal watershed would apply to this species. Thus, disturbance effects could 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.

Disturbance Effects Related to Operation of Landsburg Diversion Facilities

Some sea-run cutthroat trout fry or juveniles could be injured as a result of impingement on the water intake screens at Landsburg, or crossing the Landsburg Diversion Dam moving downstream. Improvements for fish protection, however, include new intake screens and modifications to the dam designed to minimize such impacts (Section 4.3.2). Because of the new fish screens and dam modifications committed to in the HCP, the City does not believe that disturbance to, direct injury to, or death of individuals as a result of operation of the Landsburg facilities will have any effects with population-level consequences.

Disturbance 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 sea-run cutthroat trout fry or juveniles in shallow areas, particularly along stream margins, potentially resulting in death of some individuals from high temperature or dehydration, to the extent that the small fish could not reenter flowing water. 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 should substantially decrease the risk of stranding sea-run cutthroat trout as compared to the risk under current operations (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 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.

Because of the downramping protections committed to in the HCP, and because few small juvenile sea-run cutthroat trout are expected to be present in the mainstem Cedar River, the City believes the likelihood of disturbance to, direct injury to, or death of individuals as a result of flow downramping operations is expected to be very low in any given year.

Disturbance Effects Related to Land Management in the Municipal Watershed

The primary activities under the HCP that may result in disturbance, and possibly the

equivalent of take, of sea-run cutthroat trout that may occur in the municipal 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. It should be noted that only a portion of each of the above activities will occur within the lower municipal watershed.

The likelihood of direct take of sea-run cutthroat trout from land management activities 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 sea-run cutthroat trout habitat prior to silvicultural or road management activities; (2) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (3) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed, which minimizes potential disturbance overall and substantially reduces fishing mortality; and (5) removal of 38 percent of forest roads, which will reduce the potential for take 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 disturbance to, direct injury to, or death of individual sea-run cutthroat trout as a result of silvicultural treatments, road management, or other operational activities in streams and associated riparian areas is expected to be very low.

Population-level Effects

For several reasons, the City believes that, over the long term, the HCP will have an overall positive effect on any sea-run cutthroat trout population that may exist. Higher guaranteed flows, downramping controls, improved access to high quality habitat above Landsburg, and habitat improvement and protection projects in the lower Cedar River watershed should have positive impacts on the populations of sea-run cutthroat trout. The HCP provides a number of distinct benefits to sea-run cutthroat 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 restoration of stream and riparian habitats over the long term to more natural conditions (see above). Any short-term, local impacts to sea-run cutthroat trout 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 any sea-run cutthroat trout population in the municipal watershed.

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 sea-run cutthroat trout are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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 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 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, 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 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, 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). 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 streams, mountain lakes, seepages, riparian areas, and talus/felsenmeer slopes, especially in mature, late-successional, and old-growth forests (particularly in headwater stream basins). Younger seral-stage forest, especially in areas associated with streams, is considered important as secondary habitat.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any individuals of Group #32 species that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any individuals of Group #32 species resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. However, any such death or direct injury of individuals of Group #32 species would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, Group #32 species are similar to those described for other species addressed by the HCP that are closely associated with aquatic and riparian habitats. Long-term benefits are

expected to accrue to all of the amphibian species in Group #32, especially through protection of all streams, open water, and riparian habitat and all mature, late successional, and old-growth forest in reserve status, as well as, by the recruitment of additional mature and late-successional forest over time. All key non-forested habitat, talus/felsenmeer slopes (especially those including seepages) will also be protected within reserve forest. In addition, secondary habitat, younger seral-stage forest, will also be protected in reserve status. Protection of, and improvements in, water quality (e.g., reduced sediment, lower temperature) and streamside habitat are of particular importance to support foraging and reproductive behaviors of these species.

A net gain of potential habitat for Group #32 species is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to Group #32 species that may use the watershed through: (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.

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 in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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, including 13,889 acres of old-growth forest, are in reserve status. As a result, all key aquatic and riparian habitat (streams, lakes, ponds, seepages, especially where associated with late-successional and old-growth forest) and all key non-forested habitat (talus/felsenmeer slopes) for Group #32 species within the municipal watershed is 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 of the 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, especially the Cascade torrent salamander.

Major habitat effects on Group #32 species are similar, in general, to those described for other species addressed by the HCP that are closely associated with aquatic and riparian ecosystems, especially in late-successional and old-growth forests. 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 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). 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/felsenmeeer slopes. The Cascade torrent 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, 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 benefiting 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 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 reestasblishment 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 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 Direct Take

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of Group #32 amphibians 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) 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.

The likelihood of direct take occurring at a level that may compromise the viability of any Group #32 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 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) compliance with Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads which will reduce the potential for take related to road maintenance, improvement, and use over the long term.

Because of specific mitigation and minimization measures committed to in the HCP, the likelihood of disturbance to, direct injury to, or death of individuals of Group #32 species as a result of silvicultural treatments, road management, or other operational activities is expected to be very low. An occasional individual might be injured inadvertently as a result of management actions in riparian areas or occasionally by vehicle traffic on watershed roads.

Population-level Effects

Population-level effects on Group #32 amphibian species are, in general, as described for other species addressed by the HCP that are associated with streams and riparian habitats, especially in mature, late-successional, and old-growth forest. 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 and talus/felsenmeer

slopes, 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 any populations of the 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.

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 Group #32 species are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

Group #33 – Long-Toed Salamander, Roughskin Newt, Northwestern Salamander, Western Toad, Northern Red-Legged Frog, Cascades Frog, Oregon Spotted Frog, Western 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 western 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 (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 and are summarized below. 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.

Species	Elevation Range	Primary Habitats	Secondary Habitats	Important Habitat Elements
Long-toed salamander	All	Adults use forests, meadows; breed in seasonal wetlands, pond edges, slow streams		Rocks and logs in forest

Species	Elevation Range	Primary Habitats	Secondary Habitats	Important Habitat Elements
Roughskin newt	All	Adults use mesophytic conifer or hardwood forests and open valleys, or breeding habitat; breed in lakes, ponds, sluggish streams		Moist forest floor conditions, decayed logs; older forests; vegetation near breeding habitat
Northwestern salamander	All	Adults use humid coniferous forests; breed in ponds, lakes, and slow streams		Older forests
Western toad	All	Adults use moist areas with dense cover; breed in springs, ponds, shallow areas of lakes, marshes, and slow-moving streams		Damp woody debris
Northern red-legged frog	Below 2,800 ft	Adults use moist and riparian forests; breed in marshes, bogs, ponds, lakes, springs, and slow streams		Mature and older forests, cool water temperature (thus riparian forest cover)
Cascades frog	Above 2,600 ft	Adults use breeding habitat and nearby forest; breed in small water bodies, including areas in sphagnum bogs and forested swamps	Forests away from water	Closed canopy forest, large woody debris
Oregon spotted frog	All	Marshy ponds, wetlands with emergent vegetation, lakes, and streams	Adults also use riparian forests and dense shrubs in riparian areas	Forested areas are potential refugia
Western pond turtle (unlikely to occur in the municipal watershed)	Below 1,000 ft	Uses marshes, sloughs, moderately deep ponds, slow-moving rivers and streams, as well as meadows and forests	Rapid-flowing, clear, cold, rock and gravel streams; land up to 1,600 ft from water, for hibernation	Submerged logs and floating vegetation for resting sites; muddy bottoms for hibernation

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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any Group #33 species that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury to, or death of, any individuals of Group #33 species resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. However, any such death or direct injury of individuals of Group #33 species would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Direct and indirect effects of operational activities on, and the long-term benefits to, the Group #33 species are similar to those described for other species addressed by the HCP that are associated with aquatic and riparian habitats, and for species associated with forest habitats. The HCP is expected to result in both short- and long-term benefits to Group #33 species that may use the watershed through: (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.

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 (e.g., 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 in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the watershed, 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 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 microclimatic 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 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, 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.

Because, no harvest of timber 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 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. 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 within 25 ft of any stream.

Improvement in upland forest habitat will benefit all species in Group #33 that use upland forest as primary habitat, and it will improve conditions during dispersal for all eight 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 (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. 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 #39 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. Because no harvest for commercial purposes will occur in the municipal watershed, however, any potential impacts associated with commercial timber harvest are eliminated. 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 Direct Take

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, 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) 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 direct take occurring at a level that may compromise the viability of Group #33 species populations 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) compliance with Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads, which will reduce the potential for take related to road maintenance, improvement, and use over the long term. Occasionally, dispersing individuals might be injured or killed inadvertently by management activities in upland or riparian areas, or by vehicles on watershed roads.

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 in any given year.

Population-level Effects

Overall, population-level effects on the Group #33 species are, generally, as described for other species addressed by the HCP that are associated with streams, riparian habitats, and upland forest. 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, overall population-level effects should be positive for Group #33 species.

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 Group #33 are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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. Ranier, 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, streamside and waterfall splash zones in riparian areas, montane lakes, and streamside 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 (streamside) 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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any Van Dyke's salamanders that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any Van Dyke's salamanders resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. However, any such death or direct injury would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Long-term benefits are expected to accrue to the Van Dyke's salamander, especially through protection of all streams, open water, and riparian habitat and all mature, late successional, and old-growth forest in reserve status, as well as, the recruitment of additional mature and late-successional forest over time. All key non-forested habitat associated with aquatic systems, including talus/felsenmeer slopes will also be protected within reserve forest. In addition, secondary habitat (additional talus/felsenmeer slopes, rock outcrops, other seral-stage forest) will also be protected in reserve status. A net gain of potential Van Dyke's salamander habitat is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to the Van Dyke's salamander through: (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 streamside 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.

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). Van Dyke's salamanders could also be impacted by

management activities that contribute sediment to streams (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 the Van Dyke's salamander are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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, including all 13,889 acres of old-growth forest, are in reserve status. As a result, all key habitat (seeps, riparian (streamside) 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 within 50 ft of streams and during any operations near special habitats (e.g., talus/felsenmeer slopes or rock outcrops) activity will be restricted within a 200-foot zone to minimize the potential for habitat impacts or disturbance to key wildlife species, including Van Dyke's salamander

Major habitat effects on Van Dyke's salamander are similar, in general, to those described for other species addressed by the HCP that are associated with mature, late-successional and old-growth forests, except that this salamander is more closely associated with, and/or dependent upon, water to create suitable microhabitats than most of the other species associated with older forest environments. 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 4.2.2). 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/felsenmeeer 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. And, similar to the case for the red-backed salamander (Group #35), only 4,708 acres (less than 7 percent) of key forested habitat will be above 4,000 feet, only slightly beyond the documented extent of the Van Dyke's salamander's elevation range (3,600 feet).

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 benefiting 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 reestasblishment 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 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 streamside habitat and/or water quality. However, no timber harvest for commercial purposes will occur in the watershed, 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 Van Dyke's salamander. During restoration or ecological thinning procedures, no tree removal with the potential to reduce streambank stability will occur 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. 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 Direct Take

The primary activities under the HCP that may result in direct take 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 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 Van Dyke's salamanders may be injured or killed inadvertently by vehicles when they attempt to cross watershed roads while dispersing.

The likelihood of direct take occurring at a level which may compromise the viability of any Van Dyke's salamander populations that may occur 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 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) compliance with Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads, which will reduce the potential for take 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 Van Dyke's salamanders resulting from silvicultural treatments, road management, or other operational activities is expected to be very low in any given year, although occasionally, individual Van Dyke's salamanders may be injured or killed inadvertently by vehicles when they attempt to cross watershed roads while dispersing.

Population-level Effects

Population-level effects on the Van Dyke's salamander are, in general, as described for other species addressed by the HCP that are associated with mature, late-successional, and old-growth forest, with the exception of their closer association with water. 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.

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 Van Dyke's salamander are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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 streamside habitats.

Papillose taildroppers appear to be strongly associated with riparian vegetation in most 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 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 streamside 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).

Potential key habitat in the municipal watershed for all eight species in Group #37 includes streams, streamside areas, and riparian habitat over a broad elevation range, as well as upland forest for papillose taildropper.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any of the Group #37 species that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury to, or death of, any Group #37 species resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP in any given year. However, any such death or direct injury of Group #37 species would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The HCP is expected to result in both short- and long-term benefits to Group #37 species that may occur in the watershed through: (1) protection through reserve status of all key stream habitat, streamside 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).

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, road construction, maintenance, and use), thereby reducing water quality.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for Group #37 species are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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, including all aquatic and riparian ecosystem elements, are in reserve status. As a result, all key habitat (streams and riparian areas) for the Group #37 species within the municipal watershed is 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.

Major habitat effects on and benefits to Group #37 species are generally as described for other species associated with stream and riparian habitats. All key habitat, as well as secondary and potential habitats, are protected; over time, habitat quality and conditions for dispersal should improve substantially. Protection of and improvements in water quality and streamside habitat are of particular importance for species in Group #37.

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 benefiting these three species.

The HCP also includes management actions designed to help restore streams and riparian habitats. Streambank 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 streamside 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 streamside 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 streambank 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 #39 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 4.2.2), 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 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 reengineering (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 Direct Take

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of Group #37 invertebrates 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 direct take 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) compliance with Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads, which will reduce the potential for take 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.

Because of specific mitigation and minimization measures committed to in the HCP, the likelihood of disturbance to, direct injury to, or death of any Group #37 individuals as a result of silvicultural treatments, road management, or other operational activities is expected to be very low in any given year.

Population-level Effects

Because the extent of understanding of the ecology of Group #37 species is limited, and because none 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 with respect to all key habitat in the municipal watershed, should have a beneficial effect on populations of any of these species that may occur in the watershed. Any short-term, local impacts to these species from restoration activities in or near streams and riparian areas will be more than 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.

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 Group #37 species are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any Group #38 beetle species that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury to, or death of, any Group #38 beetles resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low under the HCP. However, any such death or direct injury of Group #38 beetles would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The HCP is expected to result in both short- and long-term benefits to any Group #38 beetles that may occur in the watershed through: (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).

Group #38 species could be negatively affected by silvicultural treatments, road management, or other operational activities near sphagnum bogs and other wetlands. 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). Group #38 species could also be impacted by management activities that contribute sediment to wetlands (e.g., silvicultural treatments near wetlands or riparian areas, or road maintenance, use, and decommissioning).

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for Group #38 species are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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 benefiting 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. Because no commercial timber harvest will occur in the watershed, however, any impacts associated with the removal of vegetative cover will be largely eliminated or short term in nature. In addition, the HCP includes a comprehensive suite of 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 Direct Take

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, 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 instream 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.

The likelihood of disturbance to, direct injury to, or death of any Group #38 individuals as a result of management actions in the vicinity of wetlands and associated riparian areas 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 #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) compliance with Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads, which will reduce the potential for take related to road maintenance, improvement, and use over the long term.

Population-level Effects

Overall, population-level effects on the Group #38 beetle species are generally as described for other species addressed by the HCP that are closely associated with wetland or riparian habitats. 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 will 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. Overall, the City expects that population-level effects on the three Group #38 beetle species will be positive.

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 Group #38 species are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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 streamside 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 fender*i, and would be used primarily for dispersal.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any Group #39 species that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any Group #39 beetles resulting from silvicultural treatments, road management, or other operational activities is expected to be very low in any given year under the HCP. However, any such death or direct injury of Group #39 beetles would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The HCP is expected to result in both short- and long-term benefits to Group #39 species through: (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.

Group #39 species could be negatively affected by silvicultural treatments, road management, or other operational activities in low-elevation forests and a variety of wetlands. 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 #39 species could also be negatively affected by management activities that contribute sediment to wetlands (e.g., stream habitat restoration projects and silvicultural treatments near wetlands or in riparian areas, or road maintenance, use, and decommissioning), thereby affecting water quality.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for Group #39 species are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the watershed, all lands outside developed areas, including all key habitat and secondary habitat for Group #39 species, are in reserve status. In addition, protection in reserve status of all forested areas of the watershed will facilitate overland dispersal of these 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 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 benefiting 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. Streambank stabilization projects, placement of large woody debris, and a stream bank re-vegetation program should benefit *Omus dejeanii* by improving streamside 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. 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.

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) 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 embedded 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 accelerate 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. 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. Implementing 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 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 reengineering

(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 Direct Take

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, 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) 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.

The likelihood of direct injury or death occurring at a level that may compromise the viability of Group #39 species populations is expected to be very low 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) compliance with Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads, which will reduce the potential for take 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.

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 individuals of Group #39 species as a result of silvicultural treatments, road management, or other operational activities in the watershed is expected to be very low in any given year.

Population-level Effects

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 with respect to all key habitat in the municipal watershed, should have a beneficial effect on populations of any of these species that may occur in the watershed. Any short-term, local impacts to these species from restoration activities near wetlands and in or near riparian areas will be more than 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 overall population-level effects should be positive for those species that may be present in the municipal watershed.

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 Group #39 species are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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. 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). 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. Potential key habitat for *V. mergella* in the municipal watershed may be present in lakes (or ponds) with a muddy bottom and well oxygenated water. Given the lack of information on the habitat associations of *V. mergella*, the City also assumes that this species may use some other types of water bodies, including some streams.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any *V. mergella* that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any *V. mergella* resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. However, any such death or direct injury of *V. mergella* would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The HCP is expected to result in both short- and long-term benefits to the *V. mergella* through: (1) protection in reserve status of 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 and late-successional structural characteristics in second-growth 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.

V. mergella could be negatively affected by silvicultural treatments, road management, or other operational activities, especially those conducted in close proximity to lakes and streams. Although direct effects (direct injury to or death of individuals) would be unlikely, indirect effects, through influences on habitat, particularly water quality, might occur (e.g., excessive sediment or nutrient input).

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the *V. mergella* are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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, 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 benefiting 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. Because no harvest for commercial purposes will occur in the municipal watershed, however, any potential impacts associated with commercial timber harvest are largely eliminated. During restoration or ecological thinning activities, no tree removal is allowed that has the potential to reduce streambank 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 Direct Take

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of *V. mergella* that may occur in the watershed include any operations that involve human activities on roads 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); and (8) routine road use.

The likelihood of direct take occurring at a level that may compromise the viability of any *V. mergella* 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 and protection of *V. mergella* 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 habitat disturbance; (3) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access to the Cedar River Municipal Watershed; and (5) removal of 38 percent of forest roads, which will reduce the potential for take related to road maintenance, improvement, and use over the long term.

Because of the mitigation and minimization measures included in the HCP, the likelihood of disturbance to, direct injury to, or death of any *V. mergella* as a result of silvicultural treatments, road management, or other operational activities is expected to be extremely low. 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.

Population-level Effects

Because pertinent information regarding the ecology of *V. mergella* is severely lacking, population-level effects for this 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 with respect to all key habitats in the municipal watershed, should have a beneficial effect on any populations of this species that may occur in the watershed.

Other Effects

The monitoring and research program included in the HCP (Section 4.5) could provide information important to conserving *V. mergella*, if this species is discovered to be present in the municipal watershed. The adaptive management program descirbed in Section 4.5.7 could then be used to determine if the mitigation and minimization strategies for *V. mergella* are achieving their conservation objectives and could facilitate adjustments needed to make the strategies better achieve these objectives.

SPECIAL HABITATS

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, 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.

No change in the amount of potential peregrine falcon habitat is expected over the 50-year term of the HCP, although the quality of many open habitats should increase as a consequence of placing all surrounding forest in reserve status. The HCP is expected to result in both short- and long-term benefits to peregrine falcons through: (1) protection through reserve status of all cliff and rock outcrop features, potentially 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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any peregrine falcons that may nest in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any peregrine falcons resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low under the HCP, as is the likelihood of disturbance to any actively nesting peregrine falcon pairs. However, any such death, direct injury, or disturbance leading to injury or death would constitute an impact equivalent to take as applied to those species listed under the ESA. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect. (The peregrine was recently delisted, but could be listed again at some time in the future.)

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 in tables 4.6-2, 4.6-3, and 4.6-4.

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, all key habitat (cliffs, rock outcrops, natural open habitats, and nonforested [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, 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 active peregrine falcon nest sites from human disturbance; (2) elimination of commercial logging activities (including log hauling) from the watershed; (3) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access (including no access for hunting) to the 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. In addition, as for other species addressed in the HCP that utilize special habitats, during watershed operations near any cliffs and rock outcrops a 200-foot zone, in which activities will be restricted, will be established to minimize the potential for habitat impacts or disturbance to peregrine falcons. And, should this species 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.

Direct Take

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.

Population-level Effects

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. Falcons have recently nested just north of the municipal watershed, and this unusual extent of contiguous protected habitat and landscape connectivity may encourage falcons to reestablish within the watershed and thereby contribute to the

continued recovery of the peregrine falcon population on a regional level.

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.

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 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.

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; and (3) the protection of all key habitats.

The combination of mitigation and minimization measures committed to in the HCP protects any grizzly bears that may occur in the municipal watershed. The likelihood of direct injury or death of any grizzly bear resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low under the HCP, as is the likelihood of disturbance to any actively denning individual or adult bear with offspring. However, any such death, direct injury, or disturbance leading to such injury or death would constitute take under the ESA.

A net gain of potential grizzly bear habitat (foraging, denning, and dispersal) and reduction in the effects of human disturbance is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to grizzly bears through: (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 core habitat and 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 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.

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 in tables 4.6-2, 4.6-3, and 4.6-4.

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 available 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 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 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) compliance with Washington Forest Practice Rules; (4) the City's policy restricting unsupervised public access (including no access for 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 (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. 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.

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 grizzly bears resulting from silvicultural treatments, road management, or other operational activities is expected to be very low.

Direct Take

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 grizzly bear resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low.

Population-level Effects

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).

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.

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 bottomlands, 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 and security habitat is considered to be areas with a density of open roads less than 1 mi/mi^2. 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.

Although the overall density of "open" roads is 4.2 mi/mi^2 now and will be about 2.7 mi/mi^2 after 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 serving as security habitat. This may particularly be the case in the CHU, in the easternmost portion of the watershed, 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 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.

The combination of mitigation and minimization measures committed to in the HCP protects any gray wolves that may occur in the municipal watershed. The likelihood of direct injury or death of any gray wolf resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low under the HCP, as is the likelihood of disturbance to any actively denning individual or adult wolf with offspring. However, any such death, direct injury, or disturbance leading to such injury or death would constitute take under the ESA.

Under the HCP, all key habitat will be protected, a net gain of gray wolf security habitat may occur over the 50-year term as a result of extensive road decommissioning, and a reduction in the effects of human disturbance is also expected. The HCP is expected to result in both short- and long-term benefits to gray wolves through: (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 security habitat and 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.

As a consequence of the elimination of timber harvest for commercial purposes, however, the ungulate populations in the watershed are expected to decrease over the term of the HCP. As no early seral forest habitat will be created by other than natural processes, the amount of early seral habitat, and the herbaceous/shrub forage supply for ungulates, will decrease. Insofar as wolves depend on an ungulate prey base, the capacity of the watershed to support wolves may diminish over time, unless the reduced human disturbance level is more important than the reduced prey base. Two additional considerations are (1) that the overall watershed landscape will be more similar to the natural landscape to which wolves in the region are 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.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for the gray wolf are detailed in Section 4.2.2 of the HCP and summarized in tables 4.6-2, 4.6-3, and 4.6-4.

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 security habitat may increase as road densities, thus human activities related to roads, are reduced over time.

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) 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 avoid areas with greater than approximately 1 mi/mi^2 of *open* roads (Mladenoff et al. 1995); as described above, habitat with these characteristics is considered to be "security habitat." 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 for habitat in an area to serve as security habitat.

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 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 security 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 security 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 Services for any wolves discovered in the watershed; (3) elimination of commercial logging activities (including virtually all log hauling) from the watershed; (4) compliance with Washington Forest Practice Rules; (5) the City's policy restricting unsupervised public access (including no access for 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 (6) 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) wolves are potentially more likely to occur in the upper municipal watershed, (2) security 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.

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 wolves resulting from silvicultural treatments, road management, or other operational activities is expected to be very low.

Direct Take

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.

Population-level Effects

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).

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.

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. Key habitats for band-tailed pigeons are considered to be mineral springs and low-elevation coniferous and mixed forests, but no mineral springs are known to exist in the municipal watershed. Band-tailed pigeons nest in trees and use a variety of open and forested habitats for foraging, including natural meadows, small patches of early-seral forest (grass-forb-shrub and open canopy stages), and mixed deciduous and conifer forest. Closed-canopy conifer and conifer/hardwood forest are preferred for nesting, and band-tailed pigeons are known to travel long distances to mineral springs and foraging areas. Band-tailed pigeons forage in smaller patches of early-seral forest habitat that are near closed canopy forest, but appear to avoid old growth.

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 disturbance or influences on habitat (e.g., removal of overstory).

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any band-tailed pigeons that may nest in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any band-tailed pigeons resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting band-tailed pigeon pairs. However, any such death, direct injury, or disturbance of band-tailed pigeons leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The HCP is expected to result in long-term benefits to band-tailed pigeons through: (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.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for band-tailed pigeons are described in Section 4.2.2 and summarized in tables 4.6-2, 4.6-3, and 4.6-4.

Primary Beneficial and Detrimental Effects of the HCP

Habitat Effects

Because no commercial timber harvest will be conducted in the watershed, 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 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. The fact that band-tiled pigeons fly long distances to forage may make such nearby habitat useful to pairs nesting in the municipal watershed, if early-seral forest is important. 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 Direct Take

The primary activities under the HCP that may result in disturbance, and possibly the equivalent of take, of band-tailed pigeons 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.

However, the likelihood of disturbance to any actively nesting band-tailed pigeons 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) 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 from human disturbance prior to silvicultural or road management activities; (3) compliance with Washington Forest Practice Rules; (4) 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 band-tailed pigeons resulting from silvicultural treatments, road management, or other operational activities is expected to be very low. Nonetheless, occasional nests might be damaged inadvertently as a result of silvicultural treatments or other management actions.

Population-level Effects

No significant population-level effects are expected. The net effect of forest habitat changes on band-tailed pigeons is not known. Reductions of early-seral habitat 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 during silvicultural treatments, despite site evaluations by interdisciplinary teams. This relatively minor risk of disturbance 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: commercial timber harvest.

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 band-tailed pigeons are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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, and other areas where nectar-producing flowers of preferred species are available. 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 holes, 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) and some other types of open conifer forest.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any rufous hummingbirds or western bluebirds that may nest in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any rufous hummingbirds or western bluebirds resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting pairs of these species. However, any such death, direct injury, or disturbance of rufous hummingbirds or western bluebirds leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The HCP is expected to result in both short- and long-term benefits to rufous hummingbirds and western bluebirds that may use the watershed primarily through: (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 natural open habitats used for foraging (e.g., meadows, persistent shrub, and wetlands) in the watershed; (3) 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; (4) protection of known nesting pairs from human disturbance; (5) removal of 38 percent of watershed roads, reducing the level of human disturbance; (6) monitoring and research; and (7) closure of the watershed to unsupervised public access, reducing potential disturbance near nests.

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. The loss of early seral habitat created artificially by commercial timber harvest could reduce the carrying capacity of the watershed for the rufous hummingbird, and possibly for the western bluebird, although the future landscape will develop into one more similar to the natural landscape to which these species are adapted.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for rufous hummingbirds and western bluebirds are described in Section 4.2.2 and summarized in tables 4.6-2 and 4.6-4.

Primary Beneficial Effects 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, all key habitat (natural

open habitats) for the rufous hummingbird within the municipal watershed is protected through reserve status. No appreciable changes in acreage of potential key habitat for these species will occur under the HCP, however the quality of some habitats may improve, and the habitats may develop more natural characteristics as forest adjacent to open habitats matures. In addition, overall habitat quality for the rufous hummingbird and western bluebird is expected to improve 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 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.

Both rufous hummingbirds and western bluebirds also forage in habitats affected by human activities, including some early seral forest. As a consequence of the 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 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.

Disturbance Effects and Direct Take

The primary activities that may result in disturbance to, and possibly the equivalent of take of, rufous hummingbirds 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 rufous hummingbirds or western bluebirds 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 rufous hummingbird and western bluebird nest sites from human disturbance, 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) compliance with Washington Forest Practice Rules; (4) 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 rufous hummingbirds or western bluebirds resulting from silvicultural treatments, road management, or other operational activities is expected to be very low.

Population-level Effects

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 or all of the potential effect of reduction in foraging habitat on populations of these species.

Because western bluebirds are considered to be an incidental species in the watershed, and because loss of snags is known to be one factor that has reduced regional populations of this species, 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 the amount of early seral forest habitat is unlikely to be limiting to these species at this time, and 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.

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 rufous hummingbirds and western bluebirds are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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 also use tree cavities. Merlins in the Cascade Mountains are found at higher elevations, from the Pacific silver fir zone up, using forest edges and meadows along the Cascade crest (Smith et al. 1997). 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, and the merlin may do so as well.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any golden eagles and merlins that may nest in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any golden eagles or merlins resulting from silvicultural treatments, road management, or other operational activities is expected to be extremely low under the HCP, as is the likelihood of disturbance to any actively nesting golden eagle or merlin pairs. However, any such death, direct injury, or disturbance leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The HCP is expected to result in both short- and long-term benefits to golden eagles and merlins that may occur in the watershed primarily through: (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; (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 (8) monitoring and research.

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 could reduce the carrying capacity of the watershed for the golden eagle, and possibly for the merlin, although the future landscape will develop into one more similar to the natural landscape to which these species are adapted.

Pertinent Mitigation and Minimization Measures

Mitigation and minimization measures for golden eagles and merlins 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

Because no commercial timber harvest will be conducted in the watershed, 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 (cliffs, rock outcrops, natural open habitats, and mature to old-growth forest) for golden eagles and merlins that may occur 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. In addition, overall habitat quality for the golden eagle and merlin is expected to improve 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 possibly merlins, also forage in some open, early seral forest, with merlins potentially using such habitats primarily near forest edges. As a consequence of the 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 merlin.

Disturbance Effects and Direct Take

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, 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) compliance with Washington Forest Practice Rules; (4). 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 golden eagles or merlins resulting from silvicultural treatments, road management, or other operational activities is expected to be very low.

Population-level Effects

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 the carrying capacity of the watershed for golden eagles and, possibly, for merlins.

This potential loss of early seral forest habitat, however, would be offset 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.

Other Effects

The monitoring and research program committed to 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 merlins and golden eagles are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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. They are aerial feeders that forage widely above the forest canopy or over open areas, such as wetlands and meadows.

The combination of mitigation and minimization measures committed to in the HCP is

expected to protect any black swifts that may nest in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any black swifts resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively nesting pairs of this species. However, any such death, direct injury, or disturbance of black swifts leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

The HCP is expected to result in both short- and long-term benefits to black swifts that may use the watershed primarily through: (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.

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 in tables 4.6-2, 4.6-3, and 4.6-4.

Primary Beneficial Effects 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, 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 Direct Take

The primary activities that may result in disturbance, and possibly the equivalent of take, of black swifts in the watershed under the HCP include any operations that involve human activities on roads near nesting areas 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 black swifts in the watershed is expected to be very low and short-term in nature, however, 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) compliance with Washington Forest Practice Rules; (4) 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 the specific mitigation and minimization measures committed to in the HCP, as listed above, the likelihood of direct injury to, or death of, any individual black swifts resulting from silvicultural treatments, road management, or other operational activities in the watershed is extremely low.

Population-level Effects

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 the black swift.

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 black swifts are achieving their conservation objectives and facilitate

adjustments needed to make the strategies better achieve these objectives.

Group #35 – Western Redback Salamander

Introduction

The western red-backed salamander is present and 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 streamside areas), is considered of secondary importance.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any western red-backed salamanders that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any western red-backed salamanders resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP. However, any such death or direct injury of western red-backed salamanders would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term "take" applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Long-term benefits are expected to accrue to the western red-backed salamander, especially through protection of mature, late successional, and old-growth forest in reserve status and the recruitment of additional mature and late-successional forest over time. All key non-forested habitat (talus/felsenmeer slopes and rock outcrops) will also be protected within reserve forest. A net gain of potential western red-backed salamander habitat is expected over the 50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to the western red-backed salamander through: (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.

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 in tables 4.6-2, 4.6-3, and 4.6-4.

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, 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.

Major habitat effects on the western red-backed 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. 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 4.2.2). 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. 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/felsenmeeer 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 watershed operations near any talus/felsenmeer slopes or rock outcrops a 200-foot zone, in which activities will be restricted, will be established to minimize the potential for habitat impacts or disturbance to western red-backed salamanders.

Disturbance Effects and Direct Take

The primary activities under the HCP that may result in direct take 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 direct take occurring at a level that may compromise the viability of western red-backed salamander populations in the watershed is expected to be very 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) compliance with Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads which will reduce the potential for take 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 western red-backed salamanders resulting from silvicultural treatments, road management, or other operational activities is expected to be very low in any given year, although occasionally, individual western red-backed salamanders may be injured or killed inadvertently by vehicles when they attempt to cross watershed roads while dispersing.

Population-level Effects

Population-level effects on the western red-backed salamander are, in general, as described for other species addressed by the HCP that are associated with late-successional and old-growth forest. 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.

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 western red-backed salamander are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

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.

The combination of mitigation and minimization measures committed to in the HCP is expected to protect any Larch Mountain salamanders that may occur in the Cedar River Municipal Watershed. The likelihood of direct injury or death of any Larch Mountain salamanders resulting from silvicultural treatments, road management, or other operational activities is expected to be very low under the HCP, as is the likelihood of disturbance to any actively breeding individuals of this species. However, any such death, direct injury, or disturbance of Larch Mountain salamanders leading to such injury or death would constitute an impact equivalent to take as applied to species listed under the ESA. Note that the term “take” applies only to those species listed under the ESA as endangered, or threatened if the respective Service publishes a rule to that effect.

Long-term benefits are expected to accrue to the Larch Mountain salamander, especially through protection of mature, late successional, and old-growth forest in reserve status and the recruitment of additional mature and late-successional forest over time. All key non-forested habitat (talus/felsenmeer slopes) will also be protected within reserve forest. A net gain of potential Larch Mountain salamander habitat is expected over the

50-year term of the HCP. The HCP is expected to result in both short- and long-term benefits to the Larch Mountain salamander through: (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.

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 in tables 4.6-2 and 4.6-4.

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, 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 operations near talus/felsenmeer slopes or rock outcrops, activity will be restricted within a 200-foot zone to minimize the potential for habitat impacts or disturbance to key wildlife species, including the Larch Mountain salamander.

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 4.2.2). 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.

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 Direct Take

The primary activities under the HCP that may result in direct take 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 direct take occurring at a level that may compromise the viability of Larch Mountain salamander populations in the watershed is expected to be very 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) compliance with

Washington Forest Practice Rules; (4) 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 (5) removal of 38 percent of forest roads which will reduce the potential for take 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 disturbance to, direct injury to, or death of any Larch Mountain salamanders as a result of silvicultural treatments, road management, or other operational activities is expected to be very low in any given year. However, individual Larch Mountain salamanders may occasionally be injured or killed inadvertently by vehicles when they attempt to cross watershed roads while dispersing.

Population-level Effects

Population-level effects on the Larch Mountain salamander are, in general, as described for other species addressed by the HCP that are associated with mature, late-successional, and old-growth forest, with the addition of this species' closer association with rocky substrates and vegetated talus/felsenmeer slopes. 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 protection complies with the principal management recommendation of WDFW (1997) for Larch Mountain salamander, and should thus benefit any populations of the species that may occur in the Cedar River Municipal Watershed.

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 Larch Mountain salamander are achieving their conservation objectives and facilitate adjustments needed to make the strategies better achieve these objectives.

DETERMINATION OF NET BENEFIT

As indicated in the summaries of effects presented above, the City believes that the HCP clearly provides a net benefit for all 83 species addressed by the HCP. The determination of whether or not a net benefit would be provided under the HCP was made by comparing operations and habitat conditions projected under the HCP with operations and habitat conditions at the time of implementation (for a more general discussion of this issue related to the Watershed Management Mitigation and

Conservation Strategies, see Section 4.2.2). For the great majority of species addressed, the benefits of the HCP are clear, because one or more of the following will occur under the HCP:

- Improvement in habitat *quality* though changes in operations (e.g., improved instream flows), restoration or rehabilitation projects (e.g., stream, riparian, and upland forest restoration within the watershed), reduction of human disturbance levels (by removal of about 38 percent of the watershed road system), or protection (though inclusion in reserve status of all old-growth forest and all second-growth forest, which will develop over time into mature and late-successional forest);

- An increase in *quantity* of available habitat (recruitment of new habitat) by increased connectivity (e.g., for fish by providing passage facilities at Landsburg or replacing culverts that block passage upstream within the watershed, or for wildlife dependent on older seral forest by a commitment not to harvest timber for commercial purposes), habitat development (e.g., through forest succession that will result in more acreage of late-seral forest in the watershed), or creation of new habitat (e.g., construction of side channels for fish in the floodplain downstream of Landsburg);

- Reductions of *impacts* on individuals (e.g., establishment of flow downramping limits and the commitment not to harvest timber for commercial purposes)

- Protection against *disturbance* (e.g., restrictions on activities near breeding sites during sensitive periods of the life cycle, such as near northern goshawks nests or gray wolf dens) and control of watershed access (reducing general human disturbance, public access for hunting or fishing, and poaching);

- Projects that will improve *survival* of individuals (e.g., improved survival of smolts thought the Ballard Locks through funding of smolt slides and freshwater water conservation); and

- Direct *population enhancement* (e.g., by the sockeye hatchery, or by emergency supplementation for chinook, coho, or steelhead, if warranted).

As discussed in Section 4.2.2, the benefit for several species may not be as obvious as for the majority. Bull trout and, to a much lesser extent, pygmy whitefish and common loons are predicted to experience minor, but potentially negative incremental impacts of changes in reservoir operations that will result from managing instream flows to increase benefits for anadromous fish species (see Section 4.5.6; Appendix 38). However, other habitat protection and restoration programs should provide positive benefits for these species that should counter the negative effects over time (4.2.2). Riparian areas around the reservoir and streams used by these species will be protected and restored (section 4.2.2), including areas in which bull trout and pygmy whitefish spawn and rear. The commitment not to harvest timber for commercial purposes and the removal of about 38 percent of forest roads under the HCP should provide major benefits for all three species. The Cedar Permanent Dead Storage Project could have adverse impacts on any of these three species if implemented, but the potential for such impacts will be carefully evaluated over a period of 5 years, mitigation will be developed if that project is

implemented (Section 4.5.6), and implementation would require amendment of the HCP and incidental take permit (see Appendix 1, Section 12.2).

Upland species that utilize forest openings, such as clearcuts, wetlands, and meadows, might not benefit as much under the HCP as those using older seral forest. Under the HCP, no early seral forest will be generated by commercial timber harvest. Rather, early seral forest will be largely by natural processes and disturbances, such as windstorms and fires. Nesting habitat for golden eagles, for example, will be protected under the HCP, but, to the extent that this species uses recently harvested areas for foraging, then foraging habitat will decrease over time.

However, it is very important to note that the landscape pattern of forest seral stages under the HCP will be nearer to that present in the natural landscape prior to European settlement, and silvicultural intervention for forest habitat restoration (section 4.2.2) will be designed to produce a forest ecosystem that functions more like a natural system than the overall forest does today. Because of this more natural pattern of forest age classes and ecosystem function, the City believes that a net benefit will accrue even to those species that use open habitats that are decreased in extent by elimination of logging, particularly considering that timber harvest expected in adjacent areas will create large areas of early seral habitat in artificially high amounts.

Habitat for the band-tailed pigeon may not improve, as the amount of mixed coniferous and deciduous should not change much, and the total area of forest openings created by commercial timber harvest will decrease. Because the overall level of forest protection is much greater than was the case in the past, however, and the level of human disturbance will be lower, and this species should experience an overall benefit.

Effects on species not known to be present in the watershed are speculative, and will depend on the presence of these species in the municipal watershed in the future and the habitats that they prefer. The natural open-habitat types believed to be used by grizzly bear and gray wolf will be protected, habitat connectivity among habitat patches will be improved as the proportion of late-seral forest increases over time, more potential denning sites will be available as more mature and late-successional forest develops, and, most importantly, removal of about 38 percent of forest roads and continued closure of the watershed to the public should provide a substantial reduction in human disturbance level and increase in usable habitat for these species. To the extent these species use Special Habitats for foraging, then available habitat will not be increased, although, by being embedded in maturing forest, meadow communities should improve in quality over time. If any of these two species also use later seral forest in the watershed for foraging or denning, then available habitat will be increased. In addition, dens of gray wolves and grizzly bears, if found, will be protected while in use (Section 4.2.2).

While the populations of ungulates on which wolves (if they were to be present in the watershed) and other large carnivores would prey are expected to decrease under the HCP, these populations should reach levels more characteristic of natural landscapes than would be the case for intensively harvested forests. Furthermore, as argued above, the ecosystems in the watershed under the HCP will function more like ecosystems influenced only by natural disturbances. Finally, the absence of competition with hunters under current watershed management should make relatively more prey animals available, and the relatively low level of human disturbance within the currently closed watershed (Section 4.2.2) should increase foraging success.

Some species within the Lake Washington Basin, both those addressed by the HCP and others not addressed, could be adversely affected by measures in the HCP. For example, construction of fish passage facilities at Landsburg will result in the recolonization by anadromous species of areas that have only resident fish today. Because the river between Landsburg and lower Cedar Falls was used by the same anadromous species prior to construction of the Landsburg Diversion Dam, however, the City considers such effects to be acceptable.

Finally, naturally reproducing salmonids could be adversely affected by sockeye produced from the interim or replacement hatchery. However, several arguments indicate that such effects should be minor (Section 4.3.4).

- Agreement on clear objectives regarding impacts, a comprehensive monitoring program, and adaptive management designed to meet these objectives should combine to keep risks low;
- The City expects that the numbers of adult sockeye will be regulated (by harvest) within appropriate escapement goals by the fisheries co-managers (WDFW and the Tribe);
- The City expects that the fry-production targets will be set by the fisheries co-managers appropriate to the system carrying capacity;
- Hatchery fry are expected to have a lower incidence of IHN virus than naturally produced fry; and
- Spawning interference should not be a significant problem, because of differences in life history characteristics and run timing of the species involved, because these species naturally occur together, and because escapement levels is expected to be regulated by the fisheries managers so that sockeye will not be superabundant on spawning areas.

In summary, the City believes that all of the species addressed in the HCP will experience a net benefit from the HCP compared to current conditions and operations. A benefit should accrue immediately after the HCP is implemented for all species, with the possible exception of bull trout and, to a much lesser extent pygmy whitefish and common loons, which will be affected in a minor fashion by *changes* in reservoir operations from current. However, habitat protection and improvements in the municipal watershed should soon produce a net benefit for these species as well.