4.5.2 Unlisted Fish and Wildlife Species

In the following analysis of federal and state candidate species, federal species of concern, and other sensitive fish and wildlife species, brief descriptions of the biology and life history requirements of each species are presented before assessing the effects of the alternatives. A more comprehensive description of the species' biology and life history requirements, as well as their current federal and/or state status, is provided in Chapter III of the draft HCP.

This analysis addresses the effects of the spotted owl and, to a limited extent, the marbled murrelet strategies, riparian ecosystem strategies, protection strategies for uncommon habitats, and species-specific protection measures, on particular unlisted species. For the west-side planning units, the effects of the alternatives are discussed, and action alternative effects are compared to the No Action alternative for each species whose range may include all or part of these planning units. For the OESF Planning Unit, analyses and comparisons are presented, as stated above, for the OESF No Action alternative, and Alternatives 2 and 3, for species whose range may include all or part of this planning unit. This analysis does not include the three east-side planning units because DNR is not seeking coverage for unlisted species east of the Cascade crest.

The No Action alternative for the five west-side planning units and the OESF Planning Unit reflects DNR's current land management activities under state and federal regulations, and its Forest Resource Plan policies. Alternatives B and C contain strategies for owl, murrelet and riparian protection that differ from the No Action alternative. However, the owl and riparian conservation strategies under Alternative C provide greater amounts of late seral forest condition, owl dispersal habitat, and riparian protection than Alternative B, and may be of more benefit to unlisted species. The provisions to protect uncommon habitats and additional species-specific protection measures for unlisted species are the same for both Alternatives B and C. The OESF action alternatives contain the same provisions as Alternatives B and C for protection of uncommon habitats, however, species-specific protection measures are not as extensive. The OESF owl conservation strategies differ between Alternatives 2 and 3, and are different from all west-side planning unit alternatives. The OESF riparian strategies are the same for Alternatives 2 and 3, but generally provide greater protection of the riparian ecosystem than Alternatives B and C.

A summary of conservation and protection measures by alternative is provided in Matrices 4.5.1a and 4.5.1b.

Matrix 4.5.2a: Management strategies for HCP (excluding OESF)

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Unlisted Species			
West-side units	Protection will be provided according to state regulations. Additional protection may occur in DNR-designated Natural Area Preserves and Natural Resource Conservation Areas. No specific provisions for unlisted species except for the northwestern pond turtle, sandhill crane, and western grey squirrel under the Washington Forest Practices Act (WAC 222-16-080(1) Unlisted species may be protected through development of wildlife habitat objectives required under FRP Policy No. 22.	Protection will be provided according to state regulations. Additional protection may occur in DNR-designated Natural Area Preserves and Natural Resource Conservation Areas. Unlisted species protected through spotted owl, marbled murrelet, and riparian conservation strategies, protection of uncommon habitats, and additional mitigation for particular species as follows: (1) harlequin duck: no activity allowed that would appreciably reduce likelihood of nesting success within 165 feet of a known active nest between May 1 and September 1; (2) northern goshawk: no activity allowed that would appreciably reduce likelihood of nesting success within 0.55 mile of a known active nest between April 1 and August 31; (3) common loon: no activity allowed that would appreciably reduce likelihood of nesting success within (continued)	Same as Alternative B.

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Unlisted Species (continued)			
West-side units (continued)		500 feet of a known active nest between April 1 and September 1; (4) Vaux's swift: trees and snags known to be used as night roosts will not be harvested; (5) myotis bats: trees and snags known to be used as communal roosts or maternal colonies will not be harvested; and, (6) California wolverine and Pacific fisher: no activity allowed that would appreciably reduce likelihood of denning success within 0.5 mile of a known active den between January 1 and July 31 (for wolverine) or February 1 and July 31 (for fisher).	

Matrix 4.5.2b: Management strategies for alternatives related to the OESF planning unit

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Unlisted Species			
Unlisted Species	Protection will be provided according to state regulations. Additional protection may occur in DNR-designated Natural Area Preserves and Natural Resource Conservation Areas. No specific provisions for unlisted species. Unlisted species may be protected through development of wildlife habitat objectives required under FRP Policy No. 22.	Protection will be provided according to state regulations. Additional protection may occur in DNR-designated Natural Area Preserves and Natural Resource Conservation Areas. Unlisted species protected through spotted owl, marbled murrelet, and riparian conservation strategies, landscape-level management planning, and protection of uncommon habitats. Conservation primarily derives from integrated, ecosystem-oriented management, rather than directing the nature of that management. Additional mitigation: (1) Vaux's swift: trees and snags known to be used as nests or night roosts will not be harvested; (2) Myotis bats: trees and snags known to be used as communal roosts or maternal colonies will not be harvested; and, (continued)	Protection will be provided according to state regulations. Additional protection may occur in DNR-designated Natural Area Preserves and Natural Resource Conservation Areas. Same as Alternative 2, except conservaton of upland wildlife that are associated with older forests will be concentrated in the owl zones.

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Unlisted Species (continued)			
Unlisted Species (continued)		(3) Fisher: within 0.5 mile of a known active den between February 1 and July 3, no activity that would appreciably reduce likelihood of denning success. Exceptions to the additional mitigation restrictions related to nesting and roosting are limited to formal, experimental studies designed to address information needs related to integrating conservation and production or as other exceptional circumstances warrant.	

Molluscs

Three species of molluscs that may occur in the HCP planning area are currently species of concern to the U.S. Fish and Wildlife Service (61 Fed. Reg. 7457 (1996); USFWS 1996). Distribution and habitat requirements are not well understood for many aquatic molluscs; therefore, for the purposes of this analysis, all habitat needs for these species are assumed to be met in aquatic environments where they have been observed.

Newcomb's Littorine Snail (*Algamorda newcombiana* [a.k.a. Littorina {*Algamorda*} *subrotunda*]).

Newcomb's littorine snail is an estuarine species that is known to occur near the high-tide mark in *Salicornia* spp. salt marshes near Grays Harbor in the South Coast Planning Unit (T. Burke, WDFW, Olympia, WA, pers. commun. to C. Turley, DNR, Olympia, WA, 1994).

Alternative A and Action Alternatives

All DNR-managed lands within the HCP area adjacent to estuarine habitat such as the salt marshes of Grays Harbor and Willapa Bay are Natural Area Preserves (NAP). As such, the habitat required by Newcomb's littorine snail is expected to be protected under all alternatives. If this snail species should be discovered in the future in estuarine habitat that is not an NAP, it is likely that protection of Newcomb's littorine snail habitat would be provided as described below.

Alternative A

The riparian ecosystem on DNR-managed lands is expected to provide some protection of the estuarine and wetland habitats primarily by the establishment and protection of riparian management zones on Type 1 through 4 Waters, and the establishment and protection of wetland management zones (WMZs) on all nonforested wetlands. Estuaries are Type 1 Waters and receive the same protection as other Type 1 Waters. Because the Newcomb's littorine snail occurs in marshes which are often associated with estuaries the establishment of, and restrictions on timber management activities within, WMZs directly protect essential habitats for this species.

Alternatives B and C

Protection of this species would increase substantially under each of the HCP alternatives because the minimum buffer width for streams likely to empty into Grays Harbor (Type 1 through 4) would be 100 feet; it would average 150 feet for Type 1 through 3 Waters. These buffers would include a minimum 25-foot no-harvest zone. Additional wind buffers would be added in areas where there is a moderate potential for windthrow. Activities within the remainder of the riparian management zones would be limited to those that are expected to maintain or restore the quality of salmonid habitat. Thus, it is expected that other aquatic species such as the Newcomb's littorine snail would benefit from the conservation measures developed in these alternatives for the protection of salmonids. This protection would be greater than under the No Action alternative because of the 25-foot no-harvest provision, protection of unstable slopes, and the guaranteed wider protective zones on each side of Type 1 through 4 Waters. These provisions should result in more natural levels of sediments, organic nutrients and large woody debris

(LWD) flowing into the estuaries from inland areas than what would occur under the No Action alternative.

OESF ALTERNATIVE 1 AND ACTION ALTERNATIVES

The Newcomb's littorine snail is not expected to occur in the OESF. Thus, an assessment of the OESF No Action and action alternatives is unnecessary.

California Floater (*Anodonta californiensis*) and Great Columbia River Spire Snail (*Fluminicola columbiana*)

The California floater and the great Columbia River spire snail both inhabit medium to large rivers. Due to the similarities in habitat requirements of these species, the assessment of the effects of the alternatives on these species has been combined.

The California Floater

The California floater is a freshwater clam that inhabits medium- to large-sized rivers and creeks including the Columbia, Wenatchee, and Okanogan Rivers (T. Burke, WDFW, Olympia, WA, pers. commun. to C. Turley, DNR, Olympia, WA, 1994).

The Great Columbia River Spire Snail

The great Columbia River spire snail is a freshwater species that occurs in the Methow and Okanogan Rivers (Columbia, Klickitat, and possibly within the Chelan Planning Unit), although historically this species was widespread throughout the Columbia River system (Neitzel and Frest 1993). This species also occurs in other rivers in eastern Washington, Oregon, and Idaho, but is restricted to rivers and large streams with ample oxygen. The Methow River is the smallest stream that the Great Columbia River spire snail is known to inhabit (Columbia and Klickitat planning units).

ALTERNATIVE A

Current management of the riparian ecosystem on DNR-managed lands is expected to provide some protection of the aquatic habitats considered important to the California floater and the great Columbia River spire snail. This protection would be provided primarily through the establishment and protection of riparian management zones on all Type 1 through 3 Waters on DNR-managed lands according to DNR's FRP policies. In the recent past, riparian management zones for Type 1 and 2 Waters have averaged 196 feet (range = 0-350 feet), and for Type 3 Waters the average has been 89 feet (range = 0-300 feet). On average, approximately 77 percent of the riparian management zones have had no timber management activity. However, Type 4 and 5 Waters have received considerably less protection; riparian management zones on Type 4 Waters have averaged 52 feet (range = 0-300 feet), and 53 percent of Type 5 Waters have received no riparian protection. These small or non-existent riparian management zones could contribute to poor water quality in the larger rivers downstream. Under this alternative, additional protection of large rivers and creeks would be provided through the identification of, and prohibition of timber harvest on, unstable slopes, and through protection of salmonid spawning, rearing, and overwintering areas as identified by an analysis of watersheds during landscape planning (WFPB 1995b). However, some impacts to the aquatic habitat upon which these species rely may occur because the level of riparian management zone

protection described above may range to zero on all water types, and the protection is not guaranteed.

ALTERNATIVE B

The management designed for protection of the riparian ecosystem under this alternative is expected to provide adequate guaranteed protection of the aquatic habitats considered important to the California floater and the great Columbia River spire snail where they occur on the west-side. Specific benefits of this alternative for aquatic species include the establishment of riparian management zones on all Type 1 through 4 Waters. Type 1 through 3 Waters would have buffers of approximately 150 feet with 50- to 100-foot buffers on the windward side. Protection of aquatic habitat is provided by the prohibition of harvest within a 25-foot no-harvest area within each zone established, and the constraint on activities within the remainder of the zone to those that are expected to maintain or restore the quality of salmonid habitat. This alternative would continue to include the No Action alternative protection of aquatic habitats which includes the protection of unstable slopes from mass-wasting events, and the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). Under Alternative B, these protective measures would contribute to a higher quality of aquatic habitat than what occurs under the No Action alternative because of the riparian management zone guarantees, which include minimum buffer widths, generally wider buffers, additional wind buffers, and a no-harvest zone.

ALTERNATIVE C

The management designed for protection of the riparian ecosystem under Alternative C is expected to provide a substantial amount of guaranteed protection of the aquatic habitats considered important to the California floater and the great Columbia River spire snail. Specific benefits of this alternative for aquatic species include the establishment of riparian management zones on all Type 1 through 5 Waters. Type 1 through 3 Waters would have buffers of approximately 150 feet, with additional 100-foot wind buffers on each side of Type 1 and 2 Waters. Each side of a Type 3 Water greater than 5 feet wide would have a 50-foot wind buffer. Protection of aquatic habitat is provided by the prohibition of harvest within a 25-foot no-harvest area within each zone established, and the constraint on activities within the remainder of the zone to those that are expected to restore and enhance the quality of salmonid habitat. This alternative would continue to include the No Action alternative protection of aquatic habitats which includes the protection of unstable slopes from mass-wasting events, and the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). The protection of aquatic habitat would be substantially greater under this alternative than under the No Action alternative because of the riparian management zone guarantees, which include minimum buffer widths, generally wider buffers on all waters, additional wind buffers, and a no-harvest zone. In addition, under this alternative, management in the riparian management zones must restore or enhance salmonid habitat, which would maintain high quality aquatic habitat in the larger rivers and streams.

OESF ALTERNATIVE 1 AND ACTION ALTERNATIVES

The California floater and the great Columbia River spire snail are not expected to occur in the OESF. Thus, an assessment of the OESF No Action and action alternatives is unnecessary.

Arthropods

Seven species of arthropods known to occur, or that may occur, in the HCP planning area are currently species of concern to the U.S. Fish and Wildlife Service (61 Fed. Reg. 7457 (1996) or candidates for state listing. An analysis of the effects of the alternatives on these species is discussed in the sections below.

Beller's Ground Beetle (*Agonum belleri*), **Long-horned Leaf Beetle** (*Donacia idola*), **and Hatch's Click Beetle** (*Eanus hatchii*)

The Beller's ground beetle, long-horned leaf beetle, and Hatch's click beetle are known to inhabit eutrophic sphagnum bogs (i.e., nonforested wetlands) in or near low elevation (less than 3,300 feet) lakes (i.e., Type 2 Waters) (Dawson 1965; Rodrick and Milner 1991). Since these species have similar habitat requirements, the analysis of the effects of the alternatives on these species has been combined.

Beller's Ground Beetle

Beller's ground beetle occurs exclusively in lowland sphagnum bogs of Washington, Oregon, and southwestern British Columbia (Johnson 1979, 1986). In Washington, Beller's ground beetle is only known to occur in Snoqualmie Bog, now a DNR Natural Area Preserve (NAP), located along the north fork of the Snoqualmie River, and in Kings Lake Bog NAP (Crawford 1994; R. Crawford, University of Washington, Seattle, pers. commun., 1993).

Long-horned Leaf Beetle

The long-horned leaf beetle occurs specifically in lowland sphagnum bogs of Washington and southwestern British Columbia (Rodrick and Milner 1991). In Washington, this species has been documented historically only in Snohomish County, and is currently known to occur in only one locale, Chase Lake, near Edmonds (R. Crawford, University of Washington, Seattle, pers. commun., 1993). Long-horned leaf beetle larvae forage on submerged plants, while adults forage on the exposed portions of aquatic plants (White 1983).

Hatch's Click Beetle

Hatch's click beetle occurs exclusively in lowland sphagnum bogs of northwestern Washington (Johnson 1979). This species is known to occur historically in Snohomish and King Counties, but is currently only known to occur at three bog sites located in central King County, including Kings Lake Bog NAP (WDFW 1994a; Crawford 1994; R. Crawford, University of Washington, Seattle, pers. commun., 1993). Adult beetles feed on honey, dew, pollen, nectar, and small soft insects (WDFW 1994a).

ALTERNATIVE A

Current management of the riparian ecosystem on DNR-managed lands is expected to provide some protection of the sphagnum bog habitat in which these three species of

beetles occur. Protection of sphagnum bogs would occur primarily through the restriction of timber management activities within wetland management zones (WMZs) that would be established around nonforested wetlands according to DNR's Forest Resource Plan (FRP) policies (DNR 1992b). Wetland management zones on nonforested wetlands in the recent past have averaged 86 feet; a policy that is expected to continue, and would be applied to all bogs greater than or equal to 0.25 acre in size.

DNR's FRP policies to control undesirable vegetation, insects, disease, specifies a hierarchical approach with direct application of herbicides and pesticides being the least preferred alternative. For example, during the last 10 years, DNR did not use any aerial insecticides (DNR 1992b). DNR balances economic, biological, environmental, and social views in determining the best approach to prevent resource damage. These policies and the establishment of WMZs should provide adequate protection of the habitat upon which these beetle species rely. In addition, habitat known to be occupied by the Beller's ground beetle and Hatch's click beetle would continue to be protected in the Natural Area Preserves.

ALTERNATIVE B

Management of the riparian ecosystem under this HCP alternative is expected to provide adequate protection of the sphagnum bog habitat in which these three species of beetles occur. This protection is expected to be achieved primarily through the establishment of wetland buffers greater than or equal to 100 feet on all bogs greater than or equal to 0.25 acres, which is greater than current practices under Alternative A. Also, habitat known to be occupied by the Beller's ground beetle and Hatch's click beetle would continue to be protected in the Natural Area Preserves. DNR's FRP policies regarding the use of herbicides and pesticides would continue, which is the same as under the No Action alternative.

ALTERNATIVE C

Management of the riparian ecosystem under this HCP alternative is expected to provide somewhat more protection of sphagnum bog habitat than Alternatives A or B. This protection is expected to be achieved primarily through the establishment of wetland buffers greater than or equal to 100 feet on all bogs greater than or equal to 0.1 acre. A no-harvest restriction would be in effect for the first 50 feet from the wetland's edge. This protection would be greater than the No Action alternative because of the guaranteed protection zones, and the no-harvest restriction in the wetland buffers. Also, habitat known to be occupied by the Beller's ground beetle and Hatch's click beetle would continue to be protected in the Natural Area Preserves. However, policies regarding the use of herbicides and pesticides would be according to DNR's FRP, which is the same as under the No Action alternative.

OESF ALTERNATIVE 1 AND ACTION ALTERNATIVES

No effects are anticipated to the Beller's ground beetle, long-horned leaf beetle, or the Hatch's click beetle under any of the OESF alternatives because these species are very localized in distribution and are not expected to occur on the Olympic Peninsula.

Columbia River Tiger Beetle (*Cicindela columbica*)
The Columbia River tiger beetle occurs exclusively along sandy shoreline habitats of the Columbia and Snake Rivers (R. Crawford, University of Washington, Seattle, pers. commun., 1993). This species is thought to be extinct along dammed areas, but may occur along the Hanford reach or along Hell's Canyon (R. Crawford, University of Washington, Seattle, pers. commun., 1993). For the purposes of this analysis, all habitat needs for this species are assumed to be met within the sandy shoreline habitats along the Columbia and Snake Rivers.

ALTERNATIVE A AND ACTION ALTERNATIVES

Within the defined HCP area (the range of the northern spotted owl), there are no DNR-managed lands adjacent to the shores of the Columbia River. Therefore, no direct protection measures for this species or its sandy river shoreline habitat are currently being implemented, nor have any protective measures been incorporated into any of the proposed alternatives.

Fender's Soliperlan Stonefly (*Soliperla fenderi*) **and Lynn's Clubtail** (*Gomphus lynnae*)
The Fender's soliperlan stonefly is known from only one locale in Washington, thus, information on habitat needs and geographic range are limited for this species. Occurrences of Lynn's clubtail also are localized. The habitat requirements for these species are similar; both utilize aquatic habitats (i.e., Type 1 through 5 Waters). Thus, for purposes of this assessment, all habitat needs for these species are assumed to be met within these habitats, and the effects of the alternatives on these species have been combined.

Fender's Soliperlan Stonefly
One specimen of the Fender's soliperlan stonefly was collected from St. Andrew Creek in Mount Rainier National Park (J. Lattin, Oregon State University, Corvallis, pers. commun., 1994). Based on the biology of related species of stoneflies and the location at which the only observation of the Fender's soliperlan stonefly was recorded, all habitat requirements are assumed to occur within and adjacent to aquatic habitats.

Lynn's Clubtail
This species of dragonfly is known primarily to use large rivers, but has also been recorded in mountain lakes (i.e., Type 2 Waters) (J. Lattin, Oregon State University, Corvallis, pers. commun., 1994). Lynn's clubtail occurs primarily east of the Cascades, and has been reported to occur along the Yakima River from Kiona, Washington to Richland, Washington. Lynn's clubtail uses silty water for breeding. This species tends to occur along low-elevation streams or rivers with a fair amount of siltation (J. Lattin, Oregon State University, Corvallis, pers. commun., 1994).

ALTERNATIVE A

These two species are not known to occur on DNR-managed lands within the range of the spotted owl. However, should they occur in the HCP area, current management of the riparian ecosystem on DNR-managed lands is expected to provide some protection of the aquatic habitats considered important to the Fender's soliperlan stonefly and Lynn's clubtail. This protection is expected to occur primarily from the establishment and

protection of riparian management zones on all Type 1 through 3 Waters according to FRP policies. The riparian management zones have averaged 196 feet on Type 1 and 2 Waters, and 89 feet on Type 3 Waters, although some of these waters have had no riparian management zones. Additional protection of aquatic habitats is provided through the identification of, and prohibition of timber harvest on, unstable slopes, and through protection of salmonid spawning, rearing, and overwintering areas as identified by an analysis of watersheds during landscape planning (WFPB 1995b). The use of herbicides and pesticides would be according to DNR's FRP policies, as described above in the analysis of effects on the beetle species.

ALTERNATIVE B

The management designed for protection of the riparian ecosystem under Alternative B is expected to provide adequate protection of the aquatic habitats considered important to the Fender's soliperlan stonefly and Lynn's clubtail, should they occur on DNR-managed lands in the HCP area. Specific benefits of this alternative include the establishment of riparian management zones on Type 1 through 4 Waters. Riparian buffers on Type 1 through 3 Waters would be based on sight potential tree height or 100 feet whichever is greater (averaging 150 feet) plus a wind buffer on the windward side where there is a moderate potential for windthrow. Type 4 Waters would have 100-foot riparian buffers. Protection of riparian management zones is provided by a 25-foot no-harvest area within each zone established, and the constraint on activities within the remainder of the zone to those that are expected to maintain or restore the quality of salmonid habitat (i.e., large woody debris, stream temperature, water quality). This alternative would continue to include the No Action alternative protection of aquatic habitats which includes the protection of unstable slopes from mass-wasting events, and the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). However, protection of aquatic habitat would be greater under this alternative than under the No Action alternative because of the riparian management zone guarantees, which include minimum buffer widths, generally wider buffers, additional wind buffers, and a no-harvest zone.

ALTERNATIVE C

The management designed for protection of the riparian ecosystem under Alternative C is expected to provide substantial protection of the aquatic habitats considered important to the Fender's soliperlan stonefly and Lynn's clubtail should they occur on DNR-managed lands in the HCP area. Specific benefits of this alternative include the establishment and protection of riparian management zones on all Type 1 through 5 Waters. Stream buffers would be based on sight potential tree height or 100 feet, whichever is greater. Additional wind buffers of 100 feet would be established on each side of Type 1 and 2 Waters. Each side of a Type 3 Water greater than 5 feet wide would have a 50-foot wind buffer. Protection of the aquatic habitat would be provided by a 25-foot no-harvest area within each zone established, and the constraint on activities within the remainder of the zone to those that are expected to restore or enhance the quality of salmonid habitat. This protection, and the riparian management zone guarantees, which include minimum buffer widths, generally wider buffers on all waters, additional wind buffers, and a no-harvest zone would contribute to maintenance of stream quality and is substantially greater than that provided under the No Action alternative.

OESF ALTERNATIVE 1 AND ACTION ALTERNATIVES

Fender's soliperlan stonefly and Lynn's clubtail are unlikely to occur on the Olympic Peninsula. However, should they occur, adequate protection would be provided under the OESF No Action and action alternatives. Current management of the riparian ecosystem in the Olympic Region of DNR places mass-wasting buffers along streams. These buffers have averaged at least 94 feet on Type 1 through 5 Waters. Minimal timber management activity is allowed in these buffers or in areas identified as unstable. An additional layer of guaranteed protection of aquatic habitat for this species is assured through the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b).

The OESF action alternatives would have the same riparian management strategy. Riparian management zones would consist of an inner mass-wasting buffer and an outer wind buffer. It is anticipated that the inner-core buffers would average 150 feet on Type 1 and 2 Waters, and 100 feet on Type 3 and 4 Waters. A 150-foot wind buffer would be added along both sides of Type 1, 2, and 3 Waters, and a 50-foot wind buffer would be added along Type 4 and 5 Waters. This riparian management strategy would provide substantial protection of the habitat upon which these species rely, and would be guaranteed, which is greater than that provided under the OESF No Action alternative.

Johnson's (mistletoe) Hairstreak (*Mitoura johnsoni*)

Johnson's (mistletoe) hairstreak, a candidate for state listing, is a butterfly whose larvae are dependent upon species of dwarf mistletoe (*Arceuthobium spp.*), which occur primarily on western hemlock (*Tsuga heterphylla*) (Pyle 1989; Larsen et al. 1995). This butterfly is known to occur in low-elevation, late-successional forests west of the Cascade crest and on the Olympic Peninsula. It occurs in mature hemlock and Douglas-fir (*Pseudotsuga menziesii*) forests infested with dwarf mistletoe, where adults are known to feed on nectar sources that include dogwood (*Cornus nuttallii*) and oregongrape (*Berberis nervosa*) (Pyle 1974). Loss of late-successional forests, insecticide use, and mistletoe suppression are thought to be detrimental to Johnson's (mistletoe) hairstreak (Larsen et al. 1995).

ALTERNATIVE A

Current policies to manage late-successional forests for spotted owls and marbled murrelets will provide habitat for Johnson's (mistletoe) hairstreak, however, the amount of habitat is likely to decline as timber harvests reduce habitat unoccupied by spotted owls or marbled murrelets. Presently DNR manages 34,826 acres in forest greater than or equal to 200 years old and 150,978 acres between 70-200 years of age in the five west-side planning units, which is considered the potential spotted owl habitat in these units. Under Alternative A, 79,079 acres of this potential habitat will be protected throughout the planning period and is projected to increase slightly to 81,178 acres by the year 2096. While consistent with federal regulations, this decline in potential spotted owl habitat (from 185,803 acres) is likely to result in a decline in hairstreak habitat, but may protect some of the existing old-growth forest on DNR-managed lands. If these butterflies depend on existing old growth as source habitats then Alternative A may provide some support for this species.

ALTERNATIVE B

Under this alternative, 65,657 acres of potential spotted owl habitat will be designated to occur within 8 miles of federal land reserves in the western Washington units. This represents a decline from Alternative A, and may represent a decline in hairstreak habitat as well. Potential habitat for spotted owls increases to 81,621 by the year 2096 under this alternative, but the suitability of regenerated stands and the adequacy of their distribution for this butterfly is unknown. Under Alternative B, there would be less old-growth and mature stands in 2096 than under Alternative A, which likely would result in greater impacts to Johnson's hairstreak butterfly than the No Action alternative.

ALTERNATIVE C

Under this alternative, 80,497 acres of potential spotted owl habitat would occur within 8 miles of federal land reserves in the western Washington units. This designation is similar to Alternative A in the amount of habitat it maintains, which may represent potential Johnson's (mistletoe) hairstreak habitat as well. This alternative would increase potential spotted owl habitat to 146,098 acres by the year 2096. Although this would be an increase in habitat over what will be provided under Alternative A, the same concerns about the suitability of regenerated stands and the adequacy of their distribution for this butterfly, as stated in Alternative B, would exist. Alternative C may provide the most support for the hairstreak if habitat suitability and distribution are adequate, and if this habitat can be colonized by the species throughout the planning period. If not, protection for Johnson's hairstreak butterfly under Alternative C would likely be less than under the No Action alternative.

OESF ALTERNATIVE 1

The No Action alternative would provide some late-successional habitat for the Johnson's (mistletoe) hairstreak via habitat protections for spotted owls and marbled murrelets. This includes 15,000 acres of suitable habitat that is deferred from harvest until 2005. Riparian buffers, while minimal, may provide additional late-successional habitats in low-elevation areas. The amount of current capable spotted owl habitat available under this plan is projected to decline from 48,900 acres to 36,800 (in year 2096) as unoccupied owl circles, marginal murrelet sites, and stands not occupied by owls or murrelets are harvested; currently capable habitat consists of forests as young as 70 years old. Although some late-successional forests would be protected and regenerated, this alternative lacks proactive attempts to regenerate well-distributed, late-successional forests that appear critical for this species.

OESF ALTERNATIVE 2

Under the unzoned alternative, 153,400 acres of predicted capable spotted owl habitat would be available in year 2096, approximately 20 percent of which would be old forest habitat available throughout the planning period. Old forest is defined as a forest that has characteristics of, and functions as, late successional forest and may possibly be developed through management. While providing old-forest habitats is emphasized in this plan, habitat quality may be limited by the degree of mistletoe infestation in regenerating stands. Further, the degree of butterfly habitat connectivity that would result is unknown. However, the unzoned alternative appears to provide the greatest amount of potential hairstreak habitat that would be well distributed throughout the OESF.

OESF ALTERNATIVE 3

Under the zoned alternative, predicted capable spotted owl habitat will be compartmentalized into a number of zones, and will amount to 97,200 acres in the year 2096. Although this alternative provides 5000 acres of old growth in owl nest groves, it is unclear how much older forest habitat would be available throughout the planning period or its suitability for Johnson's hairstreak butterfly. However, the total amount of capable owl habitat is less than that predicted for the unzoned alternative and likely would provide less habitat for this butterfly species. The habitat amounts provided in the zoned alternative would exceed those in the No Action alternative, but the suitability of the habitat and its distribution is unknown.

Fish (excluding Pacific salmon (*Oncorhynchus*) which are covered in a separate section beginning on p. 4-383)

Five fish species, excluding anadromous salmonids, are federal candidates for listing or species of concern to the U.S. Fish and Wildlife Service and are known to occur within the bounds of the west-side HCP planning units. One of these, the Olympic mudminnow, is also a candidate for listing by the state. All the spawning, juvenile and rearing habitats for three of these species are provided by the freshwater aquatic environment. River lampreys spawn and rear juveniles in freshwater but adults rear solely in the marine environment. There is no known green sturgeon spawning and juvenile habitat in Washington, though some adult rearing occurs in the Columbia River. The habitat requirements of these species are described below. Since some or all of these species' life requisites are provided by aquatic habitat types, the assessment of the effects of the riparian protection strategies under the alternatives on each of these species is combined.

Bull Trout (*Salvelinus confluentis*)

Bull trout are found throughout coastal and inland streams and lakes in Washington and are thought to occur throughout the HCP planning area. Although some individuals may spend their entire life in a small segment of a stream, most are highly migratory, traveling to headwater streams to spawn and later migrating back to larger stream segments or lakes to rear (McPhail and Murray 1979). Bull trout are most often associated with cool (36-39 degrees F), clear, mountain streams and lakes during spawning and incubation (WDFW 1994a). Streams utilized by this species are typically high-elevation headwaters fed by snowmelt or springs (Bond 1992; WDFW 1994a).

Five characteristics of rearing habitat are of primary importance to bull trout: channel stability, substrate composition, cover, temperature, and migratory corridors (Rieman and McIntyre 1993). Highest abundance of this species is attained in streams dominated by gravel and cobble (Bond 1992). This species is also associated with waters less than 64 degrees F (18 degrees C) in the summer (WDFW 1994a), but tends to occur in stream segments with temperatures below 59 degrees F (15 degrees C) (Rieman and McIntyre 1993). Because rearing habitat for juveniles includes the substrate or other protected areas, this species requires clean, mostly sediment-free bottom area or an abundance of large woody debris for cover (Rieman and McIntyre 1993). Sheltered pools with large organic debris and clean cobble substrate provide rearing habitat for adults (McPhail and Murray 1979).

Olympic Mudminnow (*Novumbra hubbsi*)
The Olympic mudminnow is restricted to drainages along the west coast of Washington, the Chehalis River, and the lower Deschutes River (Meldrim 1968; Harris 1974; Wydoski and Whitney 1979). Within this region, the species is restricted to the following areas: (1) freshwater habitats north of Grays Harbor; (2) Chehalis tributaries entering from the north and some adjacent stream mouths from the south; (3) the Chehalis River below Rainbow Falls; and, (4) the lowest reaches of the Deschutes River where it enters Puget Sound. The northernmost distribution of the Olympic mudminnow was documented around Lake Ozette (Harris 1974). Harris (1974) also indicated that this species was restricted to the coastal lowlands, and that it did not extend to the base of the Olympic Mountains in the Chehalis drainage.

Olympic mudminnows use similar habitats for spawning, and juvenile and adult rearing. Within its geographic range, spawning and rearing habitats for the Olympic mudminnow are highly restricted to ponds and marshy streams in coastal lowlands (WDFW 1994a) with the following characteristics: (1) relatively deep (at least several inches); (2) slow-flowing or still water; (3) choked with aquatic vegetation; and, (4) soft mud bottom (containing organic matter) (Hagen et al. 1972; Harris 1974; Wydoski and Whitney 1979). This species does not occur in newly silted areas containing inorganic sediment alone. Olympic mudminnows occur in a wide range of water quality conditions, but are found most often in turbid water. Although they prefer cooler waters, Olympic mudminnows also occur in water temperatures ranging from 32 to 70 degrees F (Wydoski and Whitney 1979).

Pacific Lamprey (*Lamptera tridentata*)
Pacific lamprey are found in coastal streams from southern California to the Gulf of Alaska. In Washington, this species is found inland in the Columbia, Snake, and Yakima River systems (Wydoski and Whitney 1979), and is thought to occur throughout the HCP planning area. Pacific lamprey travel up rivers and streams, sometimes several hundred miles, to the headwaters, where they spawn in cold water, depositing their eggs in clean sand, gravel (Wydoski and Whitney 1979; Brown 1985), and cobble substrates (U.S. Bonneville Power Administration et al. 1994). Kan (1975) found that the Pacific lamprey spawned predominantly in low-gradient stream segments, usually just above riffles at the tail end of pools at water depths of 0.4 to 1 meter (1-3 feet) (U.S. Bonneville Power Administration et al. 1994). Juvenile rearing habitat is found downstream from the redd where they hatched, typically in slow, cool, soft-bottomed stretches in back waters, pools, and quiet eddies (Kan 1975; Wydoski and Whitney 1979; Brown 1985) where they remain for a maximum of 5 to 6 years. At transformation, Pacific lampreys move out of the burrow and travel downstream in late summer during flood conditions, eventually reaching the sea or a lake which provides adult rearing habitat (Scott and Crossman 1973).

River Lamprey (*Lamptera ayresi*)
The river lamprey occurs in coastal streams from northern California to northern British Columbia and southeast Alaska. Little is known about the biology of this species. Similar to the Pacific lamprey, river lampreys probably spawn in low-gradient stream segments immediately upstream of riffles, using sand and gravel to excavate their redds

(Wydoski and Whitney 1979). Most river lamprey spawning habitat probably occurs in smaller headwater streams and rivers (Brown 1985). Juvenile rearing habitat for the river lamprey occurs in silt deposits in both riffle and pool habitats (Wydoski and Whitney 1979). Adult rearing habitat occurs in the Pacific Ocean, before the lampreys migrate to freshwater to spawn (Wydoski and Whitney 1979).

ALTERNATIVE A

Current management of the riparian ecosystem on DNR-managed lands is expected to provide some protection of suitable spawning and rearing habitats for the bull trout, Olympic mudminnow, and Pacific and river lampreys. This habitat receives the protection provided primarily by the establishment and protection of WMZs on nonforested wetlands and of riparian management zones on all identifiable Type 1 through 5 Waters according to DNR's FRP policies. Based on a survey of timber sales sold on DNR-managed land since 1992, no timber management activity has occurred in 77 percent of the riparian management zones established on Type 1 through 5 Waters on DNR-managed land. Riparian management zones on smaller headwater streams used by bull trout have averaged 52 feet on Type 4 Waters, and 40 feet on 47 percent of Type 5 Waters. However, these zones have ranged as low as zero for both Type 4 and Type 5 Waters, and 53 percent of Type 5 Waters have had no buffer, thus some impacts to bull trout would expected under this alternative. Because spawning and rearing for the Olympic mudminnow is restricted to ponds and marshy streams which are often associated with wetlands, the establishment of, and restriction of timber management activities within, WMZs directly protects essential habitats for this species. The average width of WMZs has been 86 feet. In addition to the smaller headwater streams, Pacific and river lampreys also inhabit low gradient streams and large rivers. Riparian management zones on Type 1 and 2 Waters have averaged 196 feet, and riparian management zones on Type 3 Water have averaged 89 feet, although these zones have ranged as low as zero. These WMZs and riparian management zones, although not guaranteed, to some extent contribute to stream stability, and water temperature and quality, providing some protection of the spawning and rearing habitat of these fish species. In addition, protection will be provided through the identification of, and prohibition of timber harvest on, unstable slopes, and through protection of salmonid spawning, rearing, and overwintering areas as identified by an analysis of watersheds during landscape planning (WFPB 1995b). Protection of salmon habitat would likely protect the stream features and functions that most of these five non-salmonid candidate fish species require.

ALTERNATIVE B

Management of the riparian ecosystem under Alternative B is expected to provide adequate guaranteed protection of spawning and rearing habitats of the bull trout, Olympic mudminnow, and Pacific and river lampreys. Specific benefits of this alternative considered important to these species include the establishment of wetland buffers and riparian management zones on all identifiable Type 1 through 4 Waters. Riparian management zone widths would be one site potential tree (approximately 150 feet) or 100 feet whichever is greater on all Type 1 through 3 Waters. Riparian management zones on Type 4 Waters would be two-thirds of a site potential tree (approximately 100 feet). Type 5 Waters would receive protection according to DNR's

FRP policies, which would be the same as Alternative A. In addition, wind buffers of 50-100 feet would be added to the windward side of Type 1 through 3 Waters where there is a moderate potential for windthrow. Protection of aquatic habitat would be provided by the prohibition of harvest within a 25-foot no-harvest area within each zone established, and the constraint on activities within the remainder of the zone to those that are expected to maintain or restore the quality of salmonid habitat. Wetland buffers would be at least 100 feet on wetlands greater than or equal to .25 acre. Additional protection of aquatic habitats includes the protection of unstable slopes from mass-wasting events, and the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). Under Alternative B, there would be greater protection than that provided under the No Action alternative because of the minimum buffer widths, wider buffers on Type 3 and 4 Waters and nonforested wetlands, guaranteed no-harvest restriction, and management that must maintain or restore salmonid habitat. Protection of salmon habitat would likely protect the stream features and functions that most of these five non-salmonid candidate fish species require.

ALTERNATIVE C

Management of the riparian ecosystem under Alternative C is expected to provide substantial guaranteed protection of spawning and rearing habitats of the bull trout, Olympic mudminnow, and Pacific and river lampreys. Specific benefits of this alternative considered important to these species include the establishment of wetland buffers and riparian management zones on all identifiable Type 1 through 5 Waters. Riparian management zones would be one site potential tree (approximately 150 feet) or 100 feet, whichever is greater, on Type 1 through 5 Waters. In addition, wind buffers of 100 feet would be added to both sides of Type 1 and 2 Waters, and 50-foot wind buffers would be added to each side of Type 3 Waters greater than 5 feet wide. Protection of the riparian management zone for aquatic species is provided by the prohibition of harvest within a 25-foot no-harvest area within each zone established, and the constraint on activities within the remainder of the zone to those that are expected to restore or enhance the quality of salmonid habitat. Wetlands protection would be the same as in Alternative B, except that Alternative C would also include 50-foot no-harvest buffers on nonforested wetlands, and 100-foot buffers on bogs greater than or equal to 0.1 acre in size. Additional protection of aquatic habitats includes the protection of unstable slopes from mass-wasting events, and the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). This protection is substantially greater than that provided under the No Action alternative because of the minimum buffer width, wider buffers on Type 3 through 5 Waters, additional wind buffers, guaranteed no-harvest restriction in riparian management zones and WMZs, and management that must restore or enhance salmonid habitat.

OESF ALTERNATIVE 1

Current management of the riparian ecosystem on the OESF is expected to provide adequate protection of spawning and rearing habitats of the bull trout, Olympic mudminnow, and Pacific and river lampreys. The Olympic Region of DNR currently places mass-wasting buffers along streams where needed. No timber removal or timber management activity occurs within these buffers or in areas identified as unstable. An

additional layer of protection of aquatic habitat upon which these species rely is assured through the restriction of timber management activities within riparian management zones and wetland buffers which directly protect essential habitat for these species. Average riparian management zone widths on Type 1 through 5 Waters in the past have been 146, 136, 94, 96, and 105 feet, respectively. Wetland management Zones have averaged 86 feet in width, and no timber harvest activity has occurred in these buffers. Additional protection for the habitat upon which these species rely is provided by the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). Protection of salmon habitat would likely protect the stream features and functions that most of these five non-salmonid candidate fish species require.

OESF Action Alternatives

Management of the riparian ecosystem would be the same under both OESF action alternatives, and would provide adequate protection of spawning and rearing habitats for the bull trout, Olympic mudminnow, and Pacific and river lampreys. Ecosystem protection under these alternatives would be derived largely from management directed at maintaining and restoring riparian ecosystem function as well as older forest conditions across much of the managed uplands which are expected to benefit all aquatic species. Specific protection of aquatic habitat would occur primarily from the establishment of, and restriction of timber harvest activities in, riparian management zones and wetland buffers. These buffers would be applied in a site-specific manner and would consist of an inner mass-wasting buffer and an outer wind buffer. Total buffer widths on Type 1 and 2 Waters would average 300 feet. Buffers on Type 3 and 4 Waters would average 250 and 150 feet, respectively. Type 5 Waters would have inner buffers based on the identifiable channel and unstable slopes, and a variable outer buffer. These buffers may range from a minimum of 25 feet to 1,000 feet depending on site-specific conditions. Wetland buffers would be the same as those described in Alternative B above. Minimal timber management activity would be allowed in the mass-wasting buffer. Additional protection for the habitat upon which these species rely is provided by the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b).

Pacific Salmon

All seven species of pacific salmon (*Oncorhynchus* spp.) are found in western Washington lakes, rivers, and streams (Wydoski and Whitney 1979). These fish have become adapted to cool, clean water, with abundant gravels and a diversity of habitats composed of riffles and pools. Because salmon have evolved in a largely forested setting, many of their adaptations are associated with cool water temperatures, high oxygen concentrations, and large woody debris (LWD) habitat. Large woody debris is contributed to the aquatic systems from the riparian forest by such processes as stream bank erosion, wind damage, and slope failures (Hicks et al. 1991; FEMAT 1993). For the species that spend a limited amount of time in the freshwater environment (i.e., chum, pink, chinook), or rely on lakes for rearing (i.e., sockeye), cool water temperatures and high oxygen levels are very important, however LWD also plays a limited role in their life history strategies. For these species the importance of LWD is more narrowly focused on

providing cover for adults and stabilizing the spawning beds for egg incubation. For the other species of salmon (i.e., coho, steelhead, cutthroat) that rear in freshwater for extended periods of time, LWD plays a greater role during both spawning and rearing. It contributes to channel stability during spawning, as well as forming rearing pools and riffles and contributing to food productivity. Large woody debris is also an important source of refuge cover for adults and juveniles during high flow conditions and when being sought after by predators.

Chum (*O. keta*)
Western Washington chum salmon are found close to saltwater, where they spawn in low-gradient tributaries or side channels of rivers. Being anadromous, this species spends part of its life in freshwater and the remainder in saltwater (Groot and Margolis 1991; Meehan and Bjornn 1991). During the initial stage of life, chum salmon eggs can be found incubating in coastal streams, while the adult phase of life is spent in the ocean. The length of time spent in the ocean can vary from 6 months to 4 years (Wydoski and Whitney 1979), while the time spent in freshwater is relatively short. The freshwater phase of a chum salmon's life is virtually over upon emergence from the gravel, as they swim down to the estuary and eventually to the sea almost immediately after emergence from the gravel. These fish rely on medium-sized spawning gravels that are relatively free of sand and silt (Koski 1975).

Pink (*O. gorbuscha*)
Pink salmon are found in just a few Puget Sound rivers and tributaries. Being anadromous, this species spends part of its life in freshwater and the remainder in the ocean feeding (Groot and Margolis 1991; Meehan and Bjornn 1991). Juvenile pink salmon use freshwater very briefly, as they migrate to the estuary and marine environment soon after emergence from the gravel. Pink salmon are unique in that they have a strict 2-year lifespan, and in Washington the odd year cycle is the most dominant (Wydoski and Whitney 1979). These salmon prefer to spawn during late summer in small- to medium-sized gravels (Wydoski and Whitney 1979).

Sockeye (*O. nerka*)
The majority of western Washington sockeye salmon are found in a few river systems that have accessible lakes, with a relatively minor portion found in systems without lakes. Most sockeye are anadromous, spending part of their life in freshwater and the remainder in saltwater (Groot and Margolis 1991; Meehan and Bjornn 1991). The freshwater stages of life are spent either in tributaries and rivers during egg incubation or in lakes and other standing bodies of water during the juvenile rearing stages. The adult feeding stages are spent in the ocean environment. The length of time spent in the ocean will vary from 1-3 years (Wydoski and Whitney 1979), with the period of freshwater residence taking from 1-2 years to achieve smolt size. Most sockeye adults enter freshwater to spawn in early to mid-summer, the adults hold in the lake through the fall, and eventually spawn in tributaries and along lake shorelines in late fall and early winter. Spawning occurs in clean small- to medium-sized gravels. After the young fry emerge from the gravel, they move into the lake for rearing for a couple years, where they feed on zooplankton and eventually migrate to sea as smolts. Kokanee are the non-anadromous variety of the sockeye salmon. Kokanee have similar spawning and rearing habits as the anadromous

form, however because it stays in the lake and does not go to sea, it doesn't achieve as large a size.

Chinook (*O. tshawytscha*)
Chinook salmon are found in all of the larger west-side river systems of Washington. Being anadromous, this species spends part of its life in freshwater and the remainder in saltwater (Groot and Margolis 1991; Meehan and Bjornn1991). The early freshwater stages of life are spent in the coastal rivers and tributaries, while the adult feeding stages are spent in the ocean environment. The length of time spent in the ocean will vary from 2-8 years (Wydoski and Whitney 1979), with most taking 3-5 years to reach adulthood. Chinook adults enter and spawn in freshwater between the months of March and December and this will vary depending on the particular variety of chinook (i.e., spring, summer, fall chinook). Spawning occurs in shallow- to deep-water streams where the eggs are deposited in medium- to large-diameter gravels. Upon emergence from the gravel, young chinook spend several months to a year in freshwater before migrating to the estuary and on to the sea. Juveniles rely on clean, cool, well-oxygenated water, with a good supply of food, and can be seen feeding in large schools throughout the lower rivers and estuaries during the summer months. Most chinook juveniles migrate (as smolt) to sea at the end of summer, however, a significant portion, especially the spring chinook, will remain in freshwater over one winter and smolt to sea the following spring. During winter residence, these juveniles have been observed burying themselves in gravel crevices or hiding within complex LWD jams, presumably to escape high velocity currents during winter and spring runoff (Bjornn 1971; Hicks et al. 1991; Groot and Margolis 1991).

Coho (*O. kisutch*)
Coho salmon are the most ubiquitous of the Pacific salmon, occurring in almost every accessible lake, river and stream in western Washington. Being anadromous, the coho spends part of its life in freshwater and the remainder in saltwater (Groot and Margolis 1991; Meehan and Bjornn 1991). The coho spends about a year and a half in freshwater, and 1-2 years in saltwater before returning to spawn as 3- to 4-year-old adults. Most coho adults enter freshwater to spawn in October through January, and the eggs incubate through the winter. Coho prefer to spawn in small- to medium-sized gravels in small streams; gravels should be free of unnaturally high levels of silt and sand (Tagart 1984). Fry emergence occurs from March through May depending on the particular river system. Most stream-dwelling juvenile coho reside in pool habitats as fry and fingerling for one summer where they feed on aquatic insects. In the winter, coho juveniles either reside in deep pools associated with LWD, or seek refuge from high flows in pond-headed or spring-fed tributaries (Cederholm and Scarlett 1981; Peterson and Reid 1984). Most yearling coho migrate to sea during the months of April through June.

Steelhead (*O. mykiss*)
Steelhead are found in most of the medium- to large-sized rivers and streams in western Washington. Steelhead are both anadromous and non-anadromous; the non-anadromous form is called the rainbow trout. There are two varieties of anadromous steelhead in Washington, the more abundant and widespread winter run, and the more restricted summer run. Steelhead spend from 1-4 years at sea, with most naturally produced

steelhead spending 2-3 years. Steelhead juveniles generally enter the marine environment after spending 2 years rearing in freshwater, however, it isn't uncommon to find 1and 3 year old smolts (Winter 1992). Juveniles prefer to reside in fast-running riffle and cascade habitats during the summer, but are also found in pool habitat associated with LWD during winter. In the winter juvenile steelhead are also found immigrating into gravel-bedded tributaries during periods of high stream flow (Cederholm and Scarlett 1982). Steelhead generally spawn in clean, small-to medium-sized gravels.

Cutthroat (*O. clarki*)
The cutthroat, like the coho, is a highly ubiquitous species. These fish can be found in most western Washington lakes, rivers and streams. Like the steelhead, the cutthroat has both the anadromous and non-anadromous forms. In the anadromous form the cutthroat spends from 2-4 years in freshwater prior to smoltification (Fuss 1982), and usually spends a year or less in the marine environment before returning to spawn. The anadromous cutthroat spawns in mid-winter through early spring, while the non-anadromous variety spawns in spring. The cutthroat usually seeks out small, remote headwater tributaries for spawning and early rearing, where it can minimize competition with other salmon species (Glova 1978). Small-sized gravels with some sand are most often used for spawning. As the rearing juveniles grow older they move downstream into larger streams where they mingle with other salmon species. The rearing habitats of preference are the riffles for the very young and deep pools with LWD for older year classes. During the winter, older aged cutthroat often move into pond fed and other runoff tributaries for refuge from high flows, and for preferred feeding conditions (Cederholm and Scarlett 1982). Many of the very steep headwater tributaries are occupied by non-anadromous forms of cutthroat (Lestelle 1978; Osborn 1981). Lake dwelling cutthroat can grow to very large size and are most often non-anadromous (Wydoski and Whitney 1979).

Pacific Salmon Status and Distribution
In western North America, anadromous salmonids range from mid-California to the Arctic Ocean (Meehan and Bjornn 1991). Their historic distribution included southern California and Mexico (Wilderness Society 1993). Freshwater salmonid habitat extends eastward into Idaho, i.e., the Snake River and its tributaries. All species from the Pacific Northwest migrate out into the Pacific Ocean, some traveling as far north as the Bering Sea. Anadromous salmonids occupy all of Washington except the area north of the Snake River drainage and east of the Columbia River in central Washington and the area east of the Okanogan Highlands in northeastern Washington (WDF et al. 1993).

Stocks and Evolutionarily Significant Units. Fisheries management of salmon is normally done according to stocks. A stock is a discrete breeding population. The Washington State Salmon and Steelhead Stock Inventory (WDF et al. 1993 p. 10) has defined stock to be:

> The fish spawning in a particular lake or stream(s) at a particular season, which fish to a substantial degree do not interbreed with any group spawning in a different place, or in the same place at a different season.

The spatial or temporal reproductive isolation required by this definition is reflected in the names given to stocks, e.g., "Nisqually River summer steelhead" or "Snohomish River fall chinook." Stocks may possess distinct biological characteristics (e.g., physical appearance, habitat preferences, genetics, or population demography), but not necessarily. As noted by Meehan and Bjornn (1991), "stock" can be considered synonymous with "subspecies."

The Endangered Species Act defines species as "any distinct population-segment of any species of vertebrate fish or wildlife which interbreeds when mature" (16 U.S.C. § 1531 et seq.). For purposes of the Endangered Species Act, salmon stocks are grouped into populations known as Evolutionarily Significant Units (ESU). If conditions warrant federal listing of a salmon, it is the stated intention of National Marine Fisheries Service to list ESUs, rather than an entire salmon species or individual stocks (56 Fed. Reg. 58612-8 (1991)). (Bull trout have not been separated into ESUs.)

An ESU is a population that (1) is substantially reproductively isolated from other population units of the same species; and, (2) represents an important component in the evolutionary legacy of the species (Waples 1991). The first criterion is essentially the same as the Washington State Salmon and Steelhead Stock Inventory (WDF et al. 1993) definition of a stock. The second criterion requires that sub-populations in separate ESUs possess significant genetic or other biological differences. As a result, many stocks are lumped into a single ESU. For example, agencies in Washington, Oregon, and California have identified more than 200 distinct stocks of coho salmon. These stocks have been grouped into six ESUs. Washington contains at least 90 stocks of coho (WDF et al. 1993), and these are distributed among three ESUs.

Salmonid Status in the Pacific Northwest. Nehlsen et al. (1991) assessed extinction risks for 214 native naturally spawning salmonid stocks occurring in Idaho, Washington, Oregon, and northern California. They defined three risk categories: high risk of extinction, moderate risk of extinction, and special concern. Stocks with a high or moderate risk of extinction have likely attained the threshold for listing under the Endangered Species Act. Stocks with a moderate risk have a larger number of spawning adults each year than do stocks with a high risk. Stocks of special concern have not attained the threshold for listing, but do face some risk of extinction or possess some unique characteristic that requires attention. Nehlsen et al. (1991) estimated that 101 (47 percent) of stocks in the Pacific Northwest had a high risk of extinction, 58 (27 percent) had a moderate risk, and 54 (25 percent) were of special concern.

Under the Endangered Species Act, the National Marine Fisheries Service regulates salmon, and it has declared several different salmonid populations as threatened or endangered. The agency listed Sacramento River winter chinook as threatened in 1990 (Nehlsen et al. 1991) and Snake River sockeye as endangered in 1991 (56 Fed. Reg. 58619-24 (1991)). Spring/summer and fall runs of Snake River chinook were listed as threatened in 1992 (47 Fed. Reg. 14653-5 (1992)). In March 1995, the steelhead populations in the Klamath Mountain of northern California were proposed for listing as threatened (60 Fed. Reg. 14253-61 (1995)).

The National Marine Fisheries Service initiated status reviews for west coast steelhead trout in May 1993 and coho salmon in October 1993 (58 Fed. Reg. 57770-1 (1993); 59 Fed. Reg. 27527-8 (1993)). The status review for steelhead is expected to be completed in 1996. The status review for coho, completed in July 1995, proposed that the species be federally listed in Oregon and California, but not in Washington (60 Fed. Reg. 38011-30 (1995)).

The federal government initiated coastwide status reviews for the other five anadromous salmonids in September 1994 (59 Fed. Reg. 46808-10 (1994)). The first of these reviews, for pink salmon, was to be completed in 1995. Completion of the status reviews for chum, sockeye, and chinook salmon, and sea-run cutthroat will probably occur in 1996. The federal listing of salmonid species could be followed by federal regulations pertaining to forest practices on nonfederal lands.

Salmonid Status *in* Washington. The Washington State Salmon and Steelhead Stock Inventory (WDF et al. 1993) identified 435 distinct salmonid stocks in Washington. Information for 322 stocks was adequate to assess their status, and of these, 38 percent were classified as "depressed" and 4 percent as "critical" (WDF et al. 1993). A depressed stock is one "whose production is below expected levels based on available habitat" (WDF et al. 1993 p. 30), and a critical stock is one for which "permanent damage to the stock is likely or has already occurred" (WDF et al. 1993 p. 30).

Nehlsen et al. (1991) compiled a list of Pacific Northwest salmon stocks threatened with extinction. For stocks in Washington, their list describes 47 as having a high risk of extinction, 18 as having moderate risk, and 27 as being of special concern. A partial list of extinct stocks (Nehlsen et al. 1991) includes 42 stocks from Washington.

Salmonid Status in the Five West-side Planning Units. The riparian conservation strategies proposed under this HCP will be applied to only the HCP planning units west of the Cascade crest. Therefore, the discussion of stock status in the area covered by the HCP is confined to those planning units. There are 299 distinct salmonid stocks in these HCP planning units (WDF et al. 1993). The status of these stocks is summarized in Table 4.5.1. For those 227 stocks for which a status could be determined, 36 percent were depressed and 4 percent were critical (WDF et al. 1993). Nehlsen et al. (1991) rated 38 stocks as having a high risk of extinction and 12 as having a moderate risk.

Distribution on DNR-managed Lands in the Five West-side Planning Units. To determine the distribution of species of anadromous salmonids on DNR-managed lands covered by the HCP, we performed an analysis using the agency's computerized geographic information system with input from the Washington Department of Fish and Wildlife's Washington Rivers Information System, which identifies all streams that salmonids are known or expected to inhabit. Digital data are to the 1:100,000 scale, and the presence of fish species is recorded by river reach.

Using this database, all watershed administrative units (WAUs) that are known or thought to contain salmonids were tabulated. Over 80 percent of DNR-managed lands west of the Cascade crest in the area covered by the HCP are in WAUs that contain coho, chinook,

and steelhead (Table 4.5.2). Smaller percentages of DNR-managed lands are in WAUs that contain the other four anadromous salmonids. With the exception of the South Puget Planning Unit, all west-side planning units have at least 80 percent of their DNR-managed lands within WAUs that contain a salmonid species.

WAUs range in size from 10,000-50,000 acres. Given the relatively small area of WAUs compared to HCP planning units, we assumed that in a WAU identified as containing a salmonid species that all Type 1, 2, and 3 Waters in that WAU are inhabited by that species. Using this assumption, the assessment shows that approximately 900 miles of Type 1, 2, and 3 Waters on DNR-managed forest land in the five west-side planning units potentially contain coho, steelhead, chinook, chum, and sea-run cutthroat (Table 4.5.3). On the basis of stream miles, the density and distribution of salmonids vary widely among species. For example, the DNR analysis estimates that coho salmon may occupy over 900 stream miles but sockeye are to be found in only 270 stream miles. All the Type 1, 2, and 3 stream miles on DNR-managed land in the South Coast Planning Unit contains at least one species of anadromous salmonid. At least 90 percent of Type 1, 2, and 3 streams on DNR-managed land in the Straits, North Puget, and Columbia planning units contain a species of anadromous salmonid. To estimate the potential impacts of forest practices activities on DNR-managed land, we assumed that (1) all managed land within a WAU affects salmonid habitat; and, (2) impacts by individual landowners are proportional to the amount of land they manage within a WAU. For some WAUs, these assumptions may be weak. For example, DNR may manage 10 percent of a WAU, but that 10 percent affects 90 percent of the salmonid spawning habitat in that WAU. Nevertheless, this analysis provides a useful estimate of DNR's potential impacts on salmonid populations. DNR staff calculated the total area of WAUs identified as containing salmonid species as well as the total area of DNR-managed land within these WAUs. The ratio of these two numbers is the proportion of DNR-managed land that could affect salmonids. This proportion suggests the magnitude of the potential impact that DNR forest management may have on these species. For example, in the Straits Planning Unit, on average, about 15 percent of all land that could impact chinook salmon is managed by DNR (Table 4.5.4). In the five west-side planning units, on average, about 11 percent of all land that could affect salmonids is managed by DNR.

Differences in impacts among individual planning units reflect differences in the distribution of DNR-managed lands relative to the species range. For example, pink salmon spawn in the lower reaches of coastal rivers (Emmett et al. 1991), and therefore, planning units with DNR-managed lands near the Pacific coast have a greater impact on this species. In the Straits Planning Unit, 13 percent of all land that could impact pink salmon is managed by DNR, but in the South Puget Planning Unit, only 2 percent is managed by DNR (Table 4.5.4).

Table 4.5.1: Status of salmonid stocks[1] within the west-side HCP planning units

	Status[2]				Extinction Risk[3]		
	Healthy	Depressed	Critical	Unknown	High	Moderate	Special Concern
Coho	26	31	1	9	7	0	0
Chinook	34	13	4	8	14	0	1
Chum	45	3	2	12	3	3	0
Sockeye	0	3	1	0	1	0	0
Pink	9	1	0	2	2	1	0
Steelhead	23	30	1	41	9	7	10
Sea-run Cutthroat[4]	--	--	--	--	2	1	8
Total stocks	137	81	9	72	38	12	19

[1]Bull trout and Dolly Varden were not included in the SASSI (WDF et al. 1993) or Nehlsen et al. studies

[2]WDF et al. 1993

[3]Nehlsen et al. 1991

[4]Species not included in WDF et al.(1993)

Table 4.5.2: Percent of DNR-managed forest land by HCP planning unit watershed analysis units that contain salmonids

Source: DNR GIS April 1995

Planning Unit	SPECIES							
	Coho	Chinook	Chum	Sockeye	Pink	Steelhead	Sea-run Cutthroat	Total DNR- managed acres
South Coast	100	97	91	3	1	97	96	238,700
Straits	98	93	93	18	67	90	98	111,700
North Puget	82	80	77	48	62	81	37	396,400
South Puget	73	73	63	9	18	71	52	145,500
Columbia	81	67	39	25	0	78	81	289,300
Total west-side planning area	86	80	70	26	29	83	67	1,181,600

Table 4.5.3: Estimated miles of salmonid-bearing streams (Types 1, 2, and 3) by salmonid species on DNR-managed lands in the five HCP planning units west of the Cascade crest (excluding the OESF)

Source: DNR GIS April 1995

Planning Unit	SPECIES							
	Coho	**Chinook**	**Chum**	**Sockeye**	**Pink**	**Steelhead**	**Sea-run Cutthroat**	**Total by Planning Unit**
South Coast	240	236	222	33	2	240	230	240
Straits	94	70	91	22	71	91	94	95
North Puget	258	239	245	138	198	258	84	284
South Puget	89	89	84	3	15	88	73	117
Columbia	236	208	144	76	0	227	230	263
Total by salmonid species	917	842	786	272	286	904	711	999

Table 4.5.4: Percent of total land area impacting salmonids that is managed by DNR in the five HCP planning units west of the Cascade crest (excluding the OESF). DNR-managed lands in the Columbia Planning Unit have no pink salmon.

Source: DNR GIS April 1995

Planning Unit	SPECIES						
	Coho	**Chinook**	**Chum**	**Sockeye**	**Pink**	**Steelhead**	**Sea-run Cutthroat**
South Coast	13	15	15	4	5	13	13
Straits	15	15	15	11	13	15	15
North Puget	13	14	15	14	13	13	15
South Puget	5	5	5	1	2	5	6
Columbia	14	13	13	16	--	14	13
Total west-side planning area	12	12	12	10	10	12	13

ALTERNATIVE A

Current management of the riparian ecosystem on managed lands is expected to provide some protection of suitable spawning and rearing habitats for the seven species of Pacific salmon. This protection is provided primarily by the establishment of protection of wetland management zones (WMZs) on nonforested wetlands, and riparian management zones on all identifiable Type 1 through 4 Waters and where necessary on Type 5 Waters according to DNR's Forest Resource Plan policies. Based on a survey of timber sales sold on DNR-managed land since 1992, no timber management activity has occurred in 77 percent of the riparian management zones established on Type 1 through 5 Waters. Riparian management zones on smaller headwater streams have averaged 55 feet on Type 4 Waters and 19 feet on Type 5 Waters, and this may not be sufficient to protect downstream water quality and habitat integrity for the various salmon species. Type 4 Waters represent 15 percent and Type 5 and 9[5] Waters represent 75 percent of the stream miles on DNR-managed lands. The average width of WMZs has been 86 feet, and this is probably sufficient to protect these areas as overwintering habitats for juvenile salmon, as well as maintaining their hydrologic regulation value. Riparian management zones on Type 1 and 2 Waters have averaged 196 feet, and 89 feet on Type 3 Waters. Type 1 and 2 Waters represent 4 percent and Type 3 Waters represent 7 percent of the stream miles on DNR-managed lands. These WMZs and riparian management zones, although not guaranteed, provide some protection of the spawning and rearing habitats of these fish species. In addition, protection will be provided through the identification of, and prohibition of timber harvest on, unstable slopes, and through protection of salmon spawning, rearing, and overwintering areas as identified by an analysis of watersheds during landscape planning (WFPB 1995b). Hydrologic maturity is only addressed as part of forest practices watershed analysis. Under Alternative A, consideration of hydrologically mature forest is not a specific requirement of timber sale layout, however, WAC 222-22-100 gives interim regulatory measures prior to watershed analysis in the significant rain-on-snow zone where local evidence indicates that material damage to public resources has occurred during peak flows. Because this rule only affects harvests in watersheds where material damage to public resources has already occurred, some sedimentation and channel destabilization could occur. This process is only completed for a small percentage of DNR-managed lands. Because of the lack of minimum riparian management zone widths on Type 4 Waters, lack of wind buffers, lack of a comprehensive road network management plan, inconsistent consideration of hydrologic maturity, and lack of protection of along some Type 4, 5, and 9 Waters, Alternative A will not adequately protect many of the salmon habitat components (i.e., gravels, clean cool well-oxygenated water, LWD, etc.).

ALTERNATIVE B

Management of the riparian ecosystem under Alternative B is expected to provide adequate guaranteed protection of spawning and rearing habitats of the seven species of Pacific salmon. Specific benefits of this alternative that would provide some guaranteed protection of aquatic habitats considered important to these species include the establishment of WMZs and riparian management zones on all identifiable Type 1 through 4 Waters. Type 5 Waters are protected when necessary, and there will be a 10-

[5] Type 9 Waters are untyped waters.

year research program undertaken to further our understanding of what forestry activities can be conducted around these streams without negatively impacting downstream aquatic habitat conditions. Protection of aquatic habitat would be provided by the prohibition of harvest within a 25-foot no-harvest area within each zone established, and the constraint on activities within the remainder of the zone to those that are expected to maintain or restore the quality of salmon habitat. Riparian management zone widths would be one site-potential tree (approximately 150 feet) or 100 feet whichever is greater on all Type 1 through 3 Waters. Riparian management zones on Type 4 Waters would be 100 feet. In addition, wind buffers of 50-100 feet would be added to the windward side of Type 1 through 3 Waters where there is a moderate potential for windthrow. Wetland management zones, based on a sight potential tree height or 100 feet whichever is greater, would be established on wetlands greater than or equal to 1 acre in size. Wetland management zone widths would be 100 feet on wetlands between 0.25 and 1 acre in size. Minimal harvest would occur in WMZs. Additional protection of aquatic habitats includes the protection of unstable slopes from mass-wasting events, and the protection of salmon spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WPFB 1995b). This protection is greater than that provided under Alternative A because of the minimum riparian management zone widths, wider management zones on wetlands and Type 3 and 4 Waters, guaranteed no-harvest restriction, and management that must maintain or restore salmon habitat. Alternative B uses the active channel margin to delineate the stream compared to Alternative A which uses the ordinary high water mark, and this will result in better protection of off-channel overwintering habitats for coho, steelhead, and cutthroat. Except for a few exceptions, two-thirds of DNR-managed lands in the significant rain-on-snow zone will be maintained in a hydrologically mature state. Alternative B would provide better protection from sediment runoff from roads than Alternative A, because of the minimization of active road density based on the comprehensive road network management plan. Because of all these protective measures Alternative B will more than adequately protect the salmon habitat components (i.e., gravels, clean cool well-oxygenated water, LWD, etc.).

ALTERNATIVE C

Management of the riparian ecosystem under Alternative C is expected to provide substantial guaranteed protection of spawning and rearing habitats of the seven species of pacific salmon. Specific benefits of this alternative that would provide substantial guaranteed protection of aquatic habitats considered important to these species include the establishment of WMZs and riparian management zones on all identifiable Type 1 through 5 Waters. Protection of the riparian management zone for aquatic species is provided by the prohibition of harvest within a 25-foot no-harvest area within each zone established, and the constraint on activities within the remainder of the zone to those that are expected to restore or enhance the quality of salmon habitat. Riparian management zone widths would be one site-potential tree (approximately 150 feet) or 100 feet whichever is greater on Type 1 through 5 Waters. In addition, wind buffers of 100 feet would be added to both sides of Type 1 and 2 Waters, and 50-foot wind buffers would be added to each side of Type 3 Waters greater than 5 feet wide. Wetland management zones, based on a sight potential tree height or 100 feet whichever is greater, would be established on wetlands greater than or equal to 1 acre in size. WMZs would be 100 feet on wetlands between 0.25 and 1 acre in size. Minimal harvest would occur in WMZs.

All bogs greater than or equal to 0.1 acre in size would receive WMZs. No harvest would occur in WMZs of forested wetlands. Except for a few exceptions, two-thirds of DNR-managed lands in the significant rain-on-snow zone will be maintained in a hydrologically mature state. Additional protection of aquatic habitats includes the protection of unstable slopes from mass-wasting events, and the protection of salmon spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). This protection is substantially greater than that provided under Alternative A because of the minimum riparian management zone widths, wider riparian management zones on wetlands and Type 3 through 5 Waters, additional wind buffers, guaranteed no-harvest restriction, hydrologic maturity considerations, and management that must restore or enhance salmon habitat. Alternative C would provide better protection from sediment runoff from roads than Alternative A, because of the minimization of active road density based on the comprehensive road network management plan. Because of all these protective measures Alternative C will more than adequately protect the salmon habitat components (i.e., gravels, clean cool well-oxygenated water, LWD, etc.).

Amphibians And Reptiles

One species of amphibian, the spotted frog, is a federal candidate for listing. Six species of amphibians and two species of reptiles that occur in the HCP planning area are either species of concern to the U.S. Fish and Wildlife Service or state candidates for listing as threatened or endangered (WDW 1993a; 61 Fed. Reg. 7457 (1996); USFWS 1996). The habitat requirements of, and assessments of the effects of the alternatives on, each of these species are presented in the following sections.

Larch Mountain Salamander (*Plethodon larselli*)

The Larch Mountain salamander has a highly restricted range (Herrington and Larsen 1985), and, until recently, was found only along a 36-mile stretch of the Columbia River Gorge in Washington and Oregon. However, four populations have been found near Mt. St. Helens and just south of Mt. Rainier (Leonard et al. 1993). Within its range, the Larch Mountain salamander occurs at elevations between 165 and 4,100 feet above sea level (WDW 1993b) and appears to have relatively restricted habitat requirements, including stabilized talus ranging in size between 0.4 and 2.3 inches with some soil deposits in the interstices, and at entrances to some caves (L. Jones, USFS, Olympia, WA, pers. comm., 1995). The species life requisites also appear to be met in old-growth forest stand conditions where woody debris may provide the protective refugia that are offered by talus in other areas (C. Crisafulli, USFS, Amboy, WA, pers. commun., 1995). Larch Mountain salamanders are more common in areas with dense overstories of conifers or deciduous trees that help maintain higher moisture levels (WDW 1993b). The species appears to be confined to talus, old-growth coniferous forests, or collapsed lava tubes throughout its range. The core of the species range is in DNR's Columbia and Klickitat planning units.

ALTERNATIVE A

Under this alternative, some talus slopes and large woody debris in older forests may be encompassed and protected within the riparian management zones or WMZs, and incidental to protection of owl habitat. Although no specific conservation measures are

directed to potential Larch Mountain salamander habitat, such as talus fields or cave entrances, DNR voluntarily protects some talus in the range of the Larch Mountain salamander because the status of this species in Washington is listed as state sensitive.

ALTERNATIVE B

Some talus slopes in older forests may be encompassed and protected within the proposed riparian management zones, which overall would be wider than the riparian management zones under the No Action alternative, and are guaranteed. Under this alternative, forested and nonforested wetlands would be protected with buffers at least 100 feet in width, which may protect some large woody debris and, when adjacent to talus fields, would provide some protection of Larch Mountain salamander habitat. However, management activities are allowed in these buffers which may decrease the beneficial effects the buffers would have in maintaining critical temperature and moisture regimes required by the Larch Mountain salamander. Owl NRF habitat maintained or developed in the Klickitat and Columbia planning units, containing the known range of the Larch Mountain salamander, could contribute to maintenance of the integrity of talus fields and protect large woody debris within these NRF areas. Under Alternative B, the conservation objectives for talus fields greater than or equal to 1 acre in size, or greater than or equal to 0.25 acre in size in most of the Columbia Planning Unit, are to maintain its physical integrity and minimize dramatic changes in microclimate. Talus fields would be protected by a no-harvest restriction and, where practicable, road construction and extraction of road building materials would be avoided. In addition, a 100-foot wide forested buffer would be maintained around these talus fields. Harvest would be permitted in the buffer but only where 60 percent canopy cover could be retained, which is anticipated to adequately maintain the microclimate regimes within the buffered talus. In the forested talus outside of the buffer, no more than 33 percent of the volume would be harvested. These measures would adequately protect the integrity of the talus fields where Larch Mountain salamanders are known to occur. Under this alternative, cave entrances would be protected by a 250-foot no-harvest buffer which would maintain the microclimate near entrances, where these salamanders are known to occur, and by keeping cave locations confidential. This protection is substantially greater than Alternative A because of the specific conservation measures directed to special habitat types known to be used by Larch Mountain salamanders.

ALTERNATIVE C

Some talus slopes in older forests may be encompassed and protected within the proposed riparian management zones, which overall would be substantially wider than the riparian management zones under the No Action alternative, and are guaranteed. Under this alternative, forested and nonforested wetlands would have the same buffers as Alternative B, which may protect some large woody debris and, when adjacent to talus fields, would provide more protection of Larch Mountain salamander habitat. Owl NRF habitat maintained or developed in the Klickitat and Columbia planning units, would be greater than Alternative B and, thus, Alternative A, with the same benefits. The protection provided for uncommon habitat types in Alternative C is the same as in Alternative B. Therefore, protection of Larch Mountain salamander habitat under this alternative would be slightly greater than Alternative B because of the additional riparian protection that may include some additional talus fields, and substantially better than under the No Action alternative.

The Larch Mountain salamander is not known to occur in the OESF. Thus, an assessment of the OESF No Action and action alternatives is unnecessary.

Dunn's Salamander (*Plethodon dunni*), **Van Dyke's Salamander** (*Plethodon vandykei*), **and the Tailed Frog** (*Ascaphus truei*)

Dunn's and Van Dyke's salamanders are candidates for listing by the state (WDFW 1995b). The tailed frog (*Ascaphus truei*) is currently a species of concern to the U.S. Fish and Wildlife Service and a state monitored species (WDW 1993a; 61 Fed. Reg. 7457 (1996); USFWS 1996) These species utilize similar habitats for breeding, foraging, and resting. Thus, for purposes of this assessment, the effects of the alternatives on these species have been combined.

Dunn's Salamander

Dunn's salamander is found in southwestern Washington, western Oregon, and the extreme northwestern corner of California. In Washington, the species is found only in the Willapa Hills (Leonard et al. 1993). Dunn's salamanders are usually associated with seepages or streams located in heavily shaded areas (Rodrick and Milner 1991). They are considered to be a highly aquatic species of woodland salamander (Leonard et al. 1993). The species is located in the splash zone of creeks typically under rocks and occasionally under woody debris (Leonard et al. 1993). It has also been found in talus where there is high humidity (Leonard et al. 1993). The principal management recommendation of Rodrick and Milner (1991) is the maintenance of riparian corridors along all stream types, but especially Type 4 and 5 Waters. Additional recommendations exist for wet talus where the species is known to occur.

Van Dyke's Salamander

Van Dyke's salamander is endemic to Washington (Leonard et al. 1993). Approximately half of its known geographical distribution occurs on the Olympic Peninsula. It is considered at risk due to its limited distribution and the isolation of its disjunct populations. Van Dyke's salamanders are usually associated with seepages or streams located in mature and old-growth coniferous forests (Rodrick and Milner 1991). They are considered to be the most aquatic species of woodland salamanders (Leonard et al. 1993). The species is typically located in the splash zone of creeks under rocks, logs, and woody debris (Leonard et al. 1993). It has also been found in wet talus, forest litter, and lava tubes (Rodrick and Milner 1991). The principal management recommendation of Rodrick and Milner (1991) is the maintenance of riparian corridors along all stream types, but especially Type 4 and 5 Waters. Additional recommendations exist for wet talus where the species is known to occur.

Tailed Frog

Tailed frogs are found throughout the west-side HCP planning units including specimens collected from several sites on the Olympic Peninsula (Nussbaum et al. 1983). Tailed frogs occur in or near fast-flowing, permanent streams within forested areas. The species prefers cold temperature waters and has a narrow range of temperature tolerance. Adults forage along stream edges or from the surface of exposed rocks or downed logs, and

during wet nights in the adjacent forest (Nussbaum et al. 1983). Tailed frogs are the only genus of anurans in North America that is adapted for life in cold fast-flowing mountain streams (Nussbaum et al. 1983). The species shows a preference for older forests. Welsh (1990) found that at low elevation sites (less than 3,280 feet) tailed frog density was correlated with forest age, and Carey (1989) found that tailed frogs were closely associated with old-growth forests.

ALTERNATIVE A

Current management of the riparian ecosystem on DNR-managed lands is expected to provide some protection of suitable habitat for the Dunn's and Van Dyke's salamanders, and the tailed frog. This protection would be provided primarily by the establishment of wetland buffers, and riparian management zones on all identifiable Type 1 through 5 Waters. Since 1992, no timber management activity has occurred in 77 percent of the riparian management zones established on Type 1 through 5 Waters. Riparian management zones on smaller headwater streams used by these three species have averaged 52 feet on Type 4 Waters, and 40 feet on Type 5 Waters that have received protection; 53 percent of Type 5 Waters have received no riparian management zones. On the Olympic Peninsula, no-harvest riparian management zones on Type 4 and 5 Waters have averaged 96 and 105 feet, respectively. These riparian management zones, although not guaranteed, provide some protection of the breeding, foraging and resting habitat of these amphibian species. In addition, protection is provided through the identification of, and prohibition of timber harvest on, unstable slopes, and through protection of salmonid spawning, rearing, and overwintering areas identified by an analysis of watersheds during landscape planning (WFPB 1995b). Alternative A contains no provisions for protection of talus which likely results in negative impacts to Dunn's and Van Dyke's salamanders, when wet talus areas incur some harvest.

ALTERNATIVE B

The riparian conservation strategy under Alternative B should adequately protect the breeding, foraging, and resting habitats of Dunn's and Van Dyke's salamanders and the tailed frog. Riparian buffers would be established as described in DEIS Chapter 2 and draft HCP Chapter IV. This protection includes 100-foot buffers on Type 4 streams where these species are known to occur. Based on current No Action activities and the protection of steep and unstable slopes of this alternative, it is anticipated that greater than 50 percent of Type 5 streams will be protected by restrictions on management activities near these streams. Riparian buffers would include a 25-foot no-harvest zone likely protecting stream splash zones occupied by Dunn's and Van Dyke's salamander. Management activities within the riparian buffers would be stratified according to the constraints imposed by the no-harvest, minimal-harvest, and low-harvest areas. Under the management anticipated to occur in the no-harvest and minimal-harvest areas, forests with mature or old-growth characteristics are expected to develop. The riparian buffer is thought to be sufficient for maintaining the key components of salmonid habitat: stream bank integrity, stream shading, sediment load, detrital nutrient load, and large woody debris, and thus the habitat of many amphibians such as Van Dyke's salamander and the tailed frog. Under Alternative B, the ecological integrity of the riparian buffers would be protected by an additional wind buffer on Type 1, 2, and 3 Waters on the windward side of the stream where there is a moderate potential for windthrow. Additional protection of aquatic habitat would occur through road network management that minimizes adverse

impacts to salmonid habitat. The Dunn's and Van Dyke's salamanders are occasionally found in talus (Rodrick and Milner 1991). Talus fields that are greater than or equal to 1 acre in size throughout the HCP area, and greater than or equal to 0.25 acre in the Columbia Planning Unit, would be protected as described in draft HCP Chapter IV, Section F and Appendix 3, Chapter IV, Section F, in this document. Van Dyke's salamander may be found in seeps within old-growth forests. Some of this habitat would be protected as a result of the designated owl NRF areas on DNR-managed lands, the WMZs around forested wetlands, and riparian management zones in unstable slope areas. The protection provided under Alternative B would be greater than under the No Action alternative because of the larger riparian and wetland buffers that are guaranteed, the no-harvest provision of the buffers, and the talus field protection.

ALTERNATIVE C

The riparian conservation strategy under Alternative C should adequately protect the breeding, foraging, and resting habitats of Dunn's and Van Dyke's salamanders and the tailed frog. Riparian buffers would be established as described in DEIS Chapter 2, which would be greater than those under Alternative B. This would increase the likelihood that some of the habitat upon which these species rely would be protected. Wetlands and talus field protection would be the same as under Alternative B, thus providing the same benefits as described above. The protection provided under Alternative C would be substantially greater than under the No Action alternative because of the larger riparian and wetland buffers that are guaranteed, especially on Type 4 and 5 Waters, the additional wind buffers, the no-harvest provision of the riparian management zone and WMZ buffers, and the talus field protection.

OESF ALTERNATIVE 1

Current management of the riparian ecosystem on the OESF would provide at least some protection of breeding, foraging, and resting habitat of Van Dyke's salamander and the tailed frog. The Olympic Region of DNR currently places mass-wasting buffers along streams that in the recent past have averaged 96 and 105 feet for Type 4 and 5 Waters, respectively. No timber removal or timber management activity occurs within these buffers or in areas identified as unstable. An additional layer of protection for habitat required by these species is assured through the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). Alternative 1 contains no provisions for protection of talus which likely would result in negative impacts to Dunn's and Van Dyke's salamanders, when wet talus areas incur some harvest.

OESF ACTION ALTERNATIVES

Management of the riparian ecosystem on the OESF would be the same under both action alternatives, which is similar to Alternative C. This strategy would be expected to provide substantial protection of breeding, foraging, and resting habitat of Van Dyke's salamander and the tailed frog. Ecosystem protection under these alternatives are intended to be derived largely from management directed at maintaining and restoring riparian ecosystem function as well as older forest conditions across much of the managed uplands which would be expected to benefit other aquatic species. The protection measures for talus fields described under Alternatives B and C above would also be implemented under both action alternatives on the OESF. Thus, the OESF action

alternatives would likely provide greater conservation benefits to these amphibians than the OESF No Action alternative.

Northern Red-legged Frog (*Rana aurora aurora*), **Cascades Frog** (*Rana cascadae*), **and Spotted Frog** (*Rana pretiosa*)

The northern red-legged frog, Cascades frog, and the spotted frog are known to breed in nonforested wetlands and to forage and rest in these habitats as well as in other riparian areas in forested ecosystems. Thus, for the purposes of this assessment, breeding, foraging, and resting habitats are considered to include both wetlands and riparian areas in forested ecosystems. Since their habitats are similar, discussions of the effects of the alternatives on these species have been combined.

Northern Red-legged Frog

Red-legged frogs inhabit moist and riparian forests, usually below 2,790 feet in elevation in the Pacific Northwest (Nussbaum et al. 1983; Stebbins 1985). This species is generally found near permanent water, including small ponds, quiet pools along streams, reservoirs, springs, lakes and marshes (Gordon 1939; Stebbins 1954, 1985; Nussbaum et al. 1983). Although Stebbins (1954) describes red-legged frogs as being "highly aquatic," individuals may be found in forests at considerable distances from water (Gordon 1939; Stebbins 1954; Nussbaum et al. 1983). Breeding habitats for this species vary greatly; red-legged frogs may breed in small temporary ponds, relatively large lakes, in potholes, in overflows of lakes and rivers, or in slow-moving portions of rivers (Storm 1960; Licht 1969, 1971; Calef 1973; Brown 1975; Nussbaum et al. 1983). Foraging and resting habitats occur in the same habitats as breeding, as well as in wet meadows, seeps, and hardwood shrub wetlands (Brown 1985). Although not restricted to old-growth habitat, the red-legged frog is frequently found in old-growth stands (Bury and Corn 1988). In southern Washington, Aubry and Hall (1991) found that this species was most abundant in mature stands and least abundant in young stands.

Cascades Frog

This frog is a montane species found in the Olympic Mountains of Washington, and in the Cascade mountains of Oregon, Washington and northern California (Nussbaum et al. 1983). The extent of the Cascades frog's distribution in the OESF Planning Unit is uncertain. Cascades frogs generally occur above 2,625 feet in elevation in montane meadows. This species is generally found in relatively small bodies of water rather than in large lakes (Sype 1975; O'Hara 1981; Nussbaum et al. 1983). Frequently used habitats include relatively small, unvegetated potholes and marsh-like areas that are overflows of larger lakes (O'Hara 1981). Occasionally, Cascades frogs are found in forests away from water (Nussbaum et al. 1983). Breeding habitat for Cascades frogs in the central Cascade mountains of Oregon include shallow, gently sloping margins of the shore or overflow areas, generally over soft substrates and protected from severe wave action (O'Hara 1981). In the larger ponds in which they are found, Cascades frog tadpoles prefer relatively warm, shallow water close to the shoreline with abundant vegetation (O'Hara 1981). Foraging and resting habitat occurs in the above described riparian/wetland habitats of high-elevation coniferous and subalpine forests (Brown 1985).

Spotted Frog

Although historically occurring throughout the western Cascades and Puget Sound trough, current populations of spotted frogs are extremely rare west of the Cascade mountains in Washington (McAllister and Leonard 1990). Spotted frogs are highly aquatic, using marshy ponds, streams, and lakes as high as 9,842 feet in parts of their range (Stebbins 1954, 1985; Nussbaum et al. 1983). Spotted frogs are found in numerous habitat types, including those dominated by Douglas-fir and ponderosa pine, and semi-arid to arid sites dominated by sagebrush (Stebbins 1954, 1985). Stebbins (1985) suggests that this species is more common in relatively cold water habitats than in warm, stagnant ponds. In Washington, WDFW (1994a) reports that courtship and breeding habitat includes warm, shallow margins of ponds or rivers, or in temporary ponds. Foraging and resting habitats include the same habitats as breeding, as well as early seral stages of coniferous forests along riparian/wetland habitats (Brown 1985).

ALTERNATIVE A

Current management of the riparian ecosystem on DNR-managed lands is expected to provide at least some protection of suitable breeding, foraging, and resting habitats for the northern red-legged frog, Cascades frog, and spotted frog. Because breeding, foraging, and resting habitats for each of these frog species includes palustrine wetlands such as small ponds, bogs and forested swamps (i.e., vegetated and non-vegetated wetlands), and to some extent Type 2 and 3 Waters, the primary source of protection provided under the No Action alternative is through the establishment of, and restriction of timber management activities within, WMZs and riparian management zones on all identifiable Type 1 through 5 Waters. The average width of WMZs on nonforested wetlands, established according to DNR's FRP policies, has averaged 86 feet in the recent past. Riparian management zones on Type 2 Waters have averaged 196 feet, while riparian management zones on Type 3 Waters have averaged 89 feet. Although in recent years no timber harvest activities have occurred in 77 percent of the riparian management zones established on Type 1 through 5 Waters, some of these Waters have received no riparian management zone. Additional protection of the habitats for these species would also be provided through the prohibition of timber harvest on unstable slopes, and through the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). Impacts to these species under Alternative A would likely be as a result of management activity in the riparian management zones and WMZs, and, specifically for the red-legged frog, timber removal in mature stands.

ALTERNATIVE B

Management of the riparian ecosystem under Alternative B is expected to provide adequate protection of the breeding, foraging, and resting habitats for the northern red-legged frog, Cascades frog, and spotted frog. Specific benefits of this alternative include the establishment of riparian management zones on Type 1 through 4 Waters as described in DEIS Chapter 2 and draft HCP Chapter IV. The prohibition of harvest within a 25-foot no-harvest area within each zone established, and the constraint on activities within the remainder of the zone to those that are expected to maintain or restore the quality of salmonid habitat, and thus, habitat likely to be inhabited by the red-legged frog. Riparian buffers combined with wind buffers on the windward side where there is a moderate potential for windthrow would increase riparian protection. This protection would

contribute to the maintenance of the integrity of slow-moving streams, backwater eddies, and adjacent forest stands in which these species occur. Wetland buffers would be at least 100 feet on wetlands greater than or equal to 0.25 acre in size with management restrictions that include some basal area maintenance, preclusion of ground-based equipment, and on-site mitigation for road building. This protection is greater than that provided under the No Action alternative because of the guaranteed no-harvest restriction, wider buffers on Type 3 and 4 Waters, wider wetlands buffers, and management that must maintain or restore salmonid habitat.

ALTERNATIVE C

Management of the riparian ecosystem under Alternative C is expected to provide substantial protection of the breeding, foraging, and resting habitats for the northern red-legged frog, Cascades frog, and spotted frog. Specific benefits of this alternative include the establishment of riparian management zones on Type 1 through 4 Waters as described in DEIS Chapter 2 and draft HCP Chapter IV. Additional wind buffers of 100 feet would be established on each side of Type 1 and 2 Waters. Each side of a Type 3 Water greater than 5 feet wide would have a 50-foot wind buffer. In addition to the wetlands protection provided under Alternative B, bogs greater than or equal to 0.1 acre would receive 100-foot buffers, and nonforested wetlands would have a 50-foot no-harvest zone. This protection is substantially greater than that provided under the No Action alternative because of the wider buffers on Type 3, 4, and 5 Waters, additional wind buffers, the wider wetlands buffers, guaranteed no-harvest restrictions in riparian management zones and WMZs, and management that must restore or enhance salmonid habitat.

OESF ALTERNATIVE 1

Current management of the riparian ecosystem on the OESF would provide at least some protection of breeding, foraging, and resting habitat of the northern red-legged frog and Cascades frog. The spotted frog is not found in the OESF. The Olympic Region of DNR currently places mass-wasting buffers along streams that in the recent past have averaged 96 and 105 feet for Type 4 and 5 Waters, respectively. No timber removal or timber management activity occurs within these buffers or in areas identified as unstable. Wetland management zones will be similar to the HCP No Action alternative, averaging approximately 86 feet. An additional layer of protection for habitat required by these species is assured through the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b).

OESF ACTION ALTERNATIVES

Management of the riparian ecosystem on the OESF would be the same under all action alternatives, which is similar to Alternative C, and described in DEIS Chapter 2 and draft HCP Chapter IV. The strategy of providing, on average, 100-foot interior-core buffers on Type 3 and 4 Waters, and exterior buffers would be expected to provide substantial protection of breeding, foraging, and resting habitat of the northern red-legged frog and Cascades frog. Wetlands buffers on nonforested wetlands would prohibit harvest within 50 feet of the wetland's edge, which should contribute to the maintenance of the wetland integrity. Ecosystem protection under these alternatives are intended to be derived largely from management directed at maintaining and restoring riparian ecosystem function as well as older forest conditions across much of the managed uplands which would be

expected to benefit other aquatic species. This protection is substantially greater than that provided under OESF Alternative 1 because of the wider buffers on Type 3, 4, and 5 Waters, additional wind buffers, the wider wetlands buffers, guaranteed no-harvest restrictions in riparian management zones and WMZs, and management for salmonid habitat.

Northwestern Pond Turtle *(Clemmys marmorata marmorata)*

Records in Washington indicate that the occurrences of the northwestern pond turtle appear to be clustered around the southeastern edge of Puget Sound and along a small portion of the Columbia River (Nussbaum et al. 1983; WDW 1993f). Populations are confirmed only in Klickitat and Skamania Counties, with recent individual sightings of northwestern pond turtles in Pierce, King, and Kitsap Counties (WDW 1993f). Historical records also exist in Clark and Thurston Counties (WDW 1993f). The northwestern pond turtle inhabits marshes, sloughs, moderately deep ponds, and slow-moving portions of creeks and rivers. Foraging habitat occurs in these same habitats (Brown 1985). Their resting habitat includes emergent basking sites, such as partially submerged logs, vegetation mats, rocks, and mud banks (Nussbaum et al. 1983; J. Beatty, Oregon State University, Corvallis, pers. commun., 1995). Pond turtles hibernate in the bottom mud of streams or ponds, or on land up to 1375 feet (500 meters) from water (Ernst and Barbour 1972; Holland 1989; Slavens 1992). The breeding habitat is most often located near the margin of a pond or stream, but pond turtles have been found hundreds of meters from water (Stebbins 1954; Nussbaum et al. 1983) and utilize meadows as well as young seral stages of most forest types including hardwoods, mixed hardwoods, and coniferous forests.

ALTERNATIVE A

Since the northwestern pond turtle is listed by the state as an endangered species, critical wildlife habitat has been designated for this species and is protected under each of the proposed alternatives by the Washington Forest Practices Rules (WFPB 1995c). As described in WAC 222-16-080, no "harvesting, road construction, aerial application of pesticides, or site preparation within 0.25 mile of a known individual occurrence, documented by the department of wildlife" is allowed. Thus, management under the No Action alternative is expected to provide substantial protection of known northwestern pond turtle breeding, foraging, and resting habitat. Protection of unknown turtle habitat, which would likely occur in riparian and wetland areas, would likely be provided under current DNR policy. Buffers on riparian management zones and WMZs (DEIS Chapter 2), when established, have been, on average, sufficient to maintain the integrity of riparian and wetland ecosystems. However, these buffers are not guaranteed, and the policy could change to provide less protection in the future.

HCP ALTERNATIVES

In addition to the protection provided by the Washington Forest Practices Rules, protection of essential northwestern pond turtle habitat where turtles have not been observed would be guaranteed through the protection of wetlands and riparian areas as described under each of the HCP alternatives. Protection of some potential pond turtle habitat would be provided by a 25-foot no-harvest area within each riparian management zone established, and the constraint on activities within the remainder of the zone to those

that are expected to restore or enhance the quality of salmonid habitat. Thus, aquatic species such as the northwestern pond turtle would benefit from the conservation measures developed in these alternatives for the protection of salmonids. Wetland buffers would be at least 100 feet for wetlands greater than or equal to 0.25 acre in size. Alternative C would add a no-harvest zone within 50 feet of the wetland's edge, and bogs greater than or equal to 0.1 acre would be protected with a 100-foot buffer. Although these alternatives do not provide any additional specific protection of known occurrences of the northwestern pond turtle to that afforded under the No Action alternative, they provide greater protection of riparian and wetland zones. The wetlands buffers would be a source for providing greater amounts of LWD than under the No Action alternative, which would contribute loafing sites for turtles in and around the wetlands. This wetlands protection, unlike the No Action alternative, is guaranteed and would protect areas that may be inhabited by northwestern pond turtle yet to be discovered.

OESF Alternative 1 and Action Alternatives

The northwestern pond turtle is not expected to occur in the OESF. Thus, an assessment of the OESF No Action alternative and action alternatives is unnecessary.

California Mountain Kingsnake (*Lampropeltis zonata*)

The California mountain kingsnake specimens have been collected in Skamania and western Klickitat Counties from sites near the Columbia River Gorge (Nussbaum et al. 1983). California mountain kingsnakes occur in oak and pine forests and on chaparral up to 9,000 feet in elevation (Nussbaum et al. 1983). Their breeding, foraging, and resting habitat occurs primarily in early to mid-seral stage forests (Brown 1985). They may be found under and inside rotting logs and sometimes under rocks (Nussbaum et al. 1983).

Alternative A

At present, management activities in DNR-managed forests do not include harvest of oak woodlands. Where these woodlands provide habitat for the California mountain kingsnake, the habitat would be retained as a consequence of this policy. It is not guaranteed. Timber management activities are conducted in Douglas-fir/ponderosa pine forests characteristic of east-side owl habitat, which may contain habitat for the California mountain kingsnake. Since there are no specific provisions in the Washington Forest Practices Rules or DNR's FRP policies for protection of this species of snake, harvest activities in these east-side forests may impact this species. However, habitat may also develop as a result of normal timber management activities which create early to mid-seral-stage forests.

Alternative B

The riparian conservation strategy under this alternative would provide some guaranteed protection of the breeding, foraging, and resting habitat of the California mountain kingsnake. No harvest would occur on hillslopes with a high risk of mass wasting, and some oak forests would exist within or immediately below unstable areas. The riparian management zones along Type 1, 2, 3, and 4 Waters may also encompass some oak forest. This alternative has a special provision to protect Oregon white oak woodlands and some ponderosa pine stands where white oak is a significant component (draft HCP Chapter IV). Protection measures include retention of large dominant oaks and

maintenance of 25-50 percent canopy cover in Oregon white oak woodlands. These forests occur in the Columbia Gorge, and the east slope of the southern Washington Cascades. Protecting these forests would also ensure that California mountain kingsnake habitat would be protected. This protection would be greater than that provided under Alternative A.

ALTERNATIVE C

The riparian conservation strategy under this alternative is expected to provide guaranteed protection of the breeding, foraging, and resting habitat of the California mountain kingsnake. No harvest would occur on hillslopes with a high risk of mass wasting, and some oak forests would exist within or immediately below unstable areas. The riparian management zones along Type 1, 2, 3, and 4 Waters may also encompass some oak forest. This alternative contains the same provision to protect Oregon white oak woodlands as Alternative B, and thus the same protection to the California mountain kingsnake, which would be greater than that provided under Alternative A.

OESF ALTERNATIVE 1 AND ACTION ALTERNATIVES

The California mountain kingsnake is not expected to occur in the OESF. Thus, an assessment of the OESF No Action alternative and action alternatives is unnecessary.

Birds

Twenty priority species of birds may occur in the HCP planning area. Thirteen of these are species of concern to the U.S. Fish and Wildlife Service or state candidates for listing. One species, the Sandhill crane, is listed as endangered by the state. The band-tailed pigeon and five species of cavity-nesting ducks are considered game species by the state, however, there is concern for these species because of their need for special habitats such as mineral springs or suitable cavity trees/snags. The habitat requirements of, and assessment of the effects of the alternatives on, these species are presented below.

Common Loon (*Gavia immer*)

The common loon is known to breed at only a few locations in western Washington (Rodrick and Milner 1991), and it winters along the Pacific coast. Declines in common loon populations have been attributed to the loss of nesting habitat (Erhlich et al. 1988). Common loons breed on large wooded lakes with dense populations of fish (Rodrick and Milner 1991). Nests are built on the ground within 5 feet of the water's edge (Rodrick and Milner 1991). Nest sites may be reused in successive years.

ALTERNATIVE A

Current FRP policy for protection of forested and nonforested wetlands is directed at maintaining "no net loss of acreage or function." Management activities in the recent past have resulted in WMZs averaging 86 feet in width on nonforested wetlands, which is adequate to protect loon nesting habitat at the water's edge. Although this protection is not guaranteed, it is anticipated this policy will continue. Protection for forested wetlands is limited to restricting ground disturbance, and leaving a minimum basal area in trees. The impacts of this management activity are unknown.

ALTERNATIVE B

The wetlands protection strategy, under Alternative B, is expected to protect the lake habitat utilized by the common loon. Buffers along the shoreline of nonforested wetlands greater than or equal to 0.25 acre in size would be at least 100 feet wide (DEIS Chapter 2 and draft HCP Chapter IV) would be sufficient to protect potential loon nesting habitat. The adverse impacts of human disturbance could possibly be minimized by the blocking effect of the wetland buffers. In addition, to reduce the adverse effects of human disturbance, DNR would not allow activities within 500 feet of a known active nest that would appreciably reduce the likelihood of nesting success between April 1 and September 1. This protection is greater than the No Action alternative because of the wider guaranteed wetland buffers, and the seasonal nest site protection.

ALTERNATIVE C

Under Alternative C, wetland buffers would receive the same protection as described in Alternative B (DEIS Chapter 2, draft HCP Chapter IV) with an additional provision prohibiting harvest within 50 feet of the wetland's edge. The same seasonal nest site protection as that provided in Alternative B would also be implemented. This protection is greater than the No Action alternative because of the wider guaranteed wetland buffers, the no-harvest area, and the seasonal nest site protection.

OESF ALTERNATIVE 1 AND ACTION ALTERNATIVES

The common loon is not known to breed in the OESF. Thus, an assessment of the OESF No Action and action alternatives was not conducted.

Harlequin Duck (*Histrionicus histrionicus*)

Harlequin ducks breed almost exclusively along fast-flowing mountain streams throughout the Cascade, Olympic, and Selkirk mountains in Washington (Bellrose 1976; Brown 1985; WDFW 1994a; Harlequin Duck Working Group 1993). Nests are typically located close to clear streams with rocky substrates and rapids (Harlequin Duck Working Group 1993). Nests may be on the ground in dense vegetation, piles of woody debris, undercut stream banks, between rocks, or in hollow trees (Harlequin Duck Working Group 1993). Bank vegetation near nest sites is highly variable, but the species is thought to show a preference for mature or old-growth forest in the Pacific Northwest (Harlequin Duck Working Group 1993; Rodrick and Milner 1991). Foraging habitat for the harlequin duck includes fast-moving streams where they feed primarily on benthic macroinvertebrates and roe (Harlequin Duck Working Group 1993). Resting habitat is generally described as mid-stream loafing sites (Rodrick and Milner 1991) such as gravel bars or large woody debris. Wintering habitat typically includes saltwater habitats within 140 feet (50 meters) of the shore and most of the Puget Sound (Gaines and Fitzner 1987; Wahl and Paulson 1991; WDFW 1994a). Human disturbance greatly affects this species, therefore, WDFW (1994a) recommends that roads and trails should be located farther than 165 feet from streams used by harlequin ducks.

ALTERNATIVE A

Current management of the riparian ecosystem on DNR-managed lands according to DNR's FRP policies is expected to provide at least some protection of breeding, foraging and resting habitats for the harlequin duck. This protection would be provided primarily by the establishment and protection of riparian management zones on all identifiable

Type 1 through 5 Waters, within which no management activity has occurred in 77 percent of the riparian management zones in the recent past. Buffers along Type 1 and 2 Waters have averaged 196 feet, and buffers on Type 3 Waters have averaged 89 feet. The riparian management zones of these widths would likely function as a source of in-stream large woody debris for loafing, as well as protect potential nest sites for harlequin ducks, and would be expected to continue. However, this level of riparian protection is not guaranteed. Additional protection is provided through the identification of, and restriction of timber harvest on, unstable slopes, and through protection of salmonid spawning, rearing, and overwintering areas as identified by an analysis of watersheds during landscape planning (WFPB 1995b). No specific provisions are currently being implemented to protect known nest sites from human disturbance.

ALTERNATIVE B

The management designed for protection of the riparian ecosystem under Alternative B would provide adequate protection of the breeding, foraging and resting habitats for the harlequin duck on DNR-managed lands. Specific benefits of this alternative considered important to this species include the establishment and protection of riparian management zones on all identifiable Type 1 through 4 Waters (draft HCP Chapter IV). Additional protection for this species is provided by the prohibition of harvest within a 25-foot no-harvest area within each riparian management zone established and the constraint on activities within the remainder of the zone to those that are expected to maintain and restore the quality of salmonid habitat, which may contribute to nest protection. The ecological integrity of the riparian buffer, and the duck habitat contained therein, would be protected by wind buffers along some streams where there is at least a moderate potential for windthrow as described in draft HCP Chapter IV. Aquatic habitats would also be maintained by the protection of unstable slopes from mass-wasting events, and the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). The adverse impacts of human disturbance would be minimized by the riparian buffer which is estimated to have an average width of 150 to 160 feet. Human disturbance would be further reduced by the wind buffer which would be placed along many reaches of Type 1, 2, and 3 Waters. DNR would not allow any activities within 165 feet of a known active harlequin duck nest, between May 1 and September 1, that may cause an appreciable reduction in the likelihood of nesting success. However, no provisions are made to restrict trail construction which could potentially affect unknown nesting harlequin ducks. These protection measures are greater than that provided under the No Action alternative because the riparian management zones are guaranteed, the zones are wider than the current condition and include a no-harvest provision, and some effort would be made to minimize human disturbance to known active nests.

ALTERNATIVE C

The management designed for protection of the riparian ecosystem under Alternative C would provide substantial protection of the breeding, foraging and resting habitats for the harlequin duck on DNR-managed lands. Specific benefits of this alternative that would provide guaranteed protection of aquatic habitats include the establishment and protection of riparian management zones on all identifiable Type 1 through 5 Waters (DEIS Chapter 2). Additional protection for this species is provided by the prohibition of harvest within a 25-foot no-harvest area within each riparian management zone established, and the

constraint on activities within the remainder of the zones to those that are expected to restore or enhance the quality of salmonid habitat. The ecological integrity of the riparian buffer, and the duck habitat contained therein, would be protected by additional 100-foot wind buffers on each side of Type 1 and 2 Waters and 50-foot wind buffers on Type 3 Waters. Aquatic habitats would also be maintained by the protection of unstable slopes from mass-wasting events, and the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). These provisions would ensure a continuous source of LWD, and potential nest sites. The adverse impacts of human disturbance would be minimized as described in Alternative B above. Human disturbance would be further reduced by the wind buffers along many reaches of Type 1, 2, and 3 Waters. However, no provisions are made to restrict trail construction which could potentially affect unknown nesting harlequin ducks. These protection measures are greater than that provided under the No Action alternative because the riparian management zones are guaranteed, the zones are wider than the current condition and include a no-harvest provision, and some effort would be made to minimize human disturbance to known active nests.

OESF Alternative 1

Current management of the riparian ecosystem on the OESF would provide at least some protection of breeding, foraging, and resting habitat of the harlequin duck. The Olympic Region of DNR currently places mass-wasting buffers along streams that in the recent past have averaged approximately 145 and 135 feet for Type 1 and 2 Waters, respectively. Buffers on Type 3 and 4 Waters will be about 95 feet in width. No timber removal or timber management activity occurs within these buffers or in areas identified as unstable. An additional layer of protection for habitat required by this species is assured through the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b).

OESF Action Alternatives

Management of the riparian ecosystem on the OESF would be the same under all action alternatives. Specific protection of habitat required by this species would occur primarily from the establishment of, and restriction of timber harvest activities in, mass-wasting buffers (including unstable slope areas) along all identifiable streams, and through the protection of salmonid spawning, rearing, and overwintering areas as identified through an analysis of watersheds during landscape planning (WFPB 1995b). Riparian management zones on Type 1 and 2 Waters would average 300 feet; Type 3 Waters would average 250 feet (DEIS Chapter 2, draft HCP Chapter IV). This strategy would be expected to provide substantial protection of breeding, foraging, and resting habitat of the harlequin duck. Ecosystem protection under these alternatives are intended to be derived largely from management directed at maintaining and restoring riparian ecosystem function as well as older forest conditions across much of the managed uplands which would be expected to benefit other aquatic species. However, the nest protection provision described in Alternatives B and C above would not be implemented under either OESF action alternative because, presumably, the riparian protection would be adequate to protect harlequin duck nests. This protection is greater than the OESF No Action alternative because of the guaranteed wider riparian management zones, and restricted-harvest buffers.

Barrow's Goldeneye (*Bucephala islandica*), **Bufflehead** (*Bucephala albeola*), **Common Goldeneye** (*Bucephala clangula*), **Hooded Merganser** (*Lophodytes cucullatus*), **and Wood Duck** (*Aix sponsa*)

Cavity-nesting ducks are found throughout Washington and are considered game birds by the state. These ducks generally nest in large trees near low-gradient rivers, lakes, ponds, and sloughs (Rodrick and Milner 1991). Although hunted, these species are of concern because of their need for suitable cavity trees/snags near, generally within 200 meters (550 feet) of foraging and brooding habitat. Conservation efforts that provide substantial riparian and wetland buffers with sufficient cavity tree and snag compliments should benefit cavity-nesting ducks; these measures will also protect water quality in foraging and brooding habitats.

ALTERNATIVE A

Current management activities under Alternative A would provide no-harvest riparian buffers averaging 196 feet wide (range = 0-350 feet) on each side of Type 1 and 2 Waters, 89 feet wide (range = 0-300 feet) on Type 3 Waters, and 52 feet wide (range = 0-300 feet) on Type 4 Waters. These would likely provide suitable nesting habitat where forests, cavity trees, and snags are present. Regrowth of forests in portions of buffers where forests, snags, and cavity trees are lacking may also provide some support to cavity-nesting ducks, when trees reach a sufficient size and condition for primary excavators to create cavities. Forested wetland buffers will be harvestable, with a requirement to retain at least 120 square feet of basal area per acre in wind-firm trees, which may provide potential snags and cavity trees in the future.

Washington Forest Practices Rules requiring three wildlife reserve trees and two green recruitment trees may also provide potential cavity trees for use by cavity-nesting ducks when located near riparian and wetland buffers.

ALTERNATIVE B

Under this alternative, riparian management zones at least 100 feet wide would be established on Type 1 through 3 Waters, the inner-most portion of which would be a 25-foot wide no-harvest zone. Wind buffers 100 feet wide would be added to the windward side of Type 1 and 2 Waters; 50 feet wide on some Type 3 Waters (draft HCP Chapter IV). Forested wetlands would be at least 100 feet on wetlands greater than or equal to 0.25 acre. Implementation of this alternative could result in a reduction in habitat, in riparian areas adjacent to Type 1 through 3 Waters, from Alternative A because it provides smaller buffers that may be harvested. However, riparian buffers established under Alternative B would be guaranteed. Buffers established under Alternative A may be changed to something less in the future. Under this alternative, wetland buffers would be slightly larger than under Alternative A, but they would likely incur some management. Harvests in riparian and wetland buffers would probably reduce the number of suitable cavities for nesting, however the 25-foot no-harvest and minimal-harvest zones would ensure that some cavity trees near stream banks would be retained. Openings created by some harvest entries may, however, provide plant foods for species like the wood duck. Wind buffers, where designated, may provide additional area to buffers which could reduce disturbance and provide additional cavities for cavity-nesting ducks. The provision to retain three snags and five green trees per acre, as well as the provision to retain large, unique wildlife trees, would also provide potential cavity trees

for use by cavity-nesting ducks when located near riparian buffers. Overall, Alternative B would be more beneficial in the long term than Alternative A because of the assurance of establishing no-harvest and minimal-harvest riparian and wetland buffers of a guaranteed width, and the provision to protect snags and provide green trees with the potential to become future cavity trees.

ALTERNATIVE C

Under this alternative, riparian and wetland management zones would be similar to Alternative B, except that wind buffers would be added to each side of the Type 1 through 3 Waters, and wetland buffers would have a 50 foot no-harvest area (DEIS Chapter 2). The addition of wind buffers would widen the riparian protection, compared to Alternative B, and only restoration activities would be permitted. Harvests in riparian and wetland buffers would probably reduce the number of suitable cavities for nesting, however, the 50-foot no-harvest provision for wetlands, and the 25-foot no-harvest and minimal-harvest zones in the riparian buffer would ensure that some cavity trees near wetlands and stream banks would be retained. Openings created by some harvest entries may provide plant foods for species like the wood duck. Wind buffers, where designated, may provide additional area to buffers which could reduce disturbance and provide additional cavities for cavity-nesting ducks. The provision to retain three snags and five green trees per acre, as well as the provision to retain large, unique wildlife trees would also provide potential cavity trees for use by cavity-nesting ducks when located near riparian buffers. Under Alternative C, the larger and less disturbed riparian buffers and the no-harvest portion of the wetland buffers may increase nesting habitat suitability by providing more suitable cavity trees and snags adjacent to foraging and brooding areas, and reducing the probability of disturbance from human activities.

OESF ALTERNATIVE 1

Under this alternative, riparian buffers average approximately 145, 135 and 95 feet on Type 1, 2, and 3 Waters, respectively. Wetlands protection is implemented according to DNR's FRP policies that require "no net loss of acreage or function." Wetland buffers have averaged 85 feet in width. Harvests occur according to FRP policy that allows timber removal only when adequate protection can be provided to fish and other nontimber resources.

OESF ACTION ALTERNATIVES

These alternatives have provisions that establish interior-core buffers averaging 150 feet on Type 1 and 2 Waters, and averaging 100 feet on Type 3 Waters. Exterior buffers (wind buffers) would be expected to average 150 feet on Type 1 through 3 Waters. Forested wetland buffers would be the same as under Alternative B. Riparian buffers would be designed to minimize mass-wasting potential and protect/aid natural restoration of physical processes and functions. Harvesting may occur when promoting these objectives. These buffers, and the restricted management activity within, are similar to the OESF No Action alternative except buffers established under the action alternatives would be wider. The addition of an exterior buffer would likely benefit cavity-nesting ducks if suitable cavity trees are retained within riparian zones. With the same snag and green tree retention conservation strategy as in Alternatives B and C, these alternatives would provide and protect more current and potential cavity trees than the No Action alternative..

Flammulated Owl (*Otus flammeolus*)

The flammulated owl is considered uncommon in Washington (Rodrick and Milner 1991), and is listed as a candidate species by the state (WDFW 1996), however, population studies have not been conducted in Washington and their abundance is unknown. The flammulated owl is one of the smallest North American owls and generally occurs in forested habitats over 3,000 feet in elevation east of the Cascade crest in Washington (Rodrick and Milner 1991; McCallum 1994). Flammulated owls are associated with open late-successional forests including ponderosa pine-dominated forests, mixed-conifer forests with a ponderosa pine component, and Douglas-fir-grand fir forests (Rodrick and Milner 1991; McCallum 1994). These owls nest in cavities excavated by woodpeckers, generally those made by the largest woodpecker species in the area. To forage for insects, these owls use open forest stands, open brushy areas, and forest/grassland edges (Rodrick and Milner 1991; McCallum 1994). Insecticide use and fire suppression may be detrimental to the flammulated owl.

ALTERNATIVE A AND ACTION ALTERNATIVES

The flammulated owl occurs in the three east-side planning units. Within these planning units, habitats types and amounts are evaluated as to their usefulness to spotted owls. Only a small portion of spotted owl habitat may serve as suitable flammulated owl habitat. Some forest stands considered unsuitable for spotted owls may constitute flammulated owl habitat, but a description of stand age, species composition, stand density, and elevation would be needed to evaluate this. The limited analysis of forest conditions in the east-side units precludes a complete evaluation of the effects of the alternatives for the flammulated owl, however each alternative would likely provide some suitable habitat.

Northern Goshawk (*Accipiter gentilis*)

In the Pacific Northwest, goshawks are strongly associated with late-successional coniferous forests and are most abundant in old growth (Thomas et al. 1993). Breeding goshawks use large tracts of mature and old-growth forest in which they can maneuver and forage below the canopy, and where large trees are available for nesting (Bartlet 1977; Hennessy 1978; Reynolds et al. 1982; Crocker-Bedford 1990a, 1990b; Marshall 1992b; Reynolds et al. 1992). They require trees large enough to provide a foundation for nest construction. Where nest sites are readily available, home range size is often determined by prey density (Reynolds et al. 1992). Home ranges for this species are extensive and vary between 5,000 and 6,000 acres, depending on local habitat quality (Reynolds 1983). Austin (1994) calculated a mean home range of 7,657 acres for adults in the southern Cascades, and demonstrated through statistical analysis that goshawks show a preference for closed-canopy mature/old-growth forests. There are apparently some similarities in the nesting habitat of northern goshawks and spotted owls. Spotted owl nests and goshawk nests have been located less than 100 yards from each other (Marshall 1992b). In mixed conifer forests on the east slope of the Cascades, 47 of 85 spotted owl nests occurred on stick nests built by goshawks (Buchanan et al. 1993).

Goshawk foraging areas comprise the largest portion of their home ranges and typically include a greater diversity of forest age classes and structural characteristics (e.g., snags, woody debris) than nest areas, and tend to support abundant avian prey populations (Reynolds et al. 1991). In general, foraging habitat consists of relatively open forest canopy, a well-developed shrub layer, and large trees (Reynolds et al. 1991). Large trees are used by goshawks as hunting perches, and canopy openings provide opportunities for prey capture. Foraging areas also tend to be comprised of a mixture of small (less than 4 acres), scattered openings and dense patches of mid-aged forests. Large tree components (live trees, snags, and downed logs) are scattered throughout the foraging area (Reynolds et al. 1991).

Goshawks may be highly sensitive to human disturbance. Timber harvesting within 0.25 mile (the nearest 125 acres) of goshawk nest sites in Idaho resulted in a 75 to 80 percent reduction in occupancy of their nesting territories (Patla 1990).

ALTERNATIVE A

Current management of the riparian ecosystem on DNR-managed lands would be expected to provide at least some suitable breeding, foraging, and resting habitat of the northern goshawk. This habitat would be provided primarily through the protection of relatively narrow contiguous tracts of large sawtimber and old-growth forest that are expected to occur or develop within the system of protected riparian management zones and unstable slopes on all DNR-managed lands. A recent survey of timber sales sold on DNR-managed land since 1992 indicates no timber management activity has occurred in 77 percent of the riparian management zones established on Type 1 through 5 Waters on DNR-managed land, and timber management activity is prohibited on unstable slopes under this alternative, thus, some goshawk habitat is likely available in the riparian management zone.

Current management of spotted owl suitable habitat on DNR-managed lands would be expected to provide some additional goshawk habitat because some large tracts of older forest would be protected within the 40 percent suitable habitat maintained in each owl circle. However, this protection is expected to be short term in nature, since the suitable habitat may be harvested in the future if the territory is found to be unoccupied by spotted owls for 3 consecutive years. Some goshawk habitat may also be protected as a result of delaying harvest on stands considered to be murrelet habitat. However, these stands could be released for harvest after protocol surveys demonstrate no occupancy by murrelets. Under the No Action alternative, management of other forests on DNR-managed lands would provide no additional protection of large patches of goshawk habitat because DNR-managed lands outside of the WMZs, riparian management zones, spotted owl circles, and murrelet habitat are basically maintained at 60-year rotations. DNR does voluntarily protect some goshawk nests with a 30-acre buffer, however, there is no definitive time period for this protection nor is the protection guaranteed.

ALTERNATIVE B

The combination of the riparian and spotted owl conservation strategies should provide forest conditions suitable for northern goshawk breeding, foraging, and resting habitat. In concert, these strategies should ensure the development of contiguous landscapes of sub-mature to old-growth forest. Additional goshawk habitat may also be provided as a result

of delaying harvest on most stands considered to be murrelet habitat, until a long-term murrelet strategy is developed. Until that time, the amount of goshawk habitat provided by a murrelet conservation strategy would be unknown. In areas managed for spotted owl breeding habitat there would be two 500-acre nest groves per 5,000 acres of managed forest, and at least 50 percent of the designated NRF management areas in each WAU (inclusive of the nest groves) would be sub-mature forest (as defined in Hanson et al. 1993) or higher quality habitat. The strategy specifies that each nest grove would consist of 300 acres in high quality spotted owl nesting, roosting, foraging habitat, and 200 acres in sub-mature forest or higher quality habitat, i.e., roosting, foraging habitat (draft HCP Chapter IV). Under Alternative B, areas managed for spotted owl breeding habitat would total approximately 101,000 acres of the 202,000 acres designated for NRF function.

The riparian conservation strategy would result in 11-16 percent of the land base in a late-successional condition. High quality habitat in nest groves would occupy another 12 percent of the land base, but portions of the nest groves would be in riparian areas or on unstable hillslopes. The nest groves are estimated to occupy 10 percent of the land base outside of those areas protected by the riparian conservation strategy. Nest groves and the riparian conservation strategy result in late-successional forest over at least 21-26 percent of the area managed for spotted owl breeding habitat. Another 24-29 percent of the land base must be sub-mature forest or better to meet the 50 percent prescription. In total, 40-42 percent of the area managed for spotted owl breeding habitat would be sub-mature to old-growth forest. The landscape conditions in the areas managed as spotted owl breeding habitat would meet or exceed the habitat recommendations made by Reynolds et al. (1992).

Areas managed as spotted owl dispersal habitat include 200,000 acres, with at least 100,000 acres developed and maintained at any time. The purpose of dispersal habitat is to support the movement of juvenile spotted owls between sub-populations on federal reserves, and it is likely the availability of this habitat would enhance the survival of dispersing juvenile goshawks. At least 50 percent of the designated Dispersal management areas in each WAU would meet the minimum specifications for spotted owl dispersal habitat (draft HCP Chapter IV).

Management of spotted owl NRF habitat under Alternative B would be expected to provide more northern goshawk habitat than the No Action alternative. Some suitable habitat that meets the minimum patch size requirement for this species may be protected within spotted owl NRF habitat outside of established riparian management zones and wetland buffers. Spotted owl dispersal habitat under this alternative in the west-side planning units would be managed for young-forest marginal characteristics (Hanson et al. 1993) which include the canopy closure, tree density and height, and vertical diversity that contribute to the habitat needs of the goshawk.

Management of the riparian ecosystem under this alternative would be expected to provide some northern goshawk habitat. Some potential nest trees in the riparian zones would be retained or developed over the term of the HCP. As stands adjacent to the riparian buffers develop under the proposed harvest regime rotation age of 50-100 years, they may provide adequate closed canopy contiguous blocks of forest suitable for

goshawks. Since riparian buffers would be wider than in the No Action alternative, the potential to develop goshawk habitat would be greater under this alternative.

DNR would not allow activities that may appreciably reduce the likelihood of successful nesting within 0.55 miles of a known active goshawk nest which is located in the areas managed for spotted owl breeding between April 1 and August 31. A circle of radius 0.55 miles circumscribes the entire post-fledgling family area (600 acres). This protection would serve to minimize human disturbance around active nest sites.

In addition, the strategy to retain three snags and five green trees per acre of harvest would benefit goshawks by providing habitat for prey species and potential future nest trees in upland areas. This conservation measure is enhanced by the added provisions to include one tree from the largest diameter size class, and to retain large, structurally unique trees valuable to wildlife, where possible. This conservation measure would complement the owl and riparian strategies to provide more habitat than that provided under Alternative A.

ALTERNATIVE C

The combination of the riparian and spotted owl conservation strategies should provide slightly more forest conditions suitable for northern goshawk breeding, foraging, and resting habitat than Alternative B. This would be reflected in the additional areas managed for spotted owl breeding habitat, and the wider riparian buffers. In concert, these strategies should ensure the development of somewhat larger contiguous landscapes of sub-mature to old-growth forest than Alternative B. Additional goshawk habitat may also be provided as a result of delaying harvest on most stands considered to be murrelet habitat, until a long-term murrelet strategy is developed. Until that time, the amount of goshawk habitat provided by a murrelet conservation strategy would be unknown.

In areas managed for spotted owl breeding habitat, at least 60 percent of the designated NRF management areas in each WAU would be sub-mature forest or higher quality habitat (202,200 of the 337,000 acres designated for NRF function. In areas managed for spotted owl dispersal habitat (172,000 acres), 86,000 acres would be developed and maintained at any point in time (DEIS Chapter 2).

Management of the riparian ecosystem under this alternative would be expected to provide some northern goshawk habitat. Some potential nest trees in the riparian zones would be retained or developed over the term of the HCP. As stands adjacent to riparian buffers develop, they may provide adequate closed canopy contiguous blocks of forest suitable for goshawks. Since riparian buffers would be wider than Alternative B (DEIS Chapter 2) and the No Action alternative, the potential to develop goshawk habitat would be greatest under this alternative.

The snag and green tree retention conservation measure, as well as the restriction on activities within 0.55 miles of a known active goshawk nest, within NRF-designated areas, would be the same as under Alternative B. As such, the benefits to goshawks would be the same and complementary to the owl and riparian conservation strategies, which wold be more beneficial to goshawks than what is provided under Alternative A.

OESF ALTERNATIVE 1

Current management of the riparian ecosystem on the OESF would be expected to provide at least some breeding, foraging, and resting habitat of the northern goshawk. Similar to the HCP No Action alternative, this protection would be provided primarily through the protection of relatively narrow contiguous tracts of large sawtimber and old-growth forest that are expected to occur or develop within the system of protected riparian management zones and unstable slopes in the OESF. Timber management activity is prohibited in the mass-wasting buffer of the riparian management zones and on unstable slopes under this alternative. Spotted owl dispersal habitat, as well as management of other forests, on the OESF would be the same as that described for the No Action alternative above.

OESF ACTION ALTERNATIVES

Management of the riparian ecosystem on the OESF would be the same for both action alternatives. This strategy would be expected to provide some breeding, foraging, and resting habitat of the northern goshawk. Ecosystem protection under these alternatives is intended to be derived largely from management directed at maintaining and restoring riparian ecosystem function as well as older forest conditions across much of the managed uplands which is expected to benefit all species associated with late-successional and old-growth forests such as the northern goshawk. More specific protection of the habitat for this species would occur primarily from the establishment of, and restriction of timber harvest activities in, mass-wasting buffers within riparian management zones (including unstable slope areas) (draft HCP Chapter IV, DEIS Chapter 2).

OESF ALTERNATIVE 2

Management of spotted owl NRF habitat under this alternative would be expected to provide some protection of breeding, foraging, and resting habitat of the northern goshawk. Management of spotted owls under this alternative would be expected to be achieved through the protection and restoration of the ecosystem functions of older forests. This management activity would provide some large contiguous tracts of older forest that would likely function as suitable habitat for use by goshawks. The landscape would be expected to have 40 percent suitable spotted owl habitat, 20 percent of which would be old forest, distributed throughout the OESF. In addition, the strategy to retain three snags and five green trees peracre of harvest would benefit goshawks by providing for prey species and potential future nest trees in upland areas. This conservation measure is enhanced by the added provisions to include one tree from the largest diameter size class and to retain large, structurally unique trees valuable to wildlife, where possible. Together, the owl strategy, the snag and leave tree strategy, and the guaranteed riparian and wetland management zones would provide adequate suitable goshawk habitat throughout the OESF. This goshawk habitat would be more than that provided under the No Action alternative.

OESF ALTERNATIVE 3

This alternative would focus on a stratified management design to develop nesting, roosting, and foraging habitat configurations that would attract and support territorial owls (DEIS Chapter 2). Where these areas occur, management in the annual home range area would maintain and/or restore 40 percent young-forest marginal, sub-mature, and

old-forest habitat conditions. These habitats contribute to the mosaic of habitat conditions required by the goshawk and, as such, would provide adequate habitat to support this species. However, this habitat would not be available throughout the OESF but in concentrated areas based on spotted owl life requisites. Nevertheless, the owl strategy, the snag and green tree retention strategy described in Alternative 2, and the guaranteed riparian and wetland management zones, would provide adequate suitable goshawk habitat in the OESF. This goshawk habitat would be more than that provided under the No Action alternative.

Golden Eagle (*Aquila chrysaetos*)

The principal threat to the golden eagle in Washington is the destruction of open rangeland habitat, with which it is most commonly associated. Prior to 1982, nesting of the golden eagle west of the Cascade mountains in Washington State was considered rare (Bruce et al. 1982). In western Washington, nest sites are primarily in large trees within mature or old-growth forests near the edge of clearcuts (Rodrick and Milner 1991). Clearcut logging creates forest conditions highly favorable to golden eagles (Bruce et al. 1982), i.e., it hunts for mammals (rabbits, squirrels, mountain beaver) in large open areas, and therefore, current forest practices appear to have expanded the amount of suitable golden eagle habitat. Golden eagles use the same territory annually, but use alternate nests in different years (Rodrick and Milner 1991). Golden eagles may nest in large trees or on cliffs, and nesting occurs between January 15 and July 15 (Rodrick and Milner 1991). Golden eagles can persist in intensively managed forests where timber harvests create a distribution of different seral stages within drainage basins.

ALTERNATIVE A

Current management activities are likely providing or protecting some golden eagle habitat, although it is probably incidental, as a result of the riparian buffers and protection of owl territories under the ESA. Nesting and perching sites may be protected by the riparian buffers that have been averaging 196 feet on Type 1 and 2 Waters. In addition, current timber harvest practices have created a mosaic of forest stands of various ages, from clearcuts to 60 years old. This management activity creates a landscape with some foraging habitat for the golden eagle. However, the riparian buffers are not guaranteed, and the only protection of golden eagle habitat required by law is under the Bald and Golden Eagle Protection Act (16 U.S.C. § 668 et seq.), which specifies protection for the eagle and eagle nests from disturbance.

ALTERNATIVE B

The combination of the riparian conservation strategy and forest management in the west-side planning units should provide breeding, foraging, and resting habitat for the golden eagle. Many forests on unstable hillslopes would not be harvested and some of these areas would contain large trees. Management activities within the riparian buffer must maintain or restore the quality of salmonid habitat. This management is expected to result in the development of late-successional forest containing large live trees. The ecological integrity of the riparian buffer, and the eagle nesting sites contained therein, would be protected by wind buffers. Even-aged forest management throughout the west-side planning units would continue to provide openings for foraging habitat. In areas managed for spotted owl breeding habitat, at least 50 percent of the areas in each WAU

would be sub-mature forest or higher quality habitat with old-growth quality features. In total, approximately 40 percent of the area managed for spotted owl breeding habitat would be sub-mature to old-growth forest which should provide an adequate supply of potentially suitable nest trees. Cliffs may also be used as nest sites for golden eagles. Under Alternative B, there is a provision for some cliff protection whereby mining of rock from cliffs for road construction would be avoided when materials can otherwise be reasonably acquired, although this would not be guaranteed protection from disturbance. DNR would also evaluate, in coordination with USFWS, and protect the integrity of cliffs judged suitable for and likely to be used by wildlife. Trees along the base and top of cliffs suitable for nesting raptors would be retained. In addition, very large old trees specified for retention under this alternative would be available as potential nest trees for golden eagles. The potential habitat provided for golden eagles under Alternative B would be substantially more than that provided under the No Action alternative.

ALTERNATIVE C

This alternative contains the same protection for golden eagles as Alternative B except Alternative C would have more spotted owl breeding habitat. In areas managed for spotted owl breeding habitat, at least 60 percent of the areas in each WAU would be sub-mature forest or higher quality habitat with old-growth quality features which would provide an adequate supply of potentially suitable nest trees. Cliffs and large, old tree protection is the same as under Alternative B, therefore, the potential habitat provided for golden eagles under Alternative C would be slightly more than Alternative B and greater than that provided under the No Action alternative.

OESF ALTERNATIVE 1

Current management of the riparian ecosystem on the OESF would be expected to provide at least some breeding, foraging, and resting habitat of the golden eagle. Similar to the HCP No Action alternative, this protection would be provided primarily through the protection of relatively narrow contiguous tracts of large sawtimber and old-growth forest that are expected to occur or develop within the system of protected riparian management zones and unstable slopes in the OESF. Timber management activity is prohibited in the mass-wasting buffer of the riparian management zones and on unstable slopes under this alternative. These buffers likely provide some big trees and snags that could potentially function as nest and perch trees. In addition, current timber harvest practices have created a mosaic of forest stands of various ages, from clearcuts to 60 years old. This management activity creates a landscape with some foraging habitat for the golden eagle.

OESF Alternative 2

Management of spotted owl NRF habitat under this alternative would be expected to provide some protection of breeding, foraging, and resting habitat of the golden eagle. Ecosystem protection under this alternative is intended to be derived largely from management directed at maintaining and restoring riparian ecosystem function as well as older forest conditions across much of the managed uplands. The old forest condition is expected to cover nearly 30 percent of the OESF in the long term. Older forests would be well-connected across the OESF because of their association with the stream network, which has guaranteed buffers. Riparian buffers and the older forest conditions developed

from the owl conservation strategy should provide an potential nest trees. In addition, the provisions addressing cliffs and very large, old trees in Alternatives B and C above would also apply to management activities on the OESF. These management activities would provide habitat that fulfills all life requisites of the golden eagle, and are substantially greater than the OESF No Action alternative.

OESF ALTERNATIVE 3

The protection and development of owl habitat necessary to support territorial owls would also develop and enhance habitat for the golden eagle. Management for owl breeding habitat would complement the riparian strategy and provide old forest habitat in concentrated areas. This strategy is expected to provide a source of nest and perch sites for golden eagles, as well as foraging areas where this habitat is adjacent to younger seral stages of forest growth. In addition, the provisions addressing cliffs and very large, old trees in Alternatives B and C above would also apply to management activities on the OESF. These management activities would provide habitat that fulfills all life requisites of the golden eagle, and are substantially greater than the OESF No Action alternative.

Sandhill Crane (*Grus canadensis*) and Black Tern (*Chlidonias niger*)

Sandhill crane and black tern utilize similar habitats in Washington State. Thus, for the purposes of this assessment, breeding, foraging, and resting habitats are considered to be provided by nonforested wetlands as described below. Since their habitats are similar, the assessment of the effects of the alternatives on these species has been combined.

Sandhill Crane

Sandhill crane migrants occur throughout the state and breeding has been documented in both eastern and western Washington (WDFW 1994a; W. Vogel, USFWS, Pacific Northwest Habitat Conservation Plan Program, Olympia, WA, pers. commun.,1995). Sandhill cranes are extremely wary and therefore use only large tracts of open habitat with good visibility (WDFW 1994a). Potential habitat for this species includes grain fields, wet meadows, large marshes (i.e., nonforested wetlands), and shallow ponds (Type 2 and 3 Waters) (Brown 1985; WDFW 1994a). Nesting habitat consists of extensive shallow-water marshes with dense emergent plant cover (Littlefield and Ryder 1968). Wet meadows and grasslands are used for foraging and resting habitat (Brown 1985; WDFW 1994a).

Black Tern

The black tern is a common summer resident in eastern Washington and a migrant in western Washington (Wahl and Paulson 1991). The black tern appears to migrate primarily along the coast (Haley 1984), but is also expected to use the Columbia River as a route from breeding areas in eastern Washington and British Columbia.

Potential breeding (east-side planning units only), foraging, and resting habitat for the black tern is considered to include inland lakes, ponds, reservoirs, freshwater marshes, and wet meadows. Nests of this species in Washington are found on the east side of the Cascade mountains on pond and lake shorelines, marshes, swamps, bogs, and wet

meadows (Brown 1985; National Geographic Society 1987). During the nesting season, black terns feed on insects and small fish (Haley 1984).

ALTERNATIVE A

Current management of the riparian ecosystem on DNR-managed lands is expected to provide some suitable foraging and resting habitats for the black tern, and foraging, resting and breeding habitat for the sandhill crane. Protection of this habitat is primarily through the establishment of riparian management zones on Type 2 Waters and WMZs on nonforested wetlands. No timber management activity has occurred in over 75 percent of the riparian management zones established on Type 2 Waters on DNR-managed land since 1992, which includes the lakes and ponds that provide foraging and resting habitat for these species in the HCP planning area. Under DNR's FRP policies, this protection of riparian buffers is expected to continue. Furthermore, under this alternative, timber harvest activities are restricted in WMZs established on nonforested wetlands which include the wet meadows, marshes, lakes and ponds that provide potential habitat for these species. Additional protection of sandhill crane habitat is provided by the state designation of critical wildlife habitat for the sandhill crane under WAC 222-16-080, which includes the area within 0.25 mile of a documented breeding area (WFPB 1995c). Some suitable resting and foraging habitat for this species is assumed to occur within this 0.25-mile buffer for this species.

ALTERNATIVE B

Management of the riparian ecosystem under Alternative B is expected to provide adequate amounts of foraging and resting habitats for the black tern, and foraging, resting and breeding habitat for the sandhill crane in the west-side planning units. Specific benefits of this alternative for these species that would provide some guaranteed protection of aquatic habitats include the establishment and protection of wetland buffers, and of riparian management zones on Type 2 Waters. Protection of aquatic habitat would be provided by the prohibition of harvest within a 25-foot no-harvest area within each zone established, and the constraint on activities within the remainder of the zone to those that are expected to maintain or restore the quality of salmonid habitat. In addition, wind buffers on the windward side of Type 1 and 2 Waters would help to maintain the integrity of the riparian buffers, adding to the protection of the aquatic habitat. This protection is greater than that provided under the No Action alternative for the black tern, and would be in addition to that afforded the sandhill crane by the state critical wildlife habitat designation.

ALTERNATIVE C

Management of the riparian ecosystem under Alternative C is expected to provide adequate foraging and resting habitats for the black tern, and foraging, resting and breeding habitat for the sandhill crane. Specific benefits of this alternative are the same as under Alternative B except wind buffers would be established on both sides of Type 1 and 2 Waters, and the constraint on activities within the buffer zone would be restricted to those that are expected to restore or enhance the quality of salmonid habitat. This protection is substantially greater than that provided under the No Action alternative for the black tern, and would be in addition to that afforded the sandhill crane by the state critical wildlife habitat designation.