FINAL DRAFT

Management Strategies for Core Wildlife Habitat Areas in Eastern Jefferson County

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1. Introduction

1.1 Background Information

Jefferson County initiated the identification of important wildlife habitat units in an effort to protect and enhance key wildlife habitat areas and corridors linking wildlife habitat in eastern Jefferson County. Blocks of primary habitat are used by wildlife species for breeding, rearing, foraging, wintering, roosting, and resting, and are essential to the species' survival, as well as being key to the protection of biological diversity. Effective wildlife habitat corridors facilitate the movement of animals between blocks of intact habitat (core areas) capable of supporting viable populations. While core areas contain all the habitat features necessary to support species throughout the year, corridors need not contain all habitat elements necessary for breeding or long-term survival of target species. Instead, the corridor acts as "road" between blocks of core habitat that meets these wildlife needs. Notable exceptions to this are reptiles and amphibians, which often reproduce in wildlife corridors, particularly those that exist along streams and wetlands.

1.2 Objectives and Goals

The objectives of this project are to facilitate public education and involvement in wildlife conservation in eastern Jefferson County and to advance official (legislative) involvement in wildlife conservation at the County level. Specific goals to be achieved by this work are:

- to provide protection of biodiversity in eastern Jefferson County, with particular attention to wildlife species of significance;
- to identify for enhancement or restoration areas that have the potential to become valuable wildlife habitat areas;
- to make specific management recommendations for core habitat areas and corridors where possible to maintain habitat values and quality in a way that preserves existing property rights;
- to implement viable, efficient, and effective regulation of wildlife habitat in eastern Jefferson County; and
- to provide a tool to educate landowners about the existence and value of wildlife habitat.

2. Methods and Justification

2.1 Project Area

The project area is eastern Jefferson County from the eastern border to US Forest Service land to the west. The natural environment is composed of coniferous, deciduous, and mixed forest ranging in age from sapling to mature (>100 years), but mostly in young (<20 years) and mid-aged (20-80 years) stands; recent clear cuts and plantations; palustrine open water (POW), emergent (PEM), scrub-shrub (PSS), and forested (PFO)

wetlands; meadows and pastureland; streams and riparian zones; estuaries; and shorelines. Land uses in the project area include residential, commercial, and rural development; light industry; mining; parks and open space; agriculture; and forestry.

2.2 Core Area/Corridor Identification Process

Because it was not feasible to identify all actual species occurrences in eastern Jefferson County, we refined our search to most efficiently identify those areas likely to support most of the wildlife species known to live in the eastern County. The result allows us to concentrate efforts on core habitat areas which of are of greatest significance to wildlife and which afford the best opportunity to address wildlife needs without overburdening landowners throughout the County.

We used data from the Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species (PHS) and Heritage programs to map known occurrences of priority species in eastern Jefferson County. Using the polygons generated for priority and heritage species and habitats, we roughly delineated areas supporting breeding or wintering wildlife populations. This ensured the inclusion of vulnerable aggregations of wildlife, such as heron rookeries and shorebird congregations. We also considered State and federal threatened, endangered, species of concern, and monitor species known to occur in eastern Jefferson County. Species in the groups listed above are referred to collectively as "species of significance" in this document.

Wetland and riparian areas of significance to wildlife are also included in the databases, and we used these to identify both tracts of significance to wildlife and potential linkages between habitat areas supporting key species. Wetlands and riparian zones are of great importance to wildlife, particularly birds and amphibians (Naiman et al. 1993, Azous and Horner 1997), and were therefore useful in determining potential core areas and corridors.

In addition to considering species of special significance, we wanted to ensure that suitable levels of species richness and biological diversity were maintained within the designated corridors. To achieve this, we applied Johnson and O'Neil's (2001) predictor of species diversity. This generated a predicted diversity using habitat types present in each core area.

We applied a number of criteria to the areas to assist in their designation as Core 1, Core 2, Core 3, or Corridor. Core 1 designation was given to areas that supported species of significance, were contiguous, and contained features or habitat types of particular importance to wildlife, such as snag-rich stands, mature forest, or forested wetlands. Proximity to federal forestland or protected State forestland was an additional factor in designating an area as Core 1. We avoided the inclusion of areas likely to have future concentrated residential development in Core 1 areas. Areas designated Core 2 generally met most of the criteria for Core 1 areas, but may be somewhat fragmented by highways, contain developed areas, or include some areas of less valuable habitat, such as agricultural areas or young forest. Core 3 areas were composed mostly of historic wetlands currently in agricultural use, young forest, and degraded riparian habitat and streams. These areas were selected primarily for their restoration and enhancement potential, although many of them support PHS species or congregations. Designated corridors follow existing streams and riparian zones where they connect two core areas.

Generally speaking, mammals require the greatest area for movement, while reptiles and amphibians can move in a more constrained area, provided suitable habitat is available.

Birds may be able to move across less contiguous areas, although it should be noted that some species avoid fragmented forests. By using riparian zones as the backbone of wildlife corridors, we expect to encompass many other species in addition to the PHS species for which data were available, as these areas are important to all of the taxa of interest. Because streams are afforded the benefit of a measure of regulatory protection by existing codes, the process of protecting wildlife habitat within the riparians corridors already has a basis in law.

We next used the Jefferson County Comprehensive Plan Land Use Map to help place core areas in places that were primarily designated for low-density development, long-term forestry, or agriculture. Digital data from the US Forest Service depicting habitat restoration and enhancement opportunities at the County-Federal land boundary were used to identify areas where potential for habitat improvement is greatest. We avoided major barriers to wildlife passage, including US 101, SR 104, SR 19, and SR 20, whenever possible. We included areas adjacent or proximate to federal forestland in core areas when other factors supported the core designation. Federal forests in Jefferson County are allocated to late-successional reserves, riparian reserves, and Adaptive Management Areas (AMAs). AMAs range from 500 to 30,000 acres in size and are distributed throughout Olympic National Forest. They were designed to provide opportunities for land managers, researchers, and communities to explore new forest practices and test management principles. Contiguity of the core areas with federal forestlands is likely to expand the amount of habitat available to wildlife in the project area.

2.3 Aerial Photograph Interpretation and GIS

After generating maps showing potential core areas delineated using the guidelines described above, we used 2001 orthophotos at a scale of 3860:1 to define areas where actual habitat that could support the PHS species exists within the these core areas. The aerial photo interpretation data were entered into a Geographic Information Systems (GIS) database so that habitat types could be overlain with land use and zoning. We used this to refine the core areas to limit them to areas that had actual habitat to support a core habitat designation. The maps also provide a clear picture of the land use zones that pertain to each core area, as well as where the core areas lie in respect to surrounding land uses. This information can be used as a tool for making management recommendations on particular parcels.

2.4 Management Recommendations

We based recommendations on strategies that are known to be successful in the protection and enhancement of wildlife populations and habitat. We used Best Available Science (defined according to WAC 365-195-900) and other peer-reviewed literature to develop recommendations. We also took into consideration the current zoning and land use regulations within each corridor.

3. Core Areas (this section describes Core 1 and Core 2 areas)

The habitat types described below occur in Core 1 and 2 areas. Habitat types described for Core 3 areas and corridors (see Sections 5 and 6) may also occur in Core 1 and 2 areas, but generally to a lesser extent. As well, habitat types described in this section may also occur in Core 3 areas and corridors. Figures 1 through 5 show the occurrence of all habitat types within all designated cores and corridors.

Areas designated as Core 1 contain the most intact habitat in the project area. They may contain particularly valuable wildlife habitat, such as forested wetlands, intact riparian areas, or estuaries. They are generally unbroken by significant development, clear cuts, or plantations. By comparison, Core 2 areas lack at least one of the features represented in Core 1 areas. They may include fragmented, more heavily logged forest, disturbed wetlands, or agriculture or other development.

3.1 Forested Areas

Interpretation of aerial photographs of the project area allowed us to distinguish among coniferous, deciduous, and mixed coniferous-deciduous forest. It makes more sense to evaluate wildlife habitat according to seral stage than forest type, as the composition and structure of a forest stand is associated with succession. Most existing science addresses wildlife use of forest habitat with respect to seral stage or dominant climax species, rather than coniferous versus deciduous.

Conifer forest is the most common forest type in Washington, and eastern Jefferson County falls within the vegetation zone referred to as Puget Sound Douglas Fir in recent analyses. Hardwood and mixed coniferous-deciduous forests occur in many seral stages of conifer forest in Washington, and it is probably safe to assume that mixed and deciduous stands in the project areas are not climax forest (Karl et al. 1999). In fact, were eastern Jefferson County forests to truly be in climax stage, western hemlock would probably replace Douglas fir at 400-500 years (Franklin and Dyrness 1973), but fire history limits the final stage of succession. Mature forests in the project area are generally a Douglas fir-western hemlock-western red cedar mix.

3.1.1 Forests and Wildlife

A great abundance and diversity of wildlife uses the forest habitat of western Washington State. The dominant Douglas fir forests of the area support the highest birds densities of any North American coniferous forest system (Weins 1975). The forests of eastern Jefferson County are used by many species of significance, including torrent salamanders, tailed frogs, bald eagles, spotted owls, marbled murrelets, northern goshawks, mountain quail, Vaux's swift, harlequin ducks, cavity-nesting ducks, and elk. Most of these species (mountain quail and elk are the exceptions) rely most heavily on mature and old-growth forest stages.

Birds are probably the best-studied group of animals in forest. The presence of bird species in forested communities is thought to be strongly associated with habitat features within forest stands (Lehmkuhl et al. 1991, Hansen et al. 1995). Some of these features are in turn associated with particular stand ages. Specialized bird species within upland forests preferred forest stands with large dominant trees, mixed tree species composition, a multilayered canopy, irregular crown structure, patches of dense foliage, large standing dead wood, and abundant woody debris on the forest floor (Mannan and Meslow 1984, Hansen et al. 1994, Manuwal and Huff 1987, Manuwal 1991, and O'Connell et al. 1993). The availability of snags and large-diameter, old trees with loose bark for nesting and habitat for invertebrate food sources likely contributes to the high density of birds in late successional forest stands (Thomas 1979, Verner 1980, Mannan 1982, Anthony 1984, Mannan and Meslow 1984, Zarnowitz and Manuwal 1985, Manuwal 1991).

Many of the habitat features important to wildlife are typical of mature and old-growth forest. Harvest practices that truncated succession at rotation age (70 years or less) have resulted in a predominance of early- and mid-stage forest in Washington (Bunnell et al. 1997) In addition, several high-profile endangered species, including marbled murrelet and spotted owl, utilize old-growth forest predominantly. There is also a growing evidence of declining populations of species associated with coniferous forest, particularly neotropical migrant birds that use late-stage forest (Robbins et al. 1989, reviews in Askins et al. 1990, DeGraaf and Rappole 1995). Given these concerns, it is easy to see how managing for mature and old-growth stands can take precedence over other forest concerns. However, successional stage alone is probably a poor criterion of habitat value (Bunnell et al. 1997). Multi-age forest management is increasingly used with the expectation that it will benefit the greatest number of species. It also allows for more options and greater freedom regarding how forest resources are utilized.

3.1.2 Forest Management Strategies

Because timber production is one of the dominant land uses on forested portions of the project area, many management recommendations are aimed at forest stands. Much of the forestry occurring in the project area is regulated by existing state laws, limiting the extent to which new regulatory tools can be applied. Small forested properties also provide wildlife habitat, and several recommendations can be made at the parcel scale as well.

Precise measurements, e.g., preferred snag diameter and height, size of retained live trees, number of retained trees, etc., are not given in these recommendations. Preferences in habitat features vary widely from species to species, making it impossible to define the "best" characteristic of a feature. For example, downy woodpeckers and pileated woodpeckers may very well inhabit the same forest stand, but their preferred snag sizes may not even overlap. Thus, we avoid definitive measurements in most cases.

Explore alternatives to clear cutting. It is generally accepted that clear cutting causes the most drastic habitat changes of all harvest methods. Alternatives include selective cutting, group-selection cutting, and live-tree and snag retention. Shelterwood harvesting is a method in which half the trees are left standing for 5-10 years after an initial harvest, and then cut during a second harvest. This allows for high timber productivity. Aggregated green-tree retention involves leave clusters of trees uncut, providing islands of habitat. All of these techniques preserve a degree of structural diversity in harvested stands, allowing for greater complexity in regenerating stands. Avoiding a Douglas fir even-aged monoculture will benefit wildlife by increasing bird densities (Meslow 1978).

Preserve snags. This is a characteristic of the alternative harvest methods mentioned in the previous strategy, but the importance of snags to wildlife bears repeating.

Leave cull logs after harvesting. The Washington State University Cooperative Extension recommends leaving at least two logs per acre. Quality is not important, but logs should be at least 20 feet long and 12-15 inches in diameter.

Leave brush piles when clearing downed timber. Piles flattened to about 2 feet in height are most beneficial as cover.

Design harvest to provide travel corridors between forest stands. Planning selection and group-selection cutting to retain rows of habitat along which animals can travel may lessen the impact of the cut.

Minimize site preparation after harvest. This might mimic natural conditions of early seral stages. In Pacific Northwest coniferous forests, structural complexity tends to be high in the early and late seral stages (Spies et al. 1988).

Where the option exists, retain older forest stands and manage young ones on the longest feasible rotation. Late-successional forest is underrepresented in the landscape, and while a mixed of sucessional stages is beneficial to wildlife, it is unlikely that adequate amounts of late-successional forest exist in the project area.

Thin regenerating stands. Thinning increases structural complexity and promotes old growth.

Retain understory in regenerating stands. This provides low cover for wildlife and can be implemented in small stands, provided it is not a fire hazard.

Place logging roads with care. Avoid sensitive areas such as wetlands and riparian zones.

Fell timber away from buffer zones. Felling into the buffer can damage habitat**.**

Minimize disruption during clear cutting by limiting the area and time in which harvest activities occur. Cutting outside of the spring breeding season disturbs wildlife less than harvesting while animals are defending nests and young.

Manage forest stands to protect sensitive species known to use them. Preserve dominant trees along shorelines and in forest tracts 10 acres or greater in size for eagles, osprey, and great blue herons; retain a windthrow buffer of 300-600 feet around mature stands in core habitats that border USFS land to the west of the project area for marbled murrelets; in the same cores areas, preserve stands of 400 acres or more with 60% managed as mature for northern goshawks (the 400-acre blocks can include adjacent USFS land).

3.2 Riparian

Riparian habitat includes all seral stages of plant communities associated with rivers, streams, sloughs, springs, and open water bodies. Because this group overlaps with wetlands, riparian zones are limited to plant communities associated with rivers, streams, and creeks in this document. Other associations are considered in Section 4.3, Wetlands.

3.2.1 Riparian Areas and Wildlife

Riparian habitats support a greater abundance and diversity of wildlife than any other habitat type in the state of Washington, and about 85% of the state's wildlife species use them for breeding, rearing, foraging, escape cover, resting, or other vital activities (Knutson and Naef 1997). Approximately 30% of all species found in the coastal zone from northern California to southeast Alaska are riparian obligates, meaning they depend absolutely on riparian habitat for their survival (Kelsey and West 1998). The presence of healthy riparian habitat not only benefits those species depending directly on riparian plant associations, but also many aquatic and upland species that occur in rivers and streams or adjacent uplands. The availability of water, moderate microclimate, and fertile soils in riparian zones enhance the plant community, allowing it to support a great variety of vegetative species, invertebrates, fish, reptiles, amphibians, birds, and mammals (Mitsch and Gosselink 1986). Nearly upland development, logging, and conversion to agriculture can cause degradation of riparian habitat. These disturbances can cause reduced recruitment of woody debris; changes in stream characteristics such as turbidity and dissolved oxygen content; decreased nutrient input to aquatic systems; and increased runoff of contaminants. Where buffer adequate to meet requirement of certain species, including cavity-nesting ducks, great blue herons, and torrent salamanders, are not preserved, these species can lose nest sites, cover, and food sources.

Riparian areas in the core habitat areas and corridors provide breeding, migrating, foraging, and wintering habitat for several species of significance. Tailed frog (*Ascaphus truei*), torrent salamander, bald eagle, mountain quail, Harlequin duck, great blue heron, wood duck, Barrow's goldeneye, and purple martin are all species that may breed in riparian habitat and known to occur in the project area (see Appendix A for legal status). Some of these species, such as the torrent salamander, depend on the cool stream temperatures provided by riparian vegetation. Others may depend on the thick cover or nesting cavities provided by riparian vegetation, the proximate availability of water, recruitment of woody debris, or aquatic prey. Species and groups of interest in eastern Jefferson County area that rely on riparian habitat outside of the breeding season for feeding or resting include osprey, marbled murrelet, trumpeter swan, cavity-nesting birds, waterfowl and seabird concentrations, and elk. Management strategies for riparian areas emphasize protection of special features of this habitat, such as snags, woody debris, and nearly aquatic areas, that make it valuable for these and many other wildlife species.

3.2.2 Riparian Management Strategies

Specific management recommendations listed in this section are aimed at maintaining or enhancing the structure and function of riparian zones in the project area and their associated aquatic systems.

Maintain adequate riparian zone widths. Recommended riparian widths range from 8 to 200 m in the literature (Knutson and Naef 1997). However, WDFW has developed specific widths, based on extensive literature review and studies. Table 1 shows riparian buffer widths recommended by WDFW and those required by the Jefferson County Unified Development Code.

Table 1: Recommended riparian buffer widths for riparian areas based on Knutson and Naef (1997) and the Jefferson County Unified Development Code.

Stream Type	Recommended or Required Buffers	
	WDFW Recommendation (ft)	Jefferson Co. Requirement (ft)
1, 2, and shorelines	250	150
3, >5 feet wide	200	100
3, <5 feet wide	150	100
4 and 5, low mass wasting*	150	100 (type 4 only)
4 and 5, high mass wasting*	225	50 (type 5 only)

*Mass wasting refers to the processes by which rock and earth move downslope.

The differences between the WDFW and Jefferson County recommendations for buffer width are explained to a great extent by their underlying assumptions. The WDFW buffers are generalized for the entire state of Washington, which includes many areas far more developed for industry, agriculture, and housing than Jefferson County. These buffer widths are designed to protect a riparian zone optimizing fish and wildlife habitat within all landscapes of the state, and they do not take other uses, such as forest harvest or residential development, into account. The WDFW Knutson and Naef 1997) recommends individual assessments of each riparian area. In an area surrounded by lower-impact land uses, such as medium-age forest harvest rotation or mature forest, buffer widths closer to those recommended by Jefferson County may be appropriate. On the other hand, larger buffers may be necessary where a species of significance occurs, depending on the needs of the particular species. For example, a 250 to 300-m buffer is preferred for riparian zones in great blue heron breeding areas. In general, riparian habitat in Core 1 and 2 areas are surrounded by intact habitat and may be sufficiently protected by no-use buffers closer to the narrower end of the recommended width spectrum. Riparian habitat in the Core 3 areas and corridors tends to be bordered by clear cuts, development, and agriculture, and would likely require buffer widths similar to those recommended by the WDFW to ensure adequate protection.

Do not use chemicals detrimental to fish or wildlife within riparian zones or adjacent areas. Specific buffers effective for prevent chemicals from entering aquatic systems are unknown. Restricting chemical use on adjacent lands represents a conservative approach to protecting riparian zones.

Use long timber harvest rotation cycles in forested uplands near riparian areas. WDFW (Knutson and Naef 1997) recommends 120-year rotations to ensure adequate snag and woody debris recruitment.

Avoid timber harvest on steep slopes. Timber harvest on slopes greater than 60% adjacent to riparian habitat should be avoided, particularly if they show evidence of wet areas or previous landslides.

Fell timber away from buffer zones. Felling into the buffer can damage habitat.

Exclude livestock from riparian areas. Maintain a 60-m buffer between heavily used pastures and waterways. Do not graze sensitive or degraded riparian areas.

Limit high-impact recreational use of riparian areas. Expand existing accesses, trails, and campsites where necessary rather than creating new facilities. Any new should be located only on stable slopes in already-degraded areas or areas at risk of more intensive development. Retain native vegetation and woody material in recreation areas.

Enhance riparian areas by planting native plants and removing invasive species. A qualified ecologist or state agency can offer advice concerning individual areas.

WDFW (Knutson and Naef 1997) has a guidance on riparian management and is accepted as BAS under WAC 365-195-900.

3.3 Wetlands

The wetlands identified in Figures 1 through 5 are palustrine wetlands, meaning they exist in a depression or pond. Types of palustrine wetlands located in the core areas are POW, PEM, PSS, and PFO. Estuaries also exist in some core areas. Wetland management strategies vary depending primarily on the wetland's classification, which is determined by the value of a particular wetland. A wetland's value is decided by the quality of the functions it provides, including its biomass production, habitat, erosion control, stormwater storage, water quality protection, aquifer recharge potential, and low flow augmentation. Some of the factors used to measure the quality of these functions are the wetland's size, its location in the watershed, the amount of development in the watershed, vegetative structure and composition, rate of water flow through the wetland, the size of natural buffers, and surrounding land uses. While the type of wetland determines its functional value to some extent, e.g., PFO wetlands have a great vegetative structural diversity than PEM wetland, other values are determined irrespective of type. Therefore, all palustrine wetlands are addressed together in this document.

3.3.1 Wetlands and Wildlife

Wetlands provide key habitat. A large percentage of wildlife species utilize wetlands and their buffers (Castelle et al. 1992, Mitsch and Gosselink 1993.). Several species of significance, including bald eagle, Barrow's goldeneye, wood duck, great blue heron, and purple martin are known to inhabit wetlands in the project area in the breeding season and likely depend on them for breeding or feeding young. Other species of significance that use wetlands in the project area during the breeding season, but which may not be limited by their availability, include Vaux's swift, mountain quail, northern goshawk, cavity-nesting birds, seabirds, shorebirds, and waterfowl. Species of significance known or likely to use project area wetlands for foraging, resting, or wintering include bufflehead, common goldeneye, common merganser, hooded merganser, osprey, pileated woodpecker, red-tailed hawk, trumpeter swan, and elk.

Amphibians in particular depend greatly on wetlands. Amphibian species of significance eastern in Jefferson County are found in riparian areas and are discussed in the Riparian section of this document. However, it is worth noting that 79% of amphibian species in Washington use streams, ponds, and temporary

waters and often the wetlands associated with them for some stage of breeding (Nussbaum et al. 1983).

Avian diversity in wetland ecosystems in Washington is high relative to upland ecosystem. Of the 367 species of birds in Oregon and Washington, 72% use freshwater, riparian, and wetland habitats. Seventy-seven percent of the 266 species of inland birds that breed in Oregon and Washington do so in riparian and wetland environments (Johnson and O'Neil 2001). Few mammal species are dependent upon wetlands, but many use them as sources of food, water, and cover. Forested wetlands may be of particular importance, as they provide a wetter forest environment than forested uplands. The Pacific jumping mouse, western jumping mouse, Pacific water shrew, shrew-mole, dusky shrew, and many bat species are closely associated with wet deciduous forest conditions (Corn et al. 1988, Cross 1988, Gilbert and Allwine 1991, West 1991). Forested buffers surroundings would also serve a duel purpose because they would provide cover for forest species using nearby wetlands.

3.3.2 Wetland Management Strategies

The following apply differently depending on wetland class. Estuaries and forested wetlands should never be used for water treatment or control (Azous and Horner 1997). If species of significance are present, also avoid this type of disturbance. If the wetland has been previously drained or degraded, it may be used for water quality and quantity control.

Maintain buffers in which no construction, logging, or other disturbance occurs. Effective buffer widths vary according to the quality of the wetland and may be required by the City, State, or federal regulations. Unregulated wetlands also benefit from retention of a vegetated buffer. Table 2 shows the buffer requirements of Jefferson County. Using the larger of the buffer widths shown would not only provide greater protection of the wetland, but also allows the landowner to forego a formal delineation report.

Table 2: Recommended wetland buffers for Jefferson County based on the Jefferson County Unified Development Code.

Wetland Category	Required and Minimum Buffers	
	Standard Requirements (ft)	Minimum for Waiver (ft)
1	150	225
2	100	150
3	50	75
4	25	37

Minimize impacts to forested wetlands. There are no regulations that specifically address the removal of trees from forested wetlands in Washington State. However, this wetland type is relatively rare in Jefferson County and very valuable to wildlife. Impacts to hydrology and soils of forested wetlands can be

reduced by limiting harvests to low moisture or frozen conditions, suspending logs during yarding, using low-impact harvesting techniques, and avoiding the use of tractors and wheeled skidders.

Carefully plan for and control runoff in uplands. It is less detrimental to wetlands to develop areas that are already deforested than to cut trees. Similarly, it is better to build on existing impermeable surface than to create new imperious surface on permeable ground. Test runoff water quality and install appropriate water quality controls. If building is to occur near wetlands, water quality and quantity impact can be lessened by retention of natural swales, depressions, intermittent steams, and areas with permeable soils. It may be beneficial to hire a qualified professional to assess and plan for the hydrological and chemical changes that occur with development.

Retain adjacent areas of native vegetation, especially if they connect to other wetlands. Also retain connections to other natural areas via native vegetation. See Appendix B for native wetland vegetative species.

Clear non-native and invasive vegetative species from wetlands.

Discourage human impacts by creating natural barriers. Reduce littering by planting thick native vegetation. Exclude vehicles by blocking roads with native vegetation. Fences should not be used because they restrict wildlife movement.

Look into alternatives to development scheduled for uplands bordering wetlands; conduct an alternatives analysis. These include purchase by agencies or land trusts, "green" development, alternatives to impervious surface, clustering, locating development away from sensitive areas, cashing in on incentive programs.

During development, practice water resource protection. In addition to anything required by law, work to minimize erosion and sedimentation to any water body. Bypass flow of runoff to acceptable receiving water bodies.

Use only sound pesticide and animal care techniques. Exclude livestock and chemicals from buffers. Don't use chemicals during rainy seasons. Consult a biologist on the safe use of pesticides.

Do not capture or remove beavers. Dam building creates wetlands.

3.4 Snag-Rich Areas

3.4.1 Snag-Rich Areas and Wildlife

Wildlife depend on standing dead trees for nest sites and foraging opportunities. An estimated 85 bird species are either primary cavity-nesters (excavate cavities) or secondary cavity-nesters (use existing cavities) (Evans and Conner 1979). The availability of snags is often the limiting factor deciding whether a cavity-nesting species can survive in an area. Barrow's goldeneye, wood duck, purple martin, and Vaux's swift are species of significance that are likely limited by snag availability in the project area. In addition, red-tailed hawks, spotted owls, turkey vultures, bald eagles, great blue herons, waterfowl concentrations, bat concentrations, fishers, and martens are species of significance that may benefit from the availability of snags in the project area. Downed dead wood is also an important habitat feature, as it provide cover for wildlife and nutrients to the food

cycle. It is of particular importance to reptiles, amphibians, and fish, which use it for breeding, rearing, and escape in aquatic systems.

3.4.2 Snag Management Strategies

Managing for snag-users and cavities-nesters generally consists of retaining dead and non-hazard large trees. Some dead trees are more valuable than others, so if all dead or dying trees cannot be left standing, it is beneficial to prioritize. The most desirable trees are live trees with decaying heartwood in the upper trunk or main branches. This provides a soft core at the top for excavating, and the tree is likely to remain standing longer than a dead or more rotten tree. At the other end of the spectrum are trees in which only the sapwood is rotten, because they provide poor insulation for cavities (Evans and Conner 1979). Suitable trees can be identified by rotting or dead branch stubs, other dead portions, old scars, and existing cavities.

Leave dead trees standing. Dead trees should not be cut unless they present a hazard.

Allow older trees to age. This provides assurance of future snag and woody debris recruitment.

Leave downed woody material. Do not remove or burn dead wood on the ground or in streams.

Snags can be created. If a landowner or manager wishes to attract or manage for wildlife species, they can create snags by topping or girdling live trees. Trees should be large and mature to create the most valuable snags. They should be girdled or topped above the lowest ring of branches. Leaving a jagged top creates a better snag than an evenly cut top.

Manage timber stands for maximum feasible rotation age. Older trees provide greater snag recruitment.

Practice responsible logging. Forest harvest techniques are discussed elsewhere in this document, but it should be noted here that employing appropriate harvest methods in riparian areas and adjacent uplands is essential to ensure adequate recruitment of snags and woody debris.

4. Areas of Restoration Potential (Core 3)

Management of habitat types within Core 3 areas emphasizes restoration and enhancement. Much of this land is highly degraded wetland, narrow or developed riparian zones, or fragmented, young forest or plantations. These areas provide opportunities to created or restore valuable wildlife habitat. Core 3 areas may also contain areas of intact habitat, and most of them support species of significance. Management recommendations for such areas are described in Section 4. This section focuses on the habitat types found most commonly in areas having great restoration potential.

4.1 Restoring and Enhancing Degraded Wetlands

Much of the agricultural land in Core 3 areas is on historic wetlands. Such areas have restoration potential, but may also be managed for wildlife as they exist (see Section 5.4). Degraded wetlands in Core 3 areas provide enhancement opportunities.

4.1.1 Restoration

When wetlands are filled as a result of unavoidable human activity, wetland restoration may be required. Agricultural lands in Core 3 areas should be considered for restoration if nearby wetlands are impacted by human activities, or if they are not in active use. In most cases, this requires reestablishment of wetland hydrology through removal of impediments or drainage ditches and tiles. This may require the advice of a professional wetland ecologist, but it is far more likely to be successful than creating wetlands in non-wetland areas. The following sequence is suggested for planning, designing, and installing a restoration wetland where a functioning wetland does not exist. Because restoration of a converted wetland is complicated and dependent upon local influences, consultation with local experts is strongly suggested.

Identify which wetland functions are to be restored. A wetland restoration will have a greater chance of success if emphasis is placed on the functions it naturally performed (Schneider and Sprecher 2000).

Choose a location likely to be successful. High quality soils, a passive water source, and maximum distance from disturbance and sedimentation sources will all improve chances of success (Schneider and Sprecher 2000). A professional investigation of hydrology, soils, wetland boundaries, water quality, topography, point and non-point source pollution, and habitat potential will greatly increase chances.

Obtain professional help. The success of wetland restoration depends on many factors. An ecologist should be employed to record baseline data, set performance standards, design the installation, and monitor success. Hydrology restoration may involve grading. Non-native plants may need to be removed from the site. Establishment of plants requires transplanting or seeding from off-site stock.

4.1.2 Enhancement

Enhancement of degraded wetlands can improve their value to wildlife and can be accomplished more easily than restoration. These strategies for enhancement can be employed on any wetland that has been disturbed.

Removal of non-native vegetation can improve the value of wetlands for wildlife.

Plant native wetland plants. Local nurseries often stock native plants, and their staff can usually provide useful advice on planting. The WDFW Environmental Restoration Division (ERD) is another source for help with selecting and planting native vegetation.

Expand and improve wetland buffers. Again, local nurseries and the ERD can provide advice on obtaining and installing native buffer vegetation.

Exclude livestock, vehicles, and foot traffic from wetlands and buffer. This will reduce soil compaction, water pollutants, and litter. Natural vegetative barriers are a better choice than fencing where livestock are not an issue, as fences will also hamper wildlife movement. However, fencing is the most effective method of keeping cows out of sensitive areas.

Constructing nest boxes can entice wood ducks to use wetlands. Nest boxes should be predator-proof and follow the specifications of Bellrose and Holm (1994). Boxes should not be a substitute for snags, however.

4.2 Restoring and Enhancing Riparian Areas

The importance of riparian habitat to wildlife is discussed in Section 4.2, along with management recommendations. This section addresses restoration and enhancement of degraded riparian areas.

The US Environmental Protection Agency investigated riparian restoration projects in the Pacific Northwest (Connin 1991) and found that restoration had to be approached at the watershed level to be successful. This involves consideration of the entire watershed in which the riparian area occurs, including its effects on streams flow, sedimentation, debris recruitment, and a number of other factors (Knutson and Naef 1997). Successful restoration projects did increase stream flow, water depth, and bank stability; reduce sedimentation, flood frequency, and channel width; and increasing animal and plant species diversity. The following recommendations can be employed to increase the chance that a restoration or enhancement project will succeed.

Cease damaging human activities within riparian zones. The first step in riparian restoration is to halt degrading land uses, including high-impact recreation, grazing, cutting of plants, littering, and any other potentially damaging activity.

Consult a professional. WDFW, the Natural Resources Conservation Service (NRCS), and local agencies can offer advice. Biologists at these agencies can provide information on revegetating with native species, creating fish and wildlife habitat, and the best engineering methods for developing in and near in riparian areas. NRCS may provide cost-sharing for some projects.

Make an ongoing commitment. Planning, design, installation, maintenance, and monitoring are essential and make span several years.

4.3 Restoring and Enhancing Developed Areas

Many developed areas in eastern Jefferson County exist within historical wildlife ranges. As well, residential and commercial development can be expected to expand in the area, and many presently undeveloped areas are zoned to allow future development. Human-wildlife interactions increase as a result, and this can be viewed as an opportunity for landowners not only to enjoy the wildlife resource, but to be instrumental in preserving and enhancing developed areas for wildlife. Wildlife can come to depend on developed lands as part of their regular habitat, such as elk have in the southern part of the project area. Stewardship of such areas is vital to the well-being of wildlife, especially as development exerts increasing pressure on limited habitat.

In general, retaining large trees, snags, and downed logs, preserving adequate wetland and riparian buffers, clumping development, employing sedimentation controls and best management practices during construction, and minimizing roads, staging areas, and

noise are all ways to reduce impacts to wildlife and habitat. Stewardship of parks, open areas, and natural corridors can be undertaken by landowners and community groups.

4.4 Managing Clear Cuts and Plantations

The bulk of forested land in the project area has been harvested for timber at least once. Clear cutting and replanting with timber species is a common method of timber production in Jefferson County, as it is in many part of the US. Clear cuts and plantations, or forest that may eventually be clear cut, occur in and adjacent to many of the core areas and corridors. Clear cutting impacts wildlife habitat because it removes over and forage, contributes to stream sedimentation, fragments forest habitat, breaks travel corridors, and precipitates changes in wildlife communities. However, because forest is a dynamic ecosystem, there exists the potential to reduce the impacts of clear cutting. This section addresses the relationships between clear cuts and plantations and wildlife, and makes recommendations for managing these areas for wildlife. It refers only to existing clear cuts and plantations. Alternatives to clear cutting are discussed in Section 4.1.

4.4.1 Clear Cuts, Plantations, and Wildlife

Clear cuts and plantations are commonly assumed to be poor wildlife habitat; however, if multi-purpose management is employed, they can provide habitat for birds and mammals. Even management for high timber production may temporarily benefit some species: some seed-eating species increased after herbicide treatment on plantations in Oregon (Morrison and Meslow 1983). Plantations allowed to grow without the use of herbicides have also improved habitat for some species by increasing low cover and forage species (Felix et al. 1986, McComb and Hurst 1987). Overall, however, clear cutting and planting fast-growing coniferous species results in conditions that reduce suitability for wildlife.

It is widely accepted that certain wildlife species are characteristic of different stages of succession, also called seres. Planting trees essentially eliminates the grass-forb sere. Cutting on a high-production timber schedule eliminates the old-growth and possibly mature forest seres. Clear cutting may also eliminate snags and other valuable nesting trees. Truncation of the successional process and reduction in some habitat features is likely to negatively impact those wildlife species dependent upon the diminished seres and lost features.

4.4.2 Clear Cut and Plantation Management Strategies

Increasing demands are being placed on both timber and wildlife resources, and silvicultural practices need not be incompatible with the needs of wildlife. There are a number of clear cuts and plantations in the project area that are located where they may provide important wildlife habitat if managed with wildlife in mind.

Clear cutting also reduces woody debris recruitment, increases sedimentation, can raise stream temperature, removes wildlife forage and cover, and otherwise damages riparian habitat. Managing the clear cuts and plantations along corridors to increase cover and shade, reduce erosion, and provide wildlife forage will facilitate travel by wildlife in these corridors.

The following general steps can be taken to increase the value of clear cuts and plantations to wildlife.

Thin growing plantations to open the canopy. Coniferous monocultures tend to be closed-canopied. Thinning allow sunlight to penetrate, which allows low growth of cover and forage to proliferate.

Allow natural regeneration of understory. Chemical and mechanical treatments in regenerating clear cuts and plantations reduce compositional and structural diversity of vegetation, which reduces wildlife cover, forage, and nest sites.

4.5 Managing Agricultural Lands

Agriculture is a primary land use in many parts of eastern Jefferson County. While protection and maintenance of agricultural activities is a stated goal of the Growth Management Act, there can be conflicts between agriculture and wildlife that can be mitigated.

4.5.1 Agricultural Lands and Wildlife

According to the US Department of Agriculture, 84% of mammals and 74% of birds in the United States use rangeland at some stage in their life cycle. Croplands are also used by wildlife, including some species of significance in Jefferson County. Some of these species depend upon patches of natural habitat within land used for agriculture, while others have adapted to croplands and pasturelands. In the project area, waterfowl congregate on agricultural lands, and trumpeter swans use it as wintering habitat.

4.6.1 Agricultural Land Management Strategies

There are both broad and specific strategies that can be applied to agricultural lands in the project area. Broad strategies include the decision whether or not to maintain the land in agriculture. In general, land in agricultural uses has greater habitat value than developed land, and keeping it in agriculture is preferable to converting it for development. Similarly, sensitive or priority habitats will lose some value to wildlife if they are converted to agriculture. It is also thought that crop and rangelands managed for high production have less value for wildlife than those managed less intensively for production.

Agricultural lands management is being addressed by landowners, with the Jefferson County Conservation District and Jefferson County government, on a voluntary basis at the watershed level. The following recommendations are meant to supplement strategies being developed that are focusing on water quality and anadromous fish habitat.

Restore riparian areas on agricultural lands. A healthy riparian zone can provide habitat for aquatic and terrestrial species, as well as acting as a travel corridor between patches of intact habitat. Provide as much natural vegetation as possible around all bodies of water. This will also help prevent swans from damaging pastures by providing a natural food source.

Exclude machinery and livestock from riparian and wet areas. This will allow vegetation to grow and reduce soil compaction. Thick vegetation is a

better choice than fencing, as fences will also exclude wildlife. However, fences should be used for livestock if vegetation is ineffective.

Allow corners, edges, and hedgerows to remain in a natural condition. These areas can provide habitat for animals with small home ranges, such as some reptiles and amphibians, particularly when they are enhanced with native vegetation.

Remove invasive vegetation from natural areas when necessary. Invasive plant species can spread via livestock and vehicles. See Appendix C for removal methods for common invasive species.

Produce species that are of some value to wildlife. Alfalfa and soybeans are examples of crops that can benefit wildlife. Do not commercially produce invasive species. The WDFW ERD can advise on raising wildlife-friendly crops.

Plant short-duration winter cover crops. This will lure swans away from grass fields and pastures, as well as reduce soil erosion. Annual ryegrasses are a preferred swan winter forage.

Use pesticides and fertilizers (including animal wastes) responsibly. Apply fertilizers in the minimum amounts required by crops. Pesticides should not be applied to open water. They can be directly harmful to wildlife, as well as contributing to pollution through runoff.

Use water efficiently. Drip irrigation and piped laterals are efficient water-use methods.

Treat agricultural wastewater. Settling ponds, swales, and natural depressions capture sediments, nutrients, and pollutants before they enter streams and wetlands.

Eliminate or reduce soil erosion. Cover crops and conservation tillage reduce erosion. Landowners can select crops that retain soil and have high ground cover and use harvest techniques that minimize soil disturbance. Maintaining continuous crop cover and using cultivation methods that minimize the time soil is bare will also reduce erosion.

Provide supplemental water. The availability of water may be limiting for some species at some times of the year. Troughs, plastic basins, and wildlife guzzlers are inexpensive ways to provide water for wildlife.

Provide supplemental shelter. Nest platforms and brush piles are inexpensive, efficient ways to provide shelter for birds and small mammals.

Disk soils in winter. Disking soils prior to green-up in spring promotes regeneration of natural vegetation present in the seed bank.

5. Corridors

Corridors are of particular importance because they provide a means for wildlife to travel between core areas. Corridors in the project areas are riparian corridors and management strategies detailed in Section 4.2 apply. Because of their use as travel corridors, some recommendations are particularly important for these riparian areas.

Corridors should not be broken by construction. Information on alternatives to road crossings is available from the WDFW.

Corridors should remain free of human and animal disturbance. As recommended for all riparian corridors, they should exclude livestock and high-impact human recreation. This will reduce soil compact, sedimentation, litter, and noise disturbance.

Riparian corridors should be enhanced where they are degraded. Cover is necessary for most wildlife species to use a corridor. Enhancement in riparian corridors consists primarily of planting appropriate native vegetation along the waterway. In addition to providing cover, this reduces sedimentation and pollution in the waterway. It has the added benefit of enhancing the stormwater control function of the waterway.

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