Chapter 3. Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in Chapter 2.

The cumulative effects discussed in this section include an analysis and a concise description of the identifiable present effects of past actions to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the agency proposal for action and its alternatives may have a continuing, additive, and significant relationship to those effects. The cumulative effects of the proposed action and the alternatives in this analysis are primarily based on the aggregate effects of the past, present, and reasonably foreseeable future actions. Individual effects of past actions are not listed or analyzed, and are not necessary to describe the cumulative effects of this proposal or the alternatives. (CEQ Memorandum, Guidance on the Consideration of Past Actions in Cumulative Effects Analysis, June 24, 2005.)

Forest and Stand Structure

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Forest and Stand Structure includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Forest and Structure

The Bridge Thin Analysis Area (Figure 1) consists of 20,657 acres within the McKenzie River/Elk Creek 6th field watershed located on the McKenzie River Ranger District. Timber harvesting has been a dominant disturbance on the forested landscape in the 20th century impacting approximately 3,711 acres (31%) of the 11,961 acres managed by the Forest Service within the analysis area. Prescribed burning, wildfires, windthrow, and insect and disease have had much less affect during that time. In addition, private land within the project area has had extensive harvest within the past 50 years. There is no reliable source of vegetative age data for private industrial forest lands in the project area, but based on GIS analysis and knowledge of the area, it is estimated that approximately 75%, or 6,400 acres, of the private ownership in the project area is industrial forest land. It is assumed that these lands are being managed on a 40-50 year rotation, so in the past 50 years approximately 6,400 acres of private land in the project area has been harvested. Management of private industrial forest lands is expected to remain consistent for the reasonably foreseeable future.

The following table provides a summary of timber harvest by type and decade. Regeneration harvest activities include clearcutting and shelterwood.

Table 13. Historic Harvest in the Bridge Thin Analysis Area.

Decade	Historic Management on Federal Land; Acres by Activity Category			
	Regeneration Harvest	*Commercial Thinning*	*Salvage*	*Pre-commercial Thinning*
1940s	710	0	0	0
1950s	69	0	0	0
1960s	664	0	0	0
1970s	395	18	34	267
1980s	478	249	28	284
1990s	532	282	216	312
2000-Present	0	21	15	224
Total	2,848	570	293	1,087

Approximately 2,848 acres of National Forest system land (31%) was modified with regeneration-type timber harvest, which is now in plantations 70 years old or less. Many of the existing plantations in the analysis area are now becoming ready for intermediate thinning treatments. Over the next decade younger plantations would continue to become both old enough and large enough for commercial thinning.

The project area consists of a mosaic of managed and natural forests with various stand ages and structure. The stands identified for harvest are primarily previously managed stands consisting of plantations from even aged harvest, with some older stands where selective harvest has occurred and fire regenerated natural stands also included. The current phase of structural development varies with the age of the stand, site conditions, and disturbance history. For the most part, the stands are entering stem exclusion (self-thinning) with reduced growth and limited regeneration. Gaps in the canopy created from self-thinning or disturbance from wind-throw and root rot are promoting regeneration of conifer species. The regeneration is primarily of shade tolerant species due to the small size of the gaps.

Natural disturbance from windthrow and disease has also provided various levels of snag and large down wood component that varies in the levels of decay. Most stands have some old remnant Douglas fir trees that have survived past fires and other natural disturbances. These forests have mostly Douglas fir and western hemlock over-stories with shade tolerant species in the understory when regeneration occurs. Past management in the older natural stands were primarily salvage logging.

The stands contain from 63 to 591 overstory trees per acre with average diameters of 15 inches dbh in the young managed stands and 27 inches dbh in the older stands with a site tree potential estimated to be 150 foot. Canopy closures of trees 7 inches or larger diameter breast height average 66% within the planning area. Stands have scattered root rot pockets of armillaria root disease (*Armillaria ostoyae*) and laminated root rot (*Phellinus weirii*), both of which are common on the McKenzie River Ranger District and are often associated with insects such as bark beetles.

Bridge Thin planning area stands exams occurred over several years and were completed in 2007. The data indicates that tree growth and vigor have been in decline over the years, and would continue to decline with future increases in stand size and stand density. For stands in the planning area the Stand Density Index (SDI) is relative to Douglas fir , the major species in the stands. Douglas fir has

a maximum SDI of 595 before it reaches full site occupancy (Reineke, L.H. 1933). An SDI of 60% of the maximum SDI is often considered the lower limit of self thinning and would show reduced growth. To maximize overall growth a target range of 35-50% maximum SDI is desired. The stands proposed for harvest treatment average 60% maximum SDI with a range of 21% in the Oak Savanna units to 113% in the younger plantations.

Environmental Consequences—Forest and Structure

For the following analysis of environmental consequences, the current condition of the forest stands, including measures of SDI and stand development, was modeled using the Forest Vegetation Simulator (FVS) (USDA FS 2006 PNW model with Western Cascade variant).

Alternative A (No Action) — Direct, Indirect, and Cumulative Effects

No stand treatments would occur with implementation of Alternative A. Stands growth rates would continue to decline at current rates, and natural processes that affect tree vigor and cause changes in stand structure over time would continue. Tree mortality occurring within known root rot pockets would continue unabated. Populations of Douglas fir beetle would increase and decline in response to pockets of root rot mortality.

Many stands are overstocked; site resources are being fully utilized and inter-tree competition is intense. The effects of overstocking include decreased growth, increased rates of mortality and high risk for insect attack. High rates of mortality would increase fuel loading; this combined with understory ladder fuels puts these stands at high risk for a stand replacement wildfire. These conditions are not sustainable over time. Stand conditions that can favor the spread of insect and disease in proposed harvest units would continue unabated. Decline in underrepresented species, like sugar pine (*Pinus lambertiana)* and western redcedar (*Thuja plicata*), would continue.

Seral stage diversity within the stands would remain low. In the absence of treatments including timber harvest and underburning, species tolerant to regenerating and growing under thick canopies would dominant the site over time. High stocking density and canopy closure would continue to restrict regeneration of Douglas fir and sugar pine. The species composition in many stands would slowly shift from being dominated by species less tolerant of shade to more tolerant species like western hemlock.

The current lack of quality early seral habitat for wildlife species from butterflies to elk would persist. Encroachment would continue to reduce the oak savanna habitat.

There is no ongoing or reasonably foreseeable timber harvests planned on Forest Service lands in the Bridge Project area. As disussed previously, timber harvests on private lands in the project area are ongoing and expected to remain consistent for the reasonably foreseeable future.

Alternatives B and C — Direct and Indirect Effects

Moderate Thinning

Moderate thinning maintains or increases overall stand growth and vigor by reducing competition for limiting resources such as light, water, and soil nutrients. Reduced stand densities and competition

allows the residual trees to maintain a higher growth rate than would occur with no thinning. The Moderate Thinning prescription (Rx) is proposed for the stands where exams have shown less than 200 trees per acre that are seven inches and greater in diameter at breast height (dbh). Units that would not be economically viable or could pose a safety concern were assigned a Heavy Thinning Rx.

The following units have the moderate thinning Rx: 20,21,23,24,26,32,34,58,60,62, 64, 65,66,67,70, and 81 in alternative B and 21,23,24,26,32,34,58,60,62,64,65,66,67, and 70 in alternative C.

The stands would be thinned to maintain 50-65% canopy closure and a post-treatment Stand Density Intensity (SDI) of 35-45% the SDI^{max} (SDI^{max} is the maximum number trees that can exist in a stand relative to size and spacing [Long 1996]). Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The objective is to increase growth and vigor of remaining trees. Emphasis is on maintaining non-Douglas fir species. This prescription would maintain or increase vegetative diversity and resistance to future insect infestations and disease. Moderate thinning will result in variable density by having a range of residual spacing, natural holes in stands, unthinned areas, and yarding corridors breaking up continuity.

Reduced stand densities and greater diameter growth of residual trees would increase their stability making them more resistant to windthrow as they mature (Tappeiner, et al. p.213) The residual trees should also be less susceptible to fire and root diseases such as armillaria spp. and associated insects. Where pockets of root disease are identified the surrounding 50' would be cleared and those trees susceptible to the disease would be cut and removed. Resistant and tolerant tree species may be planted within identified root rot pockets because they have a higher chance of survival than would the Douglas fir (Tappeiner, et al. p.61-62).

Moderate thinning creates openings in the canopy allowing for the release of some existing understory trees and shrubs. The canopy closures would be opened up to 50-65%, also providing opportunity for the establishment new vegetation and shade intolerant tree seedlings (Tappeiner, et al. p.230-231). These openings would, increase structural diversity and the future creation of large snags and down wood in treated stands.

Existing species composition, which is dominated by Douglas fir , would result in a remaining overstory that is primarily Douglas fir and respond to the reduced density with increased crown growth. Eventually the understory vegetation would be suppressed. As canopy closure and stand density increase over the next 10 to 15 years, an opportunity for subsequent thinning would emerge. A future thinning would maintain growth of residual trees and the growth and development of the stand. Alternative B would provide for Sugar Pine natural regeneration in unit 81 by removing non-Sugar Pine competition for a radius of 50 foot around Sugar Pine trees 24 inches and greater.

Heavy Thinning

Heavy thinning maintains or increases overall stand growth and vigor by reducing competition for limiting resources such as light, water, and soil nutrients. Reduced stand densities and competition allows the residual trees to maintain a higher growth rate than would occur with no thinning. The Heavy Thinning Rx is proposed for the stands where exams have shown greater than 200 trees per acre that are seven inches and greater in diameter at breast height (dbh). Units with less than 200

seven inch and greater trees per acre that would not be economically viable or could pose a safety concern were also assigned a Heavy Thinning Rx.

The following units have the Heavy Thinning Rx: 1, 2, 3, 4, 5, 6, 8, 10, 11, 12, 13, 14, 15, 17, 18, 25, 27, 28, 29, 30, 31, 35, 36, 37, 38, 39, 46, 47, 48, 49, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 63, 69, 72, 82, 83, 841, 88, 91 in alternative B and 1, 2, 3, 4, 5, 6, 8, 10, 11, 12, 13, 14, 15, 17, 18, 25, 27, 28, 29, 30, 31, 35, 36, 37, 38, 39, 46, 47, 48, 49, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 63, 69, and 72 in alternative C.

The stands would be thinned to maintain 40-55% canopy closure and a post-treatment Stand Density Intensity (SDI) of 17-34% the SDI^{max}. Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The objective is to increase growth and vigor of remaining trees. Emphasis is on maintaining non-Douglas fir species. This prescription would maintain or increase vegetative diversity and resistance to future insect infestations and disease.

Reduced stand densities and greater diameter growth of residual trees would increase their stability making them more resistant to windthrow as they mature (Tappeiner, et al. p.213). The residual trees should also be less susceptible to fire and root diseases such as armillaria spp. and associated insects. Where pockets of root disease are identified the surrounding 50’ would be cleared and those trees susceptible to the disease would be cut and removed. Resistant and tolerant tree species may be planted within identified root rot pockets because they have a higher chance of survival than would the Douglas fir (Tappeiner, et al. p.61-62).

Heavy thinning creates openings in the canopy allowing for the release of some existing understory trees and shrubs. The residual canopy closures would also provide opportunity for the establishment new vegetation and shade tolerant tree seedlings (Tappeiner, et al. p.230-231). These openings would, increase structural diversity and the future creation of large snags and down wood in treated stands.

Existing species composition, which is dominated by Douglas fir , would result in a remaining overstory that is primarily Douglas fir and respond to the reduced density with increased crown growth. Eventually the understory vegetation would be suppressed. As canopy closure and stand density increase over the next 10 to 15 years, an opportunity for subsequent thinning would emerge. A future thinning would maintain growth of residual trees and the growth and development of the stand. Alternative B would provide for Sugar Pine natural regeneration in unit 82, 83, 841, 88, and 91 by removing non-Sugar Pine competition for a radius of 50 foot around Sugar Pine trees 24 inches and greater.

Wildlife Thinning

Wildlife thinning maintains or increases overall stand growth and vigor by highly reducing competition for limiting resources such as light, water, and soil nutrients. Reduced stand densities and competition allows the residual trees to maintain a higher growth rate than would occur with no thinning. The Wildlife Thinning Rx is proposed for the stands which pose greater wildlife benefits for big game forage while maintaining an overstory of larger trees.

The following units have the Wildlife Thinning Rx: 40, 42, 43, 44, 45, 68, and 80 in alternative B and 40, 42, 43, 44, 45, and 68 in alternative C.

The stands would be thinned to maintain 30-50% canopy closure and a post-treatment Stand Density Intensity (SDI) of 13-17% the SDI^{max}. Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The objective is to increase growth and vigor of remaining trees. Emphasis is on maintaining non-Douglas fir species. This prescription would maintain or increase vegetative diversity and resistance to future insect infestations and disease.

The lower densities in residual stands would result in greater diameter growth making them more resistant to windthrow as they mature (Tappeiner, et al. p.213). The residual trees should also be less susceptible to fire and root diseases such as armillaria spp. and associated insects. Where pockets of root disease are identified the surrounding 50' would be cleared and those trees susceptible to the disease would be cut and removed. Resistant and tolerant tree species may be planted within identified root rot pockets because they have a higher chance of survival than would the Douglas fir (Tappeiner, et al. p.61-62).

Wildlife thinning creates openings in the canopy allowing for the release of some existing understory trees and shrubs. The residual canopy closures would also provide opportunity for the establishment of new vegetation and shade tolerant tree seedlings (Tappeiner, et al. p.230-231). These openings would increase structural diversity in treated stands and promote the future creation of large snags and down wood. To further stimulate the establishment of new vegetation fire treatments such as understory burning would occur.

Existing species composition, which is dominated by Douglas fir , would result in a remaining overstory that is primarily Douglas fir and respond to the reduced density with increased crown growth. Eventually the understory vegetation would be suppressed. As canopy closure and stand density increase over the next 20-25 years, an opportunity for subsequent thinning would emerge. A future thinning would maintain growth of residual trees and the growth and development of the stand. Alternative B would provide for Sugar Pine natural regeneration in unit 80 by removing non-Sugar Pine competition for a radius of 50 foot around Sugar Pine trees 24 inches and greater.

Oak Thinning

The objective of oak thinning is to reduce the encroachment of conifer species on existing oak savanna. Reduced stand densities and conifer competition will promote the reestablishment of grasses and Oregon White Oak (*Quercus garrayna)* into their historic range. Oak thinning in a stand would result in wide spacing with an average residual spacing around 35 feet from the oak, which is "not tolerant of over-topping by Douglas fir and associated conifers" (USDA Forest Service Handbook 654). These stand conditions will benefit wildlife species that favor this more open habitat type.

Units 84 and 85 have the Oak Thinning Rx in alternative B and alternative C. The stands would be thinned to maintain 20-45% canopy closure and a post-treatment Stand Density Intensity (SDI) of 17-24% the SDI^{max}. Trees removed would primarily be the smaller diameter Douglas fir trees in the stands. The objective is to reduce densities and competition on the Oregon White Oak from encroaching conifer trees. Emphasis is on maintaining and promoting Oregon White Oak.

The residual stands lower densities would result in greater diameter growth making them more resistant to windthrow as they mature (Tappeiner, et al. p.213). The residual trees should also be less susceptible to fire and root diseases such as armillaria spp. and associated insects. Where pockets of

root disease are identified the surrounding 50' would be cleared and those trees susceptible to the disease would be cut and removed (WSU – Forest Health).

The oak thinning creates openings in the canopy allowing for the regeneration of Oregon White Oak, grass and shrubs. To further stimulate the establishment of the White Oak, fire treatments such as underburns would occur to remove competing conifer seedling and saplings.

Existing species composition, which is dominated by Douglas fir , would skew towards a higher percentage of White Oak. Douglas fir would remain the primary conifer species in and around the oak savanna. Follow-up burning at 10 year intervals would be necessary to suppress future conifer encroachment. Without follow-up burning, the surrounding conifers would continue encroaching on the savanna and be back to current levels of canopy cover over the next 20-30 years.

Riparian Thinning

Riparian thinning maintains or increases overall stand growth and vigor by reducing competition for limiting resources such as light, water, and soil nutrients. Reduced stand densities and competition allows the residual trees to maintain a higher growth rate than would occur with no thinning.

The Riparian Thinning Rx would occur in the riparian area of units: 2, 6, 8, 13, 15, 17, 18, 28, 29, 37, 40, 43, 44, 45, 47, 49, 61, 80, 84, and 88 in alternative B and 2, 6, 8, 13, 15, 17, 18, 28, 29, 37, 40, 43, 44, 45, 47, 49, and 61 in alternative C.

The stands would be thinned to maintain 50% canopy closure and a post-treatment Stand Density Intensity (SDI) of 17-24% the SDI^{max}.

Trees removed would primarily be the smaller diameter Douglas fir trees in the stands with the objective to increase growth and vigor of remaining trees. Emphasis is on maintaining non-Douglas fir species. This prescription would maintain or increase vegetative diversity and resistance to future insect infestations and disease.

Reduced stand densities and greater diameter growth of residual trees would increase their stability making them more resistant to windthrow as they mature (Tappeiner, et al. p.213). The residual trees should also be less susceptible to fire and root diseases such as armillaria spp. and associated insects.

Riparian thinning creates openings in the canopy allowing for the release of some existing understory trees and shrubs. The residual canopy closures would also provide opportunity for the establishment of new vegetation and shade tolerant tree seedlings (Tappeiner, et al. p.230-231). These openings would, increase structural diversity and the future creation of large snags and down wood in treated stands.

Existing species composition, which is dominated by Douglas fir , would result in a remaining overstory that is primarily Douglas fir and respond to the reduced density with increased crown growth. Eventually the understory vegetation would be suppressed. As canopy closure and stand density increase over the next 5 to 10 years, an opportunity for subsequent thinning would emerge. A future thinning would maintain growth of residual trees and the growth and development of the stand.

Group Selection

The objective of group selections is to develop gaps of early seral forest by creating openings with minimal canopy cover. Shade intolerant species that need full sunlight for successful establishment and growth would be able to regenerate in openings created by group selection. Because of the small size of the group selections, there would be an edge affect (shade from residual trees around the edge of the group). Height growth would be higher towards the center of the groups, away from the edge and any leave tree or snags left in the group.

Groups would occur in conjunction with other prescriptions by randomly placing groups based on benefit to wildlife as forage opportunity and other early seral habitat needs for wildlife. Groups would consist of approximate one acre gaps with undulating edges to avoid circles or square edges in the stands. In areas where a pest problem exists, like root disease, the group would be placed on the root rot pocket. A 50' area surrounding root rot pockets would be cleared, resulting in the group select. Openings created by the removal of root rot pockets would not exceed 5 acres in size, and this is expected to be infrequent. Within the groups, all but the four largest green trees per acre are to be removed. Any existing snags and downed trees are to be left on site. Trees adjacent to the group would serve as a seed source, in addition to those left within the groups. Natural regeneration is unpredictable based on timing of cone crops and occupation of the site by competing vegetation. Post harvest treatments to insure reforestation success, may include hand piling and burning and understory burns to remove slash and remove competing vegetation, which could then be followed by tree planting of under represented species to augment natural regeneration. Edge effect and retention of overstory trees could inhibit growth in some seedlings by reducing light and moisture availability.

This prescription would provide for gaps in the stands to increase diversity and forage. Group selects would be randomly placed unless a root rot pocket is identified in which case the root rot pocket would be buffered by 50' and this would become the group select. Group selects would be small holes approximately one acre in size. In the case of a root rot pocket, the group select may be larger than an acre depending on the size of the root rot pocket. All but the largest trees (4 per acre of the largest size class for the pocket) are to be removed. In root rot pocket follow-up planting may occur with species that are non-susceptible to the species of root disease. Large downed wood on the forest floor would be maintained or increased. Snags would be maintained on site if not a hazard to logging operations. Burning and site preparation for planting would occur if necessary depending on post logging slash load and needed slash components of early seral habitat.

Underburning

Low to moderate intensity underburns would occur in some units following thinning. A effect of the underburn is to reduce competition within the residual stand. In addition, the underburn would affect shade tolerant species more severely than intolerant species, due to shade tolerant species higher susceptibility to fire kill. Greater likelihood of intolerant species naturally regenerating would be a outcome of underburning. Underburning would comply with forest Standard and Guidelines in regards to consumption of fuels and maintaining down-woody material and snags. Spring-like burning conditions would reduce the risk of burning large woody material because of high moisture content. Tolerable loss of residual stand is up to 10% of existing basal area. Any burning is to be in

accordance with air quality management district regulations. Underburning would be financed by a combination of appropriated funding and/or collected funds.

Monitoring

First, third and fifth year survival/stocking examinations to monitor seedling survival, natural regeneration, animal damage and need for release or replanting within planted groups would be conducted for harvested stands. A district timber sale review with the District Ranger, IDT Members and Resource Specialists would be conducted within one year of timber sale completion to determine if the prescribed treatments were successfully applied. The effectiveness of the prescribed treatments would be evaluated, providing valuable information for future projects.

Alternatives B and C —Cumulative Effects

Cumulative effects analysis is focused on the USDA Forest Service (FS) land within 20,657 acre McKenzie River / Elk Creek 6th field watershed, which is the Bridge Thin Analysis Area. The analysis area has been molded by past management activities including logging and fire suppression. FS land represents approximately 58% (11,961 acres) of the analysis area with the remainder being private ownership. As displayed in Table 13, in the last 50 years approximately 3,711 FS acres have been managed with regeneration, commercial thinning, or salvage logging and an additional 1,087 acres have been pre-commercially thinned. The 3,711 acres represents 31% of the FS managed land and 18% of the entire watershed. In addition, private land within the project area has had extensive harvest within the past 50 years. There is no reliable source of vegetative age data for private industrial forest lands in the project area, but based on GIS analysis and knowledge of the area, it is estimated that approximately 75%, or 6,400 acres, of the private ownership in the project area is industrial forest land. It is assumed that these lands are being managed on a 40-50 year rotation, so in the past 50 years approximately 6,400 acres of private land in the project area has been harvested. Management of private industrial forest lands is expected to remain consistent for the reasonably foreseeable future.

Timber harvest within older, fire regenerated stands would increase the FS acres of managed stands by 1.58% under Alternative B and 0.32% under Alternative C and the entire watershed by 0.91% and 0.19% respectively. Both action alternatives would include fuels treatments on 1.56% of the FS land 0.90% of the entire watershed.

As stated above, there would be a temporary increase in tree growth in the residual trees within treated units, which would also lead to development of a more diverse understory. The opening of the canopy and holes created in the wildlife thinning units would increase the amount of wildlife forage and early seral forest stands on the landscape in varying amounts. Timber sale activities would reduce the number of natural snags that currently exist within the harvest units, but they would be replaced to some extent by burning induced tree mortality. There are no other foreseeable future projects that would add to the incremental cumulative effects of past timber harvest and the proposed stand treatments.

Soil Productivity and Slope Stability

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Soil Productivity and Slope Stability includes the project activity units in the Bridge Thin Project area.

Affected Environment—Soil Productivity and Slope Stability

Geology

This project area is located within the Lower McKenzie drainage area and lies completely within the Western Cascades physiographic region. More specifically, these deposits are basaltic lava flows, flow breccias and pyroclastic deposits representing both early and later events of the Western Cascade volcanic sequence. Based on field reconnaissance, some small areas of landslide debris area also present as are areas of weathered in-place volcanic rocks. The large majority of this drainage has been reworked by glaciation and surface features are comprised of glacial deposits, such as outwash, ground, end or lateral moraine remnants.

These relatively young rocks and glacial deposits are generally quite stable in this project area. Because of extensive glacial scour, most volcanic rocks are usually not well weathered at this point. Residual soils are often relatively coarse grained, occasionally rocky, and usually contain few clays. Soils developed from glacial deposits, even on the steeper side slopes are usually quite stable. Consequently, because of the gentle side slopes in the valley bottoms, the lack of very fine soil particles in most areas, especially the glacial and outwash soils, and the fact that glacial scour removed deeper pockets of fine-grained soils on much of the steep terrain, most soils are quite stable. These various volcanic land types are generally well drained where permeability is rapid in the surface soil and moderately rapid in the subsoil. On the other hand, the glacial and alluvial soils in the valley bottoms are very well drained, and permeability is rapid to very rapid in both the surface soil and subsurface soil layers. Because of high infiltration rates in the broad valley bottoms, overland flow is generally uncommon. In the proposed units, side slopes range from near zero to about 30% on the gentler slopes to 40 to 80% on the steeper terrain. Offsite erosion is generally not a concern because of the vegetative ground cover, the high infiltration rates, and the gentle to moderate side slopes for many units.

Areas dominated by rock outcrop, talus or very shallow rocky soils occur in areas of very high relief along steep canyons and mountain landforms. Some of these areas are not suitable for timber production due to difficulties with regeneration. Other areas may be unsuitable because they could become unstable through timber harvest or road construction. However, in this project area, zones of slope instability are relatively uncommon.

For the most part, the soils of the planning area are in good condition. Previous harvest activities did not result in excessive erosion, loss of effective ground cover, or slope instability that could have affected the long-term viability of the soils to support productive healthy forests. However, prior harvest with ground based equipment has resulted in residual soil compaction in many units. The

adverse effects and extent of the compaction are within the Willamette National Forest Plan Standards and Guidelines (1990). A more detailed discussion can be found in the Soils Specialist Report in Appendix E.

Environmental Consequences—Soil Productivity and Slope Stability

Alternative A (No Action) — Direct, Indirect, and Cumulative Effects

Under this alternative, the soil resource in the near term of a few years would remain relatively unchanged. Stands would continue to develop. Intermediate and suppressed trees would slowly be removed from the stand through mortality and decay. In areas of heavy stocking, stands would stagnate. Overstocked stands would rapidly see density increase, growth slow, and mortality rise. Fuel accumulations from blow down, snow down, and bug kill would continue to increase. With bio-turbation and freeze/thaw, compaction would slowly be reduced. Short-term impacts from harvest, such as soil disturbance, dust, and slash accumulation, would not occur. There are no ongoing or reasonably foreseeable projects within the analysis area for soils productivity and slope stability.

Alternatives B and C — Direct and Indirect Effects

A field review of the project area was completed in 2006 and 2007 by a Forest Geologist to verify the present SRI land type boundaries, determine the location of unsuited and unmanageable land types, and to evaluate potential soil impacts from management (see Appendix E).

The activity most likely to result in adverse effects on soil is yarding of timber with ground-based systems. The proposed action, Alternative B, proposed the use of ground-based yarding systems on 770 acres, while Alternative C proposes ground-based yarding on approximately 760 acres. Soil compaction, displacement, and reduced infiltration can occur during timber harvest and road construction activities, which could adversely affect the re-establishment of vegetation. However, best management practices to manage these impacts within acceptable levels have been included in each of these alternatives. In addition, sub-soiling is proposed in ground based units to further reduce compaction levels. Mechanized fuel treatments on many of these acres are also proposed. Past experience with these treatments that typically result in single pass operations that operate on top of slash and on existing skid roads as much as possible is that they do not add substantially to soil impacts. This is supported by a recent study of similar mechanized fuel treatments that involve ground based vehicle mounted mastication equipment. Moghaddas and Stephens (2008). Through the use of suspension and duff retention objectives, short-term impacts of these alternatives would remain within Forest Plan standards and guidelines. Substantial erosion is not likely based on the infiltrative capacity of the coarse textured soils and the implementation of required erosion management BMPs discussed in Chapter 2. Long-term adverse effects from the loss of productivity or instablility would either be within established limits or are not anticipated.

In 2001, McKenzie River District personnel monitored the impacts resulting from the use of ground- based yarding systems in two partial cutting units similar to those proposed in the action alternatives, and on similar landtypes in the Thin Within Timber Sale monitoring, Willamette National Forest (USDA Forest Service, 2001). In both monitoring units, soil impacts were within the

acceptable limit of 20% total detrimental condition as required by the Forest Plan. In one of the units, approximately 15% of the area was impacted, and in the other unit, approximately 8 % of the area was impacted. Compaction and displacement on these monitoring units were maintained within acceptable levels by using designated skid trails, placing slash on skid trails to buffer impacts, and operating machines on continuous snow pack. It is reasonable to anticipate similar results for the proposed treatment units in the Bridge Thin Project.

Alternatives B and C — Cumulative Effects

Many of the previously managed stands that were harvested several decades ago were harvested with ground-based systems. Transects through these units indicate that existing compaction from skid roads and landings is approximately 8 to 18%. Bare soil areas no longer exist, although some evidence of disturbance is still evident. The Forest standard for disturbance and compaction is 20% of the unit area, including all roads and landings. Without the implementation of best management practices (BMPs), the potential exists for compaction from this entry to exceed those standards. To minimize the potential for cumulative adverse compaction, all skid road locations would be approved prior to use, and existing skid roads would be utilized as much as possible. After harvest, secondary skid roads would be scarified in order to avoid excessive root pruning. Primary skid roads and landings are proposed for sub-soiling to reduce compaction levels. Based on professional experience, it is estimated that upon completion of activities, compaction would remain at the 15% level or be slightly reduced over the existing levels. These results fall within the range permitted by Willamette National Forest standards and guidelines. There are no reasonably foreseeable future actions that would add additional soil impacts to the cumulative effects of past actions along with this proposed action.

Water Quality/Aquatic Resources (Significant Issue #1) _____

For each of the analysis items in this section, a discussion of the affected environment precedes the analysis of environmental consequences. The affected environment discussion provides a description of the existing condition, including important physical and biological components of the 6th field watershed in which the project occurs. It also identifies relevant information from applicable watershed analyses that was used to design and assess the project. The environmental consequences discussion describes the effects of the project on the existing condition.

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Water Quality/Aquatic resources includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Stream Shade and Stream Temperature

Road construction and timber harvest began in the project area in the 1940s, peaking on National Forest System lands in the 1970s. Much of this activity that occurred prior to implementation of the

Willamette Forest Plan in July 1990, resulted in removal of riparian vegetation that provided shade to streams in the project area. The removal of shade likely resulted in elevated stream temperatures that appear to be represented in current temperature data.

Mill Creek has been identified as having impaired water quality within the Bridge Thin Project area for temperatures in excess of the core cold water habitat standard of 16 degrees C. (Oregon DEQ. 2004/2006. 303(d) List of Impaired Waters).

From June through September of 2005 and 2006, stream temperature data were collected at four locations in the project area to support project analysis. The core cold water habitat temperature criteria of 16 degrees C. would apply to all of these streams.

A summary of this data is provided below in Table 14 along with data from Walker Creek, which is an unmanaged wilderness stream of similar size and basin characteristics to Mill Creek.

Table 14. Average Stream Temperatures.

Stream Name	Average 7-day average of Maximum Temp. ° Celsius 2005 Data	Average 7-day average of Maximum Temp. ° Celsius 2006 Data	Range of Values	Average Value	Change from Control
Cone Creek (Control)	16.6° C	18.1° C	1.5° C	17.4° C	NA
Un-named Class 3 Tributary	17.4° C	18.6° C	1.2° C	18.0° C	0.6° C
Walker Creek (Control)	14.5° C	NA	NA	14.5° C	NA
Mill Creek at Forest Boundary	14.2° C	15.8° C	1.6° C	15.0° C	0.5° C
Mill Creek at Hwy 126	20.0° C	21.2° C	1.2° C	20.6° C	NA

The existing conditions for stream temperatures in the Bridge Thin project area appear to be slightly elevated above control conditions as a result of timber harvest. Both Upper Mill Creek and the un-named McKenzie tributary that flows northward to the river are approximately 0.5 degrees C warmer than geologically and hydrologically similar control streams that have been predominantly un-impacted by land management activities. This is not a definitive difference based on only a few years of data, but the safe approach is to assume that the difference is attributable to past harvest that has reduced shade in these drainages.

Lower Mill Creek is dramatically warmer (approximately 5.5 degrees C) than the site on Upper Mill Creek. This is most likely due to a combination of agricultural, residential, and recreational impacts on private lands on the floor of the McKenzie valley, in combination with influent stream conditions as Mill Creek loses water to deep, porous glacial terrace deposits on the valley bottom.

The range of maximum temperatures from one water year to the next did not substantially differ, nor did the annual timing of the maximum temperature, which occurred between July 20 and August 10 in all instances. This suggests that management has impacted only the increased value for maximum temperature and has not affected inter-annual variability or annual timing of peak temperatures.

Environmental Consequences—Stream Shade and Stream Temperature

Alternative A (No Action) — Direct, Indirect, and Cumulative Effects

Activities that affect stream-shading vegetation would not occur, and direct, indirect, or cumulative effects of this alternative on stream temperature are not anticipated. Water temperatures in streams in the project area would continue to recover toward more natural levels, as riparian vegetation that was disturbed or removed by management activities prior to implementation of the LRMP re-grows and re-establishes streamside shade.

Alternatives B and C — Direct, Indirect, and Cumulative Effects

For all action alternatives, treatments within riparian areas have been designed to fully comply with "Northwest Forest Plan Temperature TMDL Implementation Strategies – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (USDA Forest Service and USDI Bureau of Land Management. 2005). This document was prepared in collaboration with Oregon Department of Environmental Quality and United States Environmental Protection Agency to provide documentation of Northwest Forest Plan compliance with the Clean Water Act with regard to state water quality standards for stream temperatures. As such, it redeems several of the Forest Service responsibilities identified in "Memorandum of Understanding between USDA Forest Service and Oregon Department of Environmental Quality To Meet State and Federal Water Quality Rules and Regulations" (USDA Forest Service and Oregon DEQ, 2002). The Implementation Strategy provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing stands for riparian objectives other than shade, such as production of large wood for future recruitment.

Trees within the stands proposed for treatment are 80 - 150 feet tall currently, and slopes typically fall within a 10% to 70% range. All fish bearing and perennial streams (Class 1 -3) are provided with a minimum of 60- feet of primary shade buffer to retain effective shade for stands of this height and these slopes. Intermittent (Class 4) streams are dry during the portion of the year that elevated temperatures are a problem. However, bank stability trees and 30 foot no harvest buffers would be retained for other resource objectives, and would provide substantial shade regardless. For all classes of stream, at least 50% crown closure would be retained within the entire remainder of the riparian reserve, including that portion which may provide secondary shading benefits.

Based on implementation of the design criteria outlined in the preceding discussion and field observations during project reconnaissance, no measurable direct, indirect, or incremental cumulative increases of stream temperature are anticipated within the project area, as a result of these alternatives.

Consequently, as in the No Action Alternative, water temperatures in Mill Creek and other streams in the project area would continue to recover toward more natural levels, as riparian vegetation re-grows and re-establishes streamside shade. Incremental increases or decreases in the rate of recovery as a result of implementation of this alternative are not anticipated.

Alternatives B and C—Conclusions

Based on the previous discussion and field observations, no measurable direct, indirect, or incremental cumulative increases of stream temperature are anticipated within the project area as a result of any of these alternatives. The magnitude of cumulative increases resulting from past management activities were disclosed in the earlier Affected Environment discussion and there are no reasonably foreseeable actions that would not comply with TMDL requirements for the McKenzie Basin.

Affected Environment—Stream Flows/Disturbance History

Traditionally, projects involving timber harvest on the Willamette National Forest are analyzed for their cumulative impact on the quantity and timing of peak flows and water yields using an accounting methodology known as Aggregate Recovery Percentage or ARP. The ARP model compares the amount of an analysis area within the transient snow zone that is recovered against a threshold value (Midpoint) that was calibrated for the area during development of the Forest Plan. The midpoint values were developed based on the soil, geology, vegetation, climate, and stream channel conditions of each sub-watershed, and are intended to represent a minimum safe level of vegetative recovery in the sub-watersheds to prevent significant alteration of peak flow regimes as a result of management activities. Recovery generally occurs when stand diameters average 8” dbh and crown closures exceed 70%. The transient snow zone is generally considered to include those areas of the forest between the elevations of 1,500 and 4,000 feet respectively. The analysis is based on data extracted from the Forest’s VEGIS database, which includes information about all past harvest activities in the sub-watershed. Currently, ARP levels in the McKenzie River/Elk Creek Sub-watershed stand at 88.31%, which is well above the Forest Plan Midpoint of 80%.

Since we had no reliably consistent source of vegetative age data for private industrial forest lands, we developed an average vegetative stand age for these lands that would remain steady over time. Treating these lands as zero percent recovered, or 100 percent recovered, was not intuitive. We assumed that these lands were managed over an average rotation length of 45 years, and that harvest occurred at a steady rate over the life of the rotation. This yielded an average stand age of 23 years over time, which equates to an ARP value of 88%. We also estimated the percent of these lands that were occupied by roads, based on some photo analysis. As a result, we assumed that 6% of these lands would be 0% recovered. We subtracted the 6% attributed to roads from the 88% ARP value and arrived at an adjusted ARP value of 82% that we could apply to these lands.

Environmental Consequences—Streams Flow/Disturbance History

Alternative A (No Action)—Direct and Indirect Effects

Alternative A, No Action, would result in no changes to existing peak flows, having no direct, indirect, or cumulative effects on streams flow in the project area.

Alternatives B and C—Direct and Indirect Effects

Table 15 below summarizes levels of recovery immediately after implementation of the project for each of the alternatives. The incremental change associated with each alternative is determined by comparing these values with current condition values above in Table 14.

Table 15. Recovery Levels Immediately after Project Implementation (2010).

Sub-watershed	Alternative A (No Action)	Alternative B	Alternative C	Midpoint ARP
McKenzie River/Elk Creek	88.31%	88.26%	88.26%	80%

Examination of this information indicates that ARP levels are maintained well above recommended values by all alternatives in the affected sub-watershed, even immediately after implementation when the potential for impacts to vegetative recovery would be greatest. Therefore, no altered peak stream flow regimes are anticipated from implementation of the proposed actions.

Alternatives B and C—Cumulative Effects

As previously discussed, Aggregate Recovery Percentage (ARP) provides an analysis of the cumulative impacts of past management activities, and actions included in the alternatives for this project. There are no reasonably foreseeable future actions on Forest Service or private lands within the project area that would result in effects that differ from those already disclosed for each of the alternatives.

Affected Environment—Sedimentation and Roads

The geologic terrain and soils of the Bridge Thin Project area are not inherently prone to extensive erosion unless disturbed as discussed in the Soils Specialist Report in Appendix E. However, beginning in the 1940s road construction and timber harvest began in the project area, peaking on National Forest system lands in the 1970s and continuing at somewhat higher levels on private lands within the sub-watershed. As discussed in the Soils Report, past timber harvest methods were employed on National Forest system lands that managed for minimal soil disturbance, but did result in compaction levels varying from 8% to 18% of those acres that were harvested with ground based logging systems. Road construction on the gentler portions of the project area on broad terraces adjacent to the McKenzie resulted in displacement, but little off site transport of sediment to streams, except at crossings.

Roads on the deeply dissected slopes above the riverine terraces, especially those roads constructed during the earlier part of the time period, employed construction methods such as cut and fill that resulted in relatively unstable facilities. These roads continued to produce sediment during storm events as unstable portions of road fills failed and resulted in debris torrents. Since implementation of the Forest Plan in 1990, road maintenance activities have worked to eliminate many of these unstable fill situations. Many were repaired to the higher standards after their initial failure. Even so, roads continue to be the largest source of human-caused sedimentation in the project area, especially at stream crossings where road sediment can enter streams and undersized culverts can fail during flood events. Based on observations of existing road conditions during field reconnaissance for the project, sediment outputs from roads were estimated using the roads module of the Watershed Erosion Prediction Project (WEPP) model. The current sediment yield from roads is estimated at 247 cubic yards per year for the project area.

The McKenzie River Sub-Basin, including the Bridge Thin Project Area, provides municipal water to the City of Eugene by way of the Eugene Water and Electric Board's intake at Hayden Bridge, approximately 50 miles downstream from the project area. Sedimentation and associated turbidity are the most likely consequences of the Bridge Thin Project that could adversely affect municipal water quality.

As was discussed in the Soils discussion and further detailed in the Soils Specialist Report in Appendix E, project area soils are predominantly coarse textured and are characterized by a relative lack of clay mineral components. These soil characteristics result in minimal impacts to turbidity, even when sediment is being moved. This was observed first hand by reconnaissance during a storm event in October 2007. In addition, broad, porous, riverine terraces adjacent to the McKenzie create shallow stream gradients and conditions where streams lose water to the soil. These terraces range from a quarter mile to more than a mile wide in places, creating ideal conditions for streams to lose water and velocity and a resultant reduction in sediment carrying capacity. This landform is so effective in controlling runoff that only the largest streams are able to pass through the terraces as perennial streams. Observation of one large un-named tributary that suffered a failed road crossing after the 1996 flood showed an eroded gully below a catastrophic road failure that completely attenuated on the terrace and failed to deliver material to the McKenzie River.

Environmental Consequences—Sedimentation and Roads

Alternative A (No Action)—Direct and Indirect Effects

Alternative A, No Action, continues the current management situation regarding roads maintenance in the project area. This alternative would not change the potential for sediment delivery to streams from roads in the project area.

Alternatives B and C—Direct and Indirect Effects

The area of analysis for the direct, indirect, and cumulative effects of riparian habitat enhancement is the McKenzie River/Elk Creek 6th Field Sub-watershed. Road reconstruction work associated with the Bridge Thin Project includes replacement of a number of culverts that are currently in poor repair or

inadequately sized to pass "Q100 flows", or a flood that has a 1% probability of occurring in any given year. Replacement will require in-stream work in these streams. Work will be done during non-flow periods for intermittent streams, and engineering practices such as sediment barriers and flow bypass will minimize impacts on perennial streams. Flows in perennial streams are all expected to be less than 1.0 cubic feet per second when work occurs, based on personal observation during project reconnaissance. It is not possible to do this work without some sediment delivery, and accurate estimates are not predictable. Depending on weather behavior and other variable factors, sediment yields should fall between 0.5 and 2.0 cubic yards per installation based on professional experience. The culverts currently represent an elevated risk of fill failure because the culverts to be replaced are in poor condition or are undersized for Q100 flows. Discussion with engineering personnel indicated that the average fill volume is 250 cubic yards. This material is at risk of entering the streams and potentially generating debris torrents if the existing culvert fails. Table 16 provides a summary of these replacements and the potential amount of fill material that would have a reduced risk of entering streams, as well as estimates of the amount of sediment produced from the culvert replacements. The maximum estimate of sediment yields from the culvert replacements would be 58 cubic yards for Alternative B and 62 cubic yards for Alternative C. In comparison, the approximate cubic yards of fill stabilized for Alternatives B and C are 7,250 and 8,000.

Table 16. Culvert Replacements in Perennial and Intermittent Streams by Alternative.

	Stream Type	Number of Culverts Replaced	Cubic Yards of Fill Stabilized	Sediment Yields from Culvert Replacements (Cubic Yards)
Alternative A (No Action)	Intermittent	0	0	0
	Perennial	0	0	0
	Total	**0**	**0**	**0**
Alternative B	Intermittent	20	5,000	10 - 40
	Perennial	9	2,250	4.5 - 18
	Total	**29**	**7,250**	**14.5 - 58**
Alternative C	Intermittent	20	5,000	10 - 40
	Perennial	12	3000	6 - 24
	Total	**31**	**8,000**	**15.5 - 62**

In addition, the perennial culvert replacement that is included in Alternatives B and C only would occur where Mill Creek crosses Road 2633-720. This crossing would be designed to meet 100 year flows, which would also permit restoration of fish and amphibian species to and from stream habitat above and below the crossing.

All temporary roads that would be used in the action alternatives are situated on stable terrain, and all are situated where the potential for extension of drainage networks is negligible. These conditions make run-off and transport of sediment from disturbed soils unlikely, and consequently minimal amounts of sediment are expected to reach stream channels as a result of this activity.

All action alternatives would implement the road management activities listed in the description of each action alternative, as detailed in Chapter 2. The following table provides additional information about road maintenance:

Table 17. Road Maintenance Summary.

	Alternative A	Alternative B	Alternative C
Miles	0	34.3	33.7
New/Replacement Relief Culverts	0	42	45

As a minimum, these activities would include maintenance of proper drainage through maintaining existing structures, installing water bars, or restoring natural drainage features. Also included would be the installation of new-ditch relief culverts and replacement of existing ditch-relief culverts that are currently in poor condition. These actions would reduce the likelihood of sediment leaving the road with runoff by reducing the average distance between drainage structures and consequently, the amount of water that each structure needs to handle. Less water translates to less sediment-carrying capacity

Alternatives B and C—Cumulative Effects

As was disclosed in the discussion of the affected environment, an analysis of estimated sediment outputs from roads in the project area was completed using the roads module of the Watershed Erosion Prediction Project (WEPP) model. The same analysis was conducted for the project area road system for each of the alternatives, incorporating all project related road maintenance, reconstruction, and temporary construction activities, as well as product haul. Results were calculated to estimate sediment production rates during the implementation of the project as well as conditions following completion of the project. The results are summarized in the following table.

Table 18. Estimates of Sediment Production Rates.

	Alternative A (No Action)	Alternative B	Alternative C
Road Sediment Yield During Implementation (CuYd/Yr)	247	272	271
Road Sediment Yield after Implementation (CuYd/Yr)	247	230	227

Rates of road related sediment yield remain constant under the Alternative A (No Action), reflecting no specific changes in ongoing road treatments or conditions. For each of the action alternatives, annual sediment yield increases during the life of the project as a result of project

activities. This represents an incremental increased contribution of sediment that cumulatively adds to sediment already produced under the existing road system. However, each of the action alternatives also show a net incremental decrease in annual sediment yield after completion of the project. This reflects the lasting results of improvements made to the existing road system as part of the project, and represents an incremental reduction in the cumulative amount of road generated sediment.

Affected Environment—Riparian Habitat Improvement

Road construction and timber harvest began in the project area in the 1940s, peaking on National Forest system lands in the 1970s. Much of this activity that occurred prior to implementation of the Willamette Forest Plan in 1990 resulted in removal of riparian vegetation that provided large wood and shade to streams in the project area. The effects of these actions on stream shade and stream temperatures were included in analysis discussion. From these discussions, it is clear that the removal of wood resulted in reduced availability of large wood for in-stream and riparian habitat. The purpose of this analysis is to disclose some the effects of this project as well as other recent projects which begin to address the need to restore the large wood component to riparian stands.

Primary streams within the McKenzie River/Elk Creek 6th Field watershed include Elk Creek/Cone Creek, and Mill Creek and the main stem McKenzie River. Other streams located outside the 6th field watershed in the immediate vicinity and tributary to the McKenzie River include Quartz Creek, Blue River, South Fork McKenzie River, and Horse Creek.

The watershed is located in the Western Cascades region, and marks the lower extent of Pleistocene glaciation in the McKenzie River sub-basin. The planning sub-watershed is characterized by glacial terraces that are porous (composed of coarse glacial deposits) that infrequently allow channels draining side slopes north and south of the river to make surface water connection to the McKenzie River. Landslides, torrent events and mass wasting, while completely natural and essential to aquatic habitat health over a large scale and long term developmental scale, are often intercepted by the glacial terraces. The broad glacial terraces, ranging in width from 1,000 feet to one mile, are low gradient barriers between the McKenzie River and steep slopes above. The effect to aquatic habitat quality is to intercept the products of disturbance; debris and sediment. The exceptions on the north side of McKenzie River are two small tributaries, Elk/Cone Creek and Mill Creek, and on the south side, two unnamed tributaries. The named tributaries function as typical Western Cascade tributaries that historically delivered debris and sediment to the McKenzie River. Elk Creek continues to function much as it has historically, with a bridge crossing at Hwy 126 allowing most disturbance products to reach the McKenzie River. Mill Creek is more prone to have its transport products filtered (woody debris transported by the channel) by the culvert at Hwy 126 crossing.

Elk Creek is largely unmanaged and possesses a low road density. Elk Creek channel conditions reflect a low level of management, with good habitat quality and in-stream wood density. Mill Creek and unnamed tributaries to the north and south of the McKenzie River reflect recent timber management and high road density in their aquatic habitat condition. Low in-stream wood volumes, altered sediment storage capacity and aquatic habitat quality are less able to provide for the life history requirements of native aquatic organisms.

Environmental Consequences—Riparian Habitat Improvement

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Implementing Alternative A, No Action, would have no effect on riparian habitat. An increased risk of loss of riparian stands to catastrophic fire, carried more efficiently through un-thinned riparian stands, exists. Densely stocked riparian stands suffering mortality from fire disturbance would contribute pulses of wood to adjacent stream channels, with short-term loss of stream shading in fire affected stands. The scale of fire disturbance would not be expected to exceed the historic fire disturbance on this landscape, when considered in combination with expected fire suppression.

Alternatives B and C—Direct and Indirect Effects

Area of riparian reserves thinned (Alt. B= 145 acres; Alt.C =137 acres) within stands and receiving fuel thinning treatments (142 acres for both action alternatives) are similar. Table 19 summarizes the percentage of riparian reserves affected by fuels treatments or harvest.

Table 19. Percent Riparian Acres Prescribed for Riparian Thinning and Fire Treatment (Within the McKenzie River/Elk Creek 6th Field sub-watershed)

Activity	Alternative A (No Action)	Alternative B	Alternative C
Based on Percentage of Riparian on Federally Managed Lands within the Project Area			
Riparian Thinning	0%	12.6%	11.3%
Prescribed Fire	0%	10.0%	10.0%
Based on Percentage of Riparian within the Project Area (including Private Lands)			
Riparian Thinning	0%	4.7%	4.2%
Prescribed Fire	0%	3.7%	3.7%

One of the expected results of thinning in riparian reserves is that stand structure, especially the development of larger diameter trees, can accelerate forests toward late-successional conditions. Partial cutting can also accelerate development of large diameter trees that would eventually fall and provide large wood structure in streams and adjacent riparian areas. Maintaining the existing hardwood component also adds to structural diversity and complexity.

Introduction of low severity fire into riparian reserves is also anticipated to increase the plant species and stand structural diversity. At low burn severities, large wood would not be removed from the reserves. In addition, with local differences in soil moisture and relative humidity, the pattern of burning in the riparian reserves is expected to resemble a patchwork mosaic of unburned and lightly burned sites. In the unburned portions, the existing under story vegetation including conifers would be retained. In lightly burned areas, under story conifers would experience some mortality, but fire "endurer" species such as willow and other hardwood shrubs would re-sprout and in some instances be stimulated into increased growth in response to the disturbance. The net result would be increased plant species and stand structural diversity, with a closer resemblance to historic stand condition than

non-thinned plantations. Riparian reserve effects discussion, summarized here, is further described in the Fisheries Biological Assessment and the Aquatic Conservation Strategy Consistency (Appendices A and B).

Alternatives B and C —Cumulative Effects

At the 6th field watershed scale, riparian areas on non-federal forest land (as regulated by riparian protections provided by Oregon Forest Practices) are expected to contribute a steady, low level of recruitment potential compared to historic contribution. Recruitment potential provided by river and stream adjacent rural residential property is expected to continue on a rate of decline.

The quantity of significant-sized large woody material (those 24 inches in diameter or greater) available on federally managed land to project area channels is expected to increase through time, in part accelerated through riparian reserve treatments proposed in the Bridge Thin project. Deficits of in-stream wood identified during surveys of channels in the project are expected to begin gaining in density and volume. Combined with riparian reserve protections provided by the Forest Plan, and thinning treatments proposed with action alternatives, the composition of thinned riparian reserves is expected to look less uniform and contribute a higher quality habitat element (compared to deficits in larger tree diameters found in-stream and within riparian reserve stands currently in the sub-watershed). Bridge Thin project riparian reserve thinning proposal would maintain existing hardwood elements within the reserve and maintain hardwood stand diversity and complexity.

A short-term reduction in current stem number available to channels adjacent to thinned federal reserves would occur with action alternatives. Riparian stand thinning within 60 feet of perennial channels (consisting of skyline corridors) is low in magnitude, and is expected to maintain aquatic habitat quality. The removal of thinned trees capable of contributing immediately to in-stream habitat (and influenced by action alternatives) are generally located between 60 and 100 feet distant from the channel, consisting of the upper half to upper third of tree, composed of small diameter of minor longevity and sediment storage value to current habitat. A similar rate of recruitment from among stands 0-60 feet from perennial channels is expected (compared to Alternative A), where no thinning occurs with action alternatives.

Affected Environment—Aquatic Resources

The following description of aquatic resources describes fish species considered Management Indicator Species (those native and anadromous fishes described below) in the Willamette Forest Plan. The scale of analysis of effects on aquatic resources describes the McKenzie River/Elk Creek 6th Field sub-watershed, evaluated at this scale due to the project footprint and potential effects of project activity downstream.

Management Indicator Species

Fish historically present in the project area include mountain whitefish (*Prosopium wouldiamsoni*). Mountain whitefish are currently common in main stem McKenzie River, although fragmentation of habitat at Cougar and Blue River flood control dams, likely limits the extent of habitat meeting their

life history needs. This river dwelling fish historically had access to higher quality habitat in the project area (meeting migration, reproductive, rearing and foraging needs) and were expectedly more numerous.

Native rainbow trout (*Oncorhynchus mykiss*), with similar distribution to whitefish, are river dwelling in the main stem McKenzie River and larger tributaries. The robustness of McKenzie River rainbow trout populations following completion of Cougar and Blue River dams is believed diminished. The combination of habitat condition and ODFW stocking of non-native fall spawning rainbow and introduced summer steelhead, is believed to suppress native rainbow trout abundance in the project area through fragmentation of habitat, habitat degradation, and competition with non-native species.

Native cutthroat trout (*Oncorhynchus clarki clarki*), are the most widely distributed fish in the landform, ranging from headwater streams (Class II perennial and intermittent fish-bearing streams in the project area provide habitat for cutthroat trout) to the main stem McKenzie River. Some cutthroat trout are found in Class II intermittent channels that drain project valley walls, but flow subsurface through valley bottom glacial deposits, effectively isolating these small populations from larger channels. Surface flow connectivity of these small channels to main McKenzie River occurs only during high flow/flood events. Previous timber management in riparian areas has affected aquatic habitat quality in cutthroat tributaries by altering the quantity, size and supply of in-stream woody material.

Use of tributaries by Western brook lamprey (*Lampetra richardsoni*) is documented in low gradient, fine-grained sediment channels and backwater areas. Stream classifications of Class II (fish-bearing) channels identify habitat currently utilized by Western brook lamprey. The extent of brook lamprey distribution compared to historic distribution is believed reduced in the project area, through loss of floodplain connectivity and modification of wetlands with rural development. Brook lamprey use of habitat is as juvenile (ammoceoete) rearing and adult reproduction. Ammoceotes are filter feeders, eating microscopic plant and animal matter (diatoms, algae and detritus) as they develop, buried in sediments. Adults do not feed during their short life of several months.

Listed Species Distribution and Habitat Requirements

Native spring Chinook salmon (*Oncorhynchus tshawytscha*) migration, reproduction and rearing occur in the project area in the main stem McKenzie River and overlaps current and historic bull trout distribution in the project area. Populations of listed species present and access to habitat in main stem McKenzie River and South Fork McKenzie River have been fragmented with construction of flood control and hydroelectric projects. The distribution and access to habitat of spring Chinook salmon and bull trout in the McKenzie basin has changed with construction of dams by Army Corps of Engineers, and Trail Bridge Dam (1963) by Eugene Water & Electric Board. Chinook access to 18 miles of historic habitat in the South Fork McKenzie River is interrupted by Cougar Dam, and about 4 miles of historic habitat above Trail Bridge Dam. A run size of 5,360 spring chinook is estimated to have used the South Fork McKenzie River based on redd numbers in 1956. A run size of about 200 spring Chinook is estimated to have used the McKenzie and Smith Rivers above current Trail Bridge

Dam. In an effort to restore marine-derived nutrients provided by spring Chinook and a source of bull trout prey supplied by naturally produced Chinook juveniles, ODFW places spring Chinook adults above Cougar and Trail Bridge Dam by trap and haul. Chinook salmon access to habitat below dams remains unobstructed (a fish ladder provides passage over Leaburg Dam at McKenzie river-mile 39). Current distribution of spring Chinook spawning production above Leaburg Dam is estimated at *30% in the mainstem McKenzie between the Leaburg Dam and the South Fork McKenzie confluence* (this area includes the project area reach); 10% spawning in the South Fork McKenzie below Cougar Dam; and 60% in the mainstem McKenzie above the South Fork McKenzie confluence. Current returns of Chinook adults above Leaburg Dam range from 1,110 (1997) to 9,913 (2003).

The vicinity of the project area and McKenzie River downstream of the project area is utilized by spring Chinook as spawning habitat, juvenile rearing habitat, and as a migration route to spawning habitat by adults and emerging fry from incubation areas. Low gradient reaches of the McKenzie River in the project area are used as spawning habitat by spring Chinook salmon. Spawning in these reaches occurs in September and October, with fry emergence about 3 months later. Fry emergence in the main stem McKenzie River is followed by migration of most fry to Columbia River estuaries, then the Pacific Ocean, with a portion of the emerging fry residing in low velocity, off-channel and tributary habitat of the McKenzie River for their first year of life. Habitat requirements of spawning adults are cold, clean water and channel substrates low in fine sediments. River and stream channels with a variety of flow velocities provided by riffles and pool tail-outs (adult spawning habitat), deep pools (adult holding habitat), off-channel areas and tributaries (juvenile rearing habitat), in-stream wood as a source of cover (for adults and juveniles) and pool scour. These habitats provide optimal conditions for spring Chinook salmon. Water temperatures necessary for optimal salmon spawning range from 5.6 – 12.8 degrees Celsius; egg incubation 4.5 - 12.8 degrees; juvenile rearing from 10.0 - 15.6 degrees.

The McKenzie River sub-basin provides habitat for the largest remaining portion of wild spring Chinook in the Willamette Basin. High water quality in the form of cold water temperature and good habitat quality remaining in the upper sub-basin provides the largest remaining core area for spring Chinook salmon reproduction and rearing in the basin. The project area portion of the sub-basin historically provided greater quantity and quality habitat with a greater level of channel complexity and off-channel area. River adjacent development (rural residential development and bank hardening), reduced large wood recruitment potential, and modified flow, sediment and wood routing regimes (as modified by dams and roads), have diminished salmon production in the project area. Mitigation of salmon production lost to flood control dams is supplemented by use of hatchery production. Hatchery production is believed to have altered wild spring Chinook persistence and genetic integrity in the sub-basin. Loss of local adaptation has likely occurred as a result of significant levels of straying and use of hatchery-origin spring Chinook. Changing emphasis in Oregon to native fish production (transport and passage of salmon into historic habitat, and lowered dependence on hatchery production) is expected to provide for improved wild salmon production, and recovery of locally adapted stocks. Completion of the Cougar Temperature Control Project in 2005 by ACOE has restored historic temperature regimes in this portion of the sub-basin and is expected to improve

incubation survival and migration timing in the project reach of the McKenzie River. Spring Chinook salmon are listed as Threatened and protected under the Endangered Species Act. Spring Chinook recovery efforts include a proposed Trap-and-Haul facility at the base of Cougar Dam, which is expected to improve migratory connectivity between main stem McKenzie River and the South Fork McKenzie River above the dam. The project is planned by ACOE to be implemented beginning in 2008.

Bull trout (*Salvelinus confluentus*) use of the McKenzie River in the project area is as a migratory corridor, and sub-adult and adult foraging habitat. River temperatures are naturally too warm in this portion of the McKenzie sub-basin to provide bull trout spawning and early rearing habitat (bull trout spawning/early rearing areas are located in spring-fed tributaries about 16 miles upstream of the project area).

Sixteen miles upstream of the project area, Anderson Creek, Olallie Creek and a small portion of McKenzie River channel immediately downstream of Trail Bridge Dam provide the only known bull trout spawning and rearing habitat for the main stem McKenzie bull trout population. In all known spawning tributaries, exceptional habitat and water quality conditions provide for the reproductive needs of bull trout within a narrow temperature range. Bull trout spawning occurs between 4-10^{o}C, embryo incubation between 1-6^{o}C, and juvenile rearing between 4-10^{o}C (Spence et.al 1996). The spring-fed Anderson and Olallie Creek provide optimal bull trout spawning temperatures of 4-7^{o}C, with lower temperatures available during the fall and winter incubation period. Once bull trout fry have emerged from gravels of these streams, optimal rearing temperatures are available at 4-7^{o}C.

The project area reaches of the McKenzie River and portions of the McKenzie River downstream of the project area are utilized by bull trout as sub-adult (approximately 3-5 year old bull trout) and adult (6-10 year old bull trout) foraging habitat, and as a migration route to and from spawning habitat. Bull trout migration through the project area, en route to spawning habitat, occurs upstream beginning in late spring and downstream following completion of spawning in fall. Historic channel complexity is expected to have provided greater quantity and quality for prey species, particularly spring Chinook salmon, and for greater numbers of foraging bull trout. Bull trout are currently listed as Threatened and protected under the Endangered Species Act.

Bull trout populations in the McKenzie River and South Fork McKenzie River have been isolated by the Cougar and Trail Bridge Dams. Three separate populations of bull trout currently exist in the McKenzie sub-basin. Above Trail Bridge Dam in the main stem McKenzie, an isolated Trail Bridge bull trout population consists of about 50-75 adults. Above Cougar Dam, an isolated South Fork McKenzie bull trout population consists of about 75 adults. Below the dams, the main stem McKenzie River bull trout population consists of about 150-200 adults. The distribution of listed species and habitat utilized by spring Chinook salmon and bull trout in the vicinity of the project area is illustrated in the Biological Assessment appendix. Bull trout recovery plans include a proposed Trap-and-Haul facility at the base of Cougar Dam, which is expected to improve migratory connectivity between main stem McKenzie River to the South Fork McKenzie River above the dam (and access for migrants to spring-fed spawning habitat in Roaring River). The project is planned by Army Corps of Engineers (ACOE) to be implemented beginning in 2008. Additional description of Endangered Species Act

listed aquatic species is found in the EA appendix (Biological Assessment for Spring Chinook Salmon and Bull Trout).

Aquatic Habitat Quality

A major influence on the mainstem McKenzie River channel condition in the vicinity of the project is the presence of flood control dams upstream. Cougar (completed in 1963) and Blue River (completed in 1968) dams have altered the flow regime and sediment supply to the mainstem McKenzie and cut off sediment supply from over half of the drainage area (Minear 1994). Minear also noted a reduction of large woody debris in the 1986 channel as compared to historic aerial photos from 1949, indicating a reduction in pool-forming agents and channel roughness elements. Increases in development along the McKenzie River, including timber harvest and roads, have resulted in a 44% reduction in riparian area mature conifers and 45% increase in hardwoods from levels in the 1940's.

Completion of Cougar and Blue River flood control dams during the 1960's have had significant effects on aquatic habitat quantity and quality within and near the project area. Accessible habitat for migratory and river dwelling native fish was fragmented and reduced with completion of the dams. Interception of substrate supply to the main stem McKenzie by dams has resulted in channel down cutting, substrate coarsening and abandonment of off-channel habitat (Minear 1994). The flood control dams and road system have diminished aquatic habitat quality through interception of woody material as it migrates toward larger channels. Maintenance of river navigability and river adjacent development has also reduced in-stream wood volume and supply. As a result, McKenzie River channel complexity has changed toward a simplified, single channel, where it had historically provided complex off-channel habitat more suited to a variety of life history stages of native fish.

Environmental Consequences—Aquatic Resources

Additional discussion of effects of proposed actions to aquatic resources is described in the Fisheries Biological Assessment (Appendix B).

Alternative A (No Action)—Direct, Indirect Effects

The no action alternative would leave roads untreated, yielding sediment similar to current levels. Project recommendations described would not be implemented. Ground disturbing activities associated with thinning operations, temporary road construction, pit development and fuels treatment would not occur. Landscape delivery of fine sediment, as modified by the road and stream crossing network, would remain largely as it is and subject only to scheduled maintenance (periodic road grading, ditch cleaning and culvert maintenance). The current fine sediment delivery rate as modified by the road network, would remain within the range of conditions necessary to sustain native aquatic biota, but not optimally so. Periodic stream crossing failures may occur at undersized and outdated (especially log) culverts. Culvert failures may induce stresses on resident fish populations, but not at magnitudes that would be expected to extirpate local populations such as cutthroat trout. The effect of no action upon listed species habitat use and distribution in the McKenzie River would yield fine sediments similar to current levels, with potential to produce sediment pulses associated with crossing

failures. Those risks are evident at stream crossings of the 2633 system roads, with direct connection to the McKenzie River. Risks at the stream crossings of the 1900 system roads are negligible due to the lack of surface connection with the McKenzie River.

Alternative A (No Action)—Cumulative Effects

The current road density in federally managed portions of the sub-watershed would remain near 4 miles per square mile. Continuing rural residential development in the sub-watershed (approximately 40% privately owned) may be expected to increase, based on recent trends of private development. Greater development in non-federal portions of the sub-watershed may be expected to increase the concentration of surface water on impermeable surfaces and increase fine sediment yield. Industrial timberland harvest rates are expected to continue at about a 40 to 50 year rotation and yield fine sediments at a relatively constant rate, supplied by private road networks and ground disturbance associated with timber management. Upstream passage measures at Cougar Dam are under NEPA evaluation (a trap-and-haul facility with evaluation by Army Corps of Engineers) and may be implemented following ACOE NEPA analysis. A favorable response by Management Indicator Species would be anticipated with reconnection of the South Fork McKenzie River to project adjacent reaches of the McKenzie River, primarily through population(s) access to historic refuge areas. The No Action Alternative would maintain habitat conditions currently available to aquatic MIS fish and ESA listed aquatic species.

Alternatives B and C—Direct and Indirect Effects

Potential downstream effects of timber harvest and fire treatments to habitat important to Management Indicator Species, including spring Chinook and bull trout is expected to be negligible due to treatment scale, low severity, distance of activity from stream channels/Listed Species Habitat, and the low density of tributary channels in the project area. Few project area tributaries possess surface water connection to the McKenzie River, minimizing potential to affect Listed Species Habitat. Short-term increases in sources of sedimentation from ground disturbing activity (primarily through road reconstruction, culvert replacement, temporary road construction and timber haul) are expected to occur at the site-specific level.

Habitat of importance to listed species could be subjected to short-term increases in turbidity if reconstruction activity were to occur in the immediate vicinity or during wet periods. However, distance of culvert replacements (no closer than 1 mile to listed species habitat) and seasonal restrictions would maintain habitat conditions for at-risk species (mitigation measures table). The net effect of resurfacing activity is to simultaneously reduce road origin fine sediment while replacing undersized and aged culverts. The use of best management practices and mitigation measures to trap fine sediments during culvert replacement is expected to minimize impacts to aquatic habitat and resources, with a negligible increase in sources of suspended sediment. Localized increases in turbidity during and following the season of culvert replacement, is believed to remain within the habitat needs of all aquatic MIS species. Decommissioning of road surfaces and culvert removal would similarly be required to meet seasonal restrictions, limiting the transmission of fine sediment.

Rock Quarry development would take place in the existing Mill Creek Rock Quarry located on FS Road 2633-720. The pit is currently 4 acres and there would be 0.5 acres of new development. Approximately 15,000 cubic yards of material is planned for extraction to use for road reconstruction and maintenance activities. No timber would be removed for new development. The nearest perennial streams are over 1,000 feet away. Mill Creek Rock Quarry is located 1.6 miles from LFH. Therefore, the potential to transmit fine sediment is minimal.

Road maintenance activities would occur during dry season and would be required to be maintained in stable condition during hauling (aquatic mitigations 3 and 4). Combined with improved and new ditch relief placements (42), the improved transportation system is expected to have negligible effect on aquatic habitat in the immediate vicinity of roads (from reconstruction and haul) and minimal effect on listed species habitat, most of which is 0.5 mile or greater from road locations (short-term, localized increases in sources of fine sediment over background levels).

Haul route proximity to aquatic habitat is favorable in terms of mitigating effect on potentially mobilized sediments from the road system south of the McKenzie River (1900 system roads). Haul routes on the north side of the river, in close proximity to the McKenzie River are largely paved (Hwy 126) or are aggregate roads that would be reconstructed to accommodate haul. Maintenance activities, seasonal hauling restrictions and surface water disconnect between the haul routes and McKenzie River would ensure that fine sediments are negligibly transmitted to the river. Aggregate and native surface portions of the haul route on the north side of the river (Rd 2633, 1500 and 1501 system roads), where tributaries connect directly to the McKenzie River, would be improved through reconstruction to accommodate haul and minimize mobilization of fine sediments. The lower-most crossing of the haul route within Mill Creek drainage is 1.5 miles from listed species habitat, and poses little potential to transmit fine sediment sufficient to measure in the McKenzie River. An unnamed tributary to the east of Mill Creek flows through a series of golf course ponds before reaching the McKenzie River, providing the opportunity to store mobilized sediments. Turbidity transmitted from upstream has no opportunity to transport through this low gradient portion of glacial terrace and reach the McKenzie River. The haul route in closest proximity to McKenzie River is Hwy 126, paved for its length through the project area.

Wet season haul would be allowed only on maintained aggregate or paved roads (aquatic mitigation measure 2 and 4) to protect water quality and fish habitat. When roads become excessively dusty, watering of roads is required. The net effect of these measures has been found effective at minimizing sediment mobilization and maintaining aquatic habitat quality.

Construction of 3.1 miles of temporary road would occur only on stable landforms. Where stream crossings are necessary, clean stable fill material would be used. Seasons of temporary road construction are limited to dry season only, to limit potential to transmit fine sediment.

Logging and yarding systems are subject to a variety of restrictions. Aquatic mitigation measures 5–17 are designed specifically to maintain water and habitat quality. The effect of minimizing skyline corridors and requiring riparian corridor trees be left on site, is to ensure ground disturbance remains insignificant and stream bank stability is maintained. Action alternatives would utilize 57 skyline corridors over perennial channels, and 38 corridors over intermittent channels. Removal of stream

adjacent trees includes an increased risk of transporting fine sediments in channels immediate to the corridors. Short-term and local increase in turbidity is expected during the season of yarding. The magnitude of effect is expected to remain within the range of life history needs of resident fish (Unit 40 with 10 skyline corridors over a fish-bearing channel). The ability of channels to transport fine sediment to listed fish habitat is limited by distance removed (ranging from 0.3 mile to 2.7 mile) and mitigations requiring full suspension and retention of corridor trees. In Class 4 channels, where full suspension is not possible, yarding is limited to when the stream is dry (aquatic mitigation measure 10). These measures are in place to maintain at-risk species habitat located downstream in the sub-watershed.

Table 20. Skyline Corridors Through Stream Buffers and Proximity to Listed Fish Habitat

Unit	Acres by Yarding System			Skyline Corridors Across Streams			
				Perennial		*Intermittent*	
	Ground	*Skyline*	*Helicopter*	Number of Crossings	Distance to LFH/CH (ft)	Number of Crossings	Distance to LFH/CH (ft)
2	103	14	9	0	0	2*	No Connection
11	0	31	0	10	7,600	10	tributary to perennial stream
12	0	14	0	11	6,900	3	tributary to perennial stream
36	0	34	0	0	0	6	2,800
40	20	5	0	9 (Class 2)	6,200	0	0
45	15	20	0	10	11,000	4	tributary to perennial stream
47	0	29	0	7	13,800	0	0
51	0	18	0	2**	5,600	6**	tributary to perennial stream
82	0	26	0	6*	No Connection	0	0
84	0	20	7	0	0	3*	No Connection
85	0	0	11				
88	0	8	23	0	0	4*	No Connection
91	17	18	0	2*	No Connection	0	0
841	0	22	0	0	0	0	0
Total	747	931	458	57	__	38	___

* corridors over channel with no surface connection to the McKenzie River (LFH);
**corridors over channel upstream of Tokatee Golf Course and are tributary to a series of golf course ponds.

The use of low severity fire in older stand treatments of Bridge Thin project units is expected to present negligible risk to aquatic animals or habitat. Fire treatments consist of hand or machine piling of slash along roads and understory burning in spring-like conditions. Site conditions (when fuel moisture is sufficient to maintain duff and soil stability) would sufficiently protect aquatic resources in the project area. Potential to increase nutrient levels phosphorous and nitrate to channels increases with use of fire, however the level of nutrient delivery would not exceed the range of conditions approached during historic fire disturbance. Aquatic species have adapted to a more frequent fire disturbance regime than is currently provided in a managed forest landscape. Removal of duff through burning and exposure of soil to mobilization with precipitation is of very low risk. The potential to

adversely affect aquatic biota or habitat is negligible; due to the distance fire is utilized is from the channel and low intensity of fire used in unit treatment.

Alternatives B and C—Cumulative Effects

The current road density in federally managed portions of the sub-watershed would remain near 4 miles per square mile as no new system roads are added and few are removed (0.3 mile) with the proposed project. Continuing rural residential development in the sub-watershed (approximately 40% privately owned) may be expected to increase, based on recent trends of private development. Greater development in non-federal portions of the sub-watershed may be expected to increase concentration of water from impermeable surfaces and increase fine sediment yield. Industrial timberland harvest rates are expected to continue at about a 40-year rotation and yield fine sediments at a relatively constant rate, supplied by private road networks and ground disturbance associated with timber management.

Maintenance of system roads in action alternatives is expected to withstand flood events through improved ditch relief drainage and up-sized stream culverts and may be expected to be more resistant to culvert related failure (compared to current condition). Action alternatives would result in a slight increase in sediment input (an additional 26 cubic yards per year) in the sub-watershed. The expected magnitude and duration of increase (the first fall storm following project activities) is of short duration and within the tolerance of native aquatic organisms to sustain or avoid the sediment increase. The range of conditions necessary for aquatic resources in the project sub-watershed is maintained in the short-term (with localized increases perceptible at the site scale) and increased slightly in the long-term.

With the limited extent of disturbance within riparian reserves in close proximity to stream channels associated with the project, existing aquatic habitat conditions are expected to be maintained. As described in previous effects discussion, project effects on shade and water temperature, sedimentation, and stream flows are expected to be negligible at the sixth field watershed scale. Site-specific disturbance may be expected to be of short duration (approximately 3 years, during timber harvest and haul activity) and of insufficient magnitude to place native aquatic organisms at risk.

Following examination of the cumulative effects of past actions, the proposed project, and reasonably foreseeable actions in the analysis are, the additional management-induced effects from this project would not change the following:

1. The timing or magnitude of peak flow events (planning sub-drainage ARP remain above the Willamette Forest Plan recommended levels);
2. Instability of stream banks (recommended ARP midpoints are exceeded, and exclusion of bank destabilizing activity);
3. Adverse alteration of the supply of sediment to channels (fine sediment supply would be localized and of short duration);
4. Adverse alteration of sediment storage and structure in channels (channel conditions would be maintained with proposed action alternatives).

Blue River and Cougar Dam fragmentation of aquatic habitat in the McKenzie continues to be a major influence on the aquatic landscape and plays a crucial role in at-risk species viability.

The Bridge Thin Project would not incrementally contribute to increased fragmentation of habitat. Upstream passage measures at Cougar Dam are under NEPA evaluation (a trap-and-haul facility with evaluation by Army Corps of Engineers) and may be implemented following ACOE NEPA analysis. A favorable response by Management Indicator Species would be anticipated with reconnection of the South Fork McKenzie River to project adjacent reaches of the McKenzie River, primarily through population(s) access to historic refugia areas. Other projects are not foreseeable within the Bridge Thin Project area that would add cumulatively to past and current actions. Habitat conditions necessary to aquatic MIS species (spring Chinook salmon, bull trout, rainbow trout, cutthroat trout, brook lamprey) and ESA listed species (bull trout and spring Chinook) habitat in the upper McKenzie River are expected to be maintained within and downstream of the project area.

Magnuson-Stevens Fishery Conservation Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires the identification of habitat "essential" to conserve and enhance the federal fishery resources that are fished commercially. The Pacific Fishery Management Council (PFMC) designated Essential Fish Habitat (EFH) for Chinook, coho, and Puget Sound pink salmon in their Amendment 14 to the Pacific Coast Salmon Plan, issued September 27, 2000. The interim final rule implementing the EFH provision of the MSA (62 FR 66531) requires federal agencies to consult with the NOAA Fisheries Service for any action that may adversely affect EFH. Bridge Thin Project is located in the McKenzie River Watershed, which is included in the waters designated as EFH for spring Chinook salmon by the PFMC.

Potential downstream effects from timber harvest, road reconstruction, and fire treatments on EFH habitat for spring Chinook salmon is expected to be negligible due to treatment scale, low severity and proximity of activity to stream channels. Sources of sedimentation are expected to increase in the short-term at the site-specific level from the ground disturbing activity. These increases would result primarily from road reconstruction, culvert replacement, haul and temporary road construction. No stream crossing reconstruction would occur within bull trout or spring Chinook habitat. Habitat of importance to spring Chinook could be subjected to short-term increases in turbidity if reconstruction activity were to occur in the immediate vicinity. However, the distance of reconstruction activity and prevailing sub-surface water flow in the project area would substantially reduce the risk. Project effects are expected to be of short duration during seasons of implementation. Suspended sediments are not expected to adversely impact habitat important to spring Chinook due to low project scale and intensity, flow routes, distance of activity from listed species habitat, and use of best management practices.

As described above, project cumulative effects of past, current (Bridge Thin action alternatives) and foreseeable actions is expected to maintain EFH habitat within and downstream of the project area. The proposed action would not adversely affect aquatic systems, recreational fisheries, or

designated Essential Fish Habitat. The effects that are likely to occur are based on sound aquatic conservation and restoration principles for the benefit of recreational fisheries, as directed by Executive Order #12962. Since the project would not adversely affect EFH, no further consultation under the Magnuson-Stevens Fishery Conservation and Management Act is required.

The No Action alternative would not adversely affect EFH habitat.

Endangered Species Act Consultation

The scale of analysis to address the direct, indirect, and cumulative effects on aquatic resources examined the McKenzie River/Elk Creek six-field watershed, evaluated at this scale due to the project footprint and potential effects of project activity downstream. The proposed action was evaluated for potential project effects on the Matrix of Indicators found within the Fisheries Biological Assessment (EA appendices).

These indicators are Temperature, Sediment, Large Woody Material, Peak/Base Flows, Road Density, Disturbance History, and Riparian Reserves. Potential effects occur primarily as a result of timber harvest, road reconstruction, haul and fire treatments. Effects from the proposed action are expected to be negligible due to treatment scale, low severity and proximity of activity to stream channels (as direct and indirect effects).

Short-term increase in sources of sedimentation is expected to occur at the site-specific level from ground disturbing activity. These short-term increases are primarily the result of road reconstruction, culvert replacement, timber haul and fire treatments. The absence of stream crossing reconstruction in the vicinity of listed species habitat is expected to maintain Critical Habitat for bull trout and spring Chinook salmon. Habitat of importance to spring Chinook could be subjected to short-term increases in turbidity if reconstruction activity were to occur in the immediate vicinity. However, the distance of reconstruction activity and prevailing sub-surface water flow in the project area substantially reduce the risk.

Action alternatives produce effects that are expected to be of short duration during seasons of implementation. As described above, the cumulative effects from this proposal are expected to maintain listed species and their habitat within and downstream of the project area. Implementing Alternative A (No Action) would not adversely affect listed species or adversely modify their habitat.

ESA informal consultation was originally completed with the receipt of a letter of concurrence from USFWS (ref. number 1-7-05-I-0025; date 02/07/2008) agreeing with the Forest Service determination that the proposed action was Not Likely to Adversely Affect bull trout, and it would have no adverse modification of Critical Habitat. A letter of concurrence from NMFS agreeing with the Forest Service determination that Bridge Thin Project (Alternative B, proposed action) was Not Likely to Adversely Affect spring Chinook salmon is forthcoming. No decision will be made concerning the Bridge Thin project until a letter of concurrence from NMFS is received. The quality of Critical Habitat important to listed aquatic species, including spring Chinook salmon and bull trout, is expected to be maintained with implementation of the proposed action or any action alternative.

Threatened Northern Spotted Owl (Significant Issue #2) _____

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for threatened northern spotted owl was a 2.4 mile buffer around all project units that may change habitat conditions for the spotted owl. The analysis area is within the H.J. Andrews northern spotted owl demographic study area and monitoring of owl populations have occurred since 1987 (Anthony et al. 2006). There are nineteen known activity centers within the Analysis Area. Occupancy modeling by USFWS predicted no new home ranges undetected by surveys so all the effects analysis are based on survey data. Seven spotted owl home ranges overlap project units.

Affected Environment—Threatened Northern Spotted Owl

The northern spotted owl is considered a Management Indicator Species (MIS) for old growth habitat in the Willamette Forest Plan p. IV-160 (USDA Forest Service. 1990). Past surveys for spotted owls have documented seven spotted owl activity centers within 1.2 miles of the Bridge Thin Project. All seven spotted owl activity centers have established, 100-acre late successional reserves.

Challenges to spotted owl conservation exist range-wide, which includes potential threats from wildfires, barred owl competition, great horned owl predation, West Nile Virus and sudden oak death. A detailed discussion of these potential threats can be found in the Biological Assessment in Appendix D. Disturbances on the landscape from wildfires and wind storms have affected spotted owl habitat. Loss and fragmentation of suitable spotted owl habitat and other interior forest species habitat in this planning area have had detrimental effects on these species. Fragmented habitat increases flight distance and energy consumption for foraging, and increases habitat suitability for predatory and competitive owls such as the great horned and barred owls. This fragmentation may increase spotted owl mortality, especially for juveniles.

The U.S. Fish and Wildlife Service has determined that reduction of suitable spotted owl habitat below 40% of the median home-range (1,182 acres) has a notably higher likelihood of leading to disruption of essential breeding, feeding, and sheltering behaviors (USDI Fish and Wildlife Service, 1992). A 1.2-mile radius around the activity centers defines the median home range. Three of the seven known activity centers in the Bridge Thin Project area are currently above the 40% habitat threshold.

Suitable spotted owl habitat has been defined in various documents: The ISC Report, USFWS Critical Habitat Determination, Memorandum Decision and Injunction for Judge Dwyer's Decision, and the FSEIS on Management of the Northern Spotted Owl in the National Forests. General guidelines for suitable spotted owl habitat are forested stands of Douglas fir , Western hemlock, Western redcedar, or Ponderosa pine older than 200 years and having a moderate to high canopy closure of 60-80%. An understory of multi-layered conifers and hardwoods open enough to still allow owls to fly within and beneath it, moderate to high snag densities, and large logs are also found in typical spotted owl habitat. However, all of the above characteristics do not need to be present for spotted owls to make use of an area, and for habitat to be determined suitable.

Dispersal habitat typically would not have the large, old-growth nest trees, multi-layered canopy, or many large snags and logs. The minimum canopy closure for dispersal habitat is 40%.

Past logging activities in the Bridge Thin Project area has removed many acres of spotted owl habitat. Remaining suitable habitat in the project area is now highly fragmented, lowering the overall quality of habitat on the landscape.

Environmental Consequences—Threatened Northern Spotted Owl

The Bridge Thin Project would not downgrade or remove existing suitable spotted owl habitat, which consists of nesting, roosting, and foraging habitat. Dispersal habitat would be modified and removed; however, dispersal habitat is not limited within and between home ranges in the project area. The following definitions apply to these terms:

- **Downgraded:** to alter the functionality of spotted owl suitable habitat so that the habitat no longer supports nesting, roosting, and foraging behavior. This downgrading of habitat can result when the canopy and understory are thinned yet still retain a minimum of 40% average canopy closure.
- **Removed:** to alter suitable spotted owl habitat so that the habitat no longer supports nesting, roosting, and foraging behavior. In addition, to alter dispersal habitat so that canopy cover results in less than 40 percent and no longer functions as dispersal habitat.

Effects on habitat are in compliance with Standards and Guidelines from the Willamette National Forest Plan and U.S. Fish and Wildlife Service guidance. All sites at risk from noise disturbance would be protected with seasonal restrictions. Eleven of the proposed project units are located in Critical Habitat and none within Late Successional Reserves.

Informal consultation with the U.S. Fish & Wildlife Service for effects to the northern spotted owl was initiated in October 2007 with a Biological Assessment submitted on January 10, 2008. This Biological Assessment (Appendix D) contains an analysis of spotted owls including effects of project related activities as well as new information and potential threats. A letter of concurrence dated 02/07/2008 was received from US Fish and Wildlife Service that concurred with the Biological Assessment that the Bridge Thin project may affect but is not likely to affect the northern spotted owl or its critical habitat.

Alternative A (No Action)—Direct, Indirect, Cumulative Effects

Under this alternative, no actions would be implemented to changes spotted owl breeding or dispersal habitat. Forest stands in the area would continue to grow following natural successional pathways. Fragmented forest blocks would aggregate into contiguous forest over time. Trees within younger stands would thin out naturally over a span of several decades, and may reach low quality spotted owl foraging habitat suitability in approximately 50 or more years. Due to the previous clearcuts and relatively tight spacing in plantations, trees would grow slower in diameter than if thinning were to occur. Self-thinning would take place over time mostly due to tree competition, some wind throw, and possibly from root rot over time. Down wood would be provided as tree mortality occurs, which contributes to maintaining the spotted owl prey base.

There are no ongoing or reasonably foreseeable activities planned on Forest Service land in the analysis area. The habitat condition of private ground within the affected home ranges as shown in (Table 8 of Appendix D) is almost entirely non habitat for owl sites 0104, 2034, and 2836. For owl sites 0856 and 2443 the habitat condition is approximately 70% and 80% non habitat respectively with the remaining acres likely to be harvested into non habitat in the foreseeable future, given current private timber ground harvest practices. The project analysis assumes that private lands are all non-habitat for spotted owls. Owl sites 0029 and 2422 have no private ground within their designated home ranges.

Alternative B—Direct and Indirect Effects

With alternative B, no suitable spotted owl habitat would be downgraded or removed. Fuel reduction treatment in units 101 and 103 would remove non-commercial material less than 7" in diameter on 38 acres of suitable spotted owl habitat. These 38 acres would remain suitable habitat. Heavy thinning would occur on 228 acres of dispersal habitat and result in a post treatment canopy closure below 40 percent. The canopy closures of these stands are expected to grow at a rate of approximately 1% per year and return to the 40 percent threshold within 8-10 years (Chan et al 2006) An additional 10 acres (unit 80) of dispersal habitat would be removed below 40 percent canopy closure and 38 acres (within units 84, 85, and 86) of oak thinning treatment

Alternative C—Direct and Indirect Effects

With alternative C, no suitable spotted owl habitat would be downgraded or removed. Fuel reduction treatment in units 101 and 103 would remove non commercial material less than 7" in diameter on 38 acres of suitable spotted owl habitat. These 38 acres would remain suitable habitat. Heavy thinning would occur on 218 acres of dispersal habitat and result in a post treatment canopy closure below 40 percent. The canopy closures of these stands are expected to grow at a rate of approximately 1% per year and return to the 40 percent threshold within 8-10 years (Chan et al 2006). An additional 38 acres (within units 84, 85, and 86) of oak thinning treatment would remove dispersal habitat.

Alternatives B and C—Cumulative Effects

The analysis area chosen for considering cumulative effects on spotted owls was a 2.4 mile buffer around all project units that may change habitat conditions for the spotted owl.. Seven spotted owl home ranges overlap proposed project activity units, and the analysis of a Timber sales have occurred on approximately 3,711 acres within the Bridge Thin Project area under USFS management since the 1940s (see Table 13). This represents about 31% of the 11,961 acres under USFS management in the project area.

The Biological Assessment found in Appendix D contains a detailed analysis of spotted owls. A summary of cumulative effects considering private lands is included here. The habitat condition of private ground within the affected home ranges as shown in (Table 8 of Appendix D) is almost entirely non habitat for owl sites 0104, 2034, and 2836. For owl sites 0856 and 2443 the habitat condition is approximately 70% and 80% non habitat respectively with the remaining acres likely to be harvested into non habitat in the foreseeable future, given current private timber ground harvest

practices. The project analysis assumes that private lands are all non habitat for spotted owls. Owl sites 0029 and 2422 have no private ground within their designated home ranges.

Past timber harvest has resulted in the removal or fragmentation of many acres of suitable spotted owl habitat, but some of the previously managed stands are currently providing dispersal habitat. Many stands are too young and have too small a diameter to be considered dispersal habitat at this time, but they would grow into dispersal habitat over time.

Alternative B, the proposed action, would not remove spotted owl habitat but it would reduce fuels on less than 7" diameter on 38 acres, and remove 228 acres of dispersal habitat. The USFWS has concluded that this proposed action, the Bridge Thin Timber Sale, would not jeopardize the continued existence of the spotted owl.

There are no reasonably foreseeable future actions identified which could alter suitable habitat and incrementally contribute to the cumulative effects of past actions and the proposed actions.

Big Game Habitat- (elk and deer) _____

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Big Game Habitat includes the project activity units and three Big Game Emphasis Areas (BGEA) where management activities would occur. The BGEAs were used for the scope of analysis because of the established ratings for elk habitat that is described for the BGEAs in the Willamette National Forest. The BGEAs do not include private lands.

Affected Environment—Big Game Habitat

The Bridge Thin planning area has three designated Big Game Emphasis Areas (BGEA): Florence, Taylor, and Minor Tributaries (See Figure 26). The areas are designated as High, Moderate and Low Emphasis respectively. These areas are managed for elk habitat under guidance from the Willamette Forest Plan Standards and guidelines (FW-137) with the assumption that providing high quality elk habitat would adequately address the needs for black-tailed deer.

Elk Model for Bridge Thin Project Area

A Model to Evaluate Elk Habitat in Western Oregon (Wisdom, 1986) is used to estimate habitat effectiveness (HE), which is defined as the proportion of achievement relative to an optimum condition. The management intent is to maintain effectiveness within a range of values with the optimum value being 1.0. HE incorporates and qualifies four key habitat attributes; size and spacing of forage (HEs), quality of forage (HEf), cover areas (HEc), and open road density through elk habitat (HEr). Each habitat variable is calculated individually and allows for a comparison by variable or as a whole (HEI). The elk model considers past and ongoing activities and results in an evaluation of the cumulative impacts on habitat from the past, present, and foreseeable future actions in the Big Game Emphasis areas.

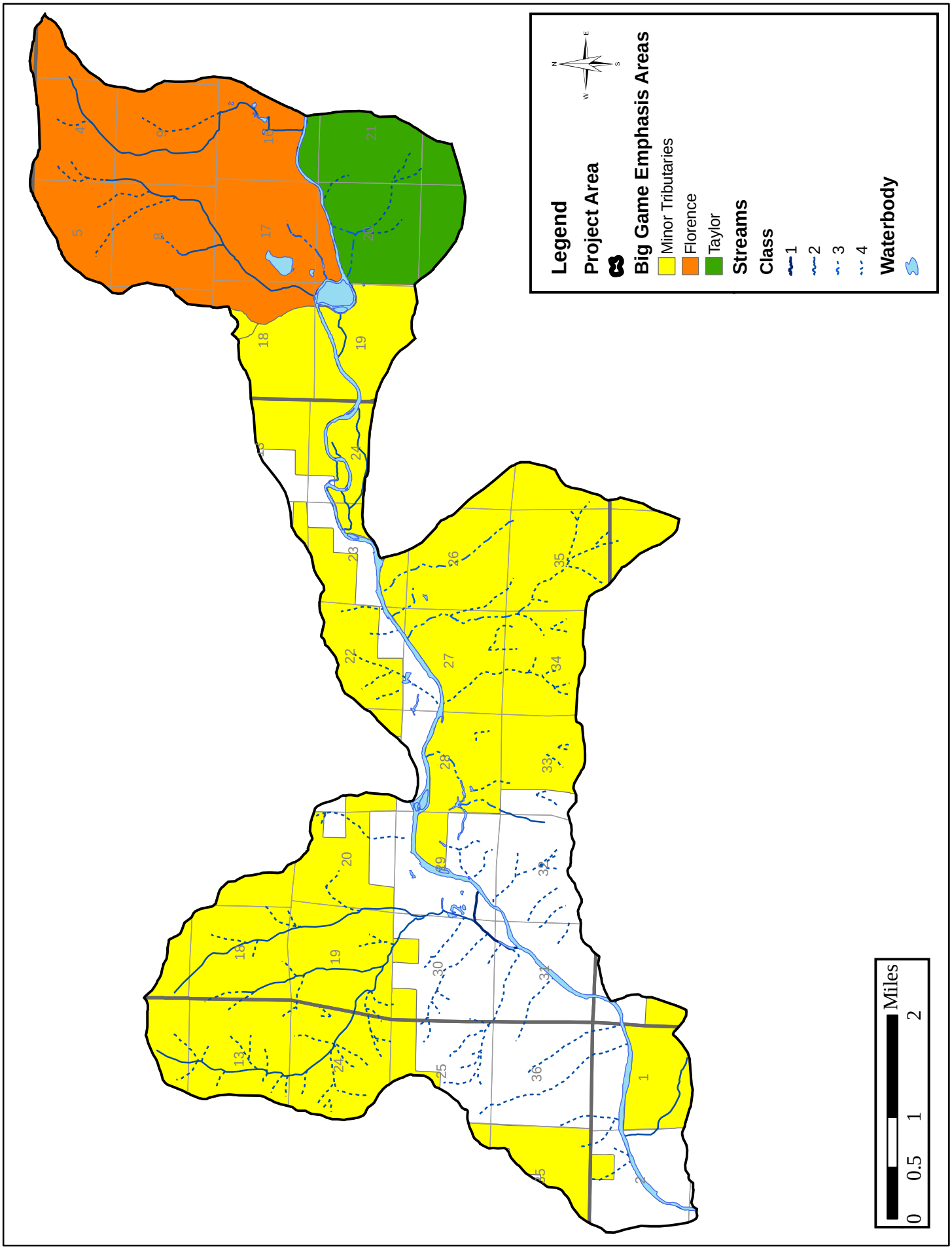

Figure 26. Big Game Emphasis Area map.

Maintaining a balance between cover and forage areas is a key component of elk habitat management in the Wisdom model. Using tightly controlled experimental conditions, Cook et al (1998) found that thermal cover did not enhance elk survival and production, was not required by elk where food was not limiting, and could not compensate for inadequate forage conditions. Further research has shown that high summer and fall forage quality is critical to elk reproduction, survival, and population growthand stability (Cook et al. 2004). The increased importance of available forage abundance and quality compared to thermal cover has also been supported by nutritional and physiological studies of black-tailed deer (Parker et al. 1999).

The Wisdom model was developed to evaluate landscape areas where quality forage areas were provided primarily by clear cutting and associated post-harvest burning and fertilization. With the dramatic decline in regeneration timber harvest under the Northwest Forest Plan, there has been a corresponding decline in high-quality elk forage habitat. This trend, coupled with recent studies, has increased the importance of providing foraging habitat for elk on the Forest. A drawback of the Wisdom model is that forage is evaluated based on the average value of defined forage areas and does not consider the amount of forage provided. Areas that do not provide meaningful forage are not considered in the forage effectiveness calculations. Consequently, providing substantial acres of temporarily improved elk and deer forage conditions by commercial thinning may result in a lower forage score in the Wisdom model if these acres lower the average value for forage areas in the landscape. Published research support the idea that increasing the amount of available forage by commercial thinning should improve the overall habitat conditions for elk and deer within the analysis area regardless of the average forage value derived from the Wisdom model.

Table 21 displays the current condition of habitat values for patch size and spacing (HEs), open road density (HEr), cover quality (HEc), forage quality (HEf), and overall habitat quality (HEI) that existed for big game habitat when watershed analyses were conducted for these areas.

Table 21. HEI Analysis for Big Game Habitat in the Bridge Thin Project Area

BGEA Name	BGEA Emphasis Level	Results for Each Model Variable Indices				
		HEs	HEr	HEc	HEf	Overall HEI
Florence	High	0.71	0.41*	0.50	0.33*	0.47*
Taylor	Moderate	0.37*	0.57	0.33*	0.45	0.42
Minor Tribs	Low	0.49	0.56	0.73	0.53	0.56

* Values are below recommended minimum threshold levels
Willamette NF Land Management Plan Standard &G Target Level:
High Level BGEA Individual Index: >0.5 Overall index: >0.6
Moderate Level GBEA Individual Index: >0.4 Overall Index: >0.5
Low Level GBEA Individual Index: >0.2 Overall index: increase any variable <0.2

Summary of Existing Elk Model Variables for the BridgeThin Project Analysis Area
• **Size and Spacing of Forage**: The size and spacing habitat effectiveness rating (HEs) for forage and cover in two elk emphasis areas indicates that the existing distribution of cover and forage is very good and that management goals for size and spacing are currently being met for Florence (0.71) and Minor Tribs (0.49). The size and spacing for Taylor (0.37) is currently below Forest Plan recommendations.
• **Road Density:** Road densities in two areas are currently adequate with HEr values of Taylor (0.57) and Minor Tribs (0.56). Road densities in the Florence (0.41) area is currently below Forest standards.
• **Cover:** The habitat effectiveness value for cover (HEc) in the Florence (0.50) area and the Minor tribs (0.73) area are currently meeting the Forest Plan standards. The Taylor (0.33) emphasis area is currently below Forest Plan standards.
• **Forage:** The forage quality habitat effectiveness rating (HEf) for Taylor (0.45) and minor Tribs (0.53) are currently meeting Forest Plan standards. The Florence (0.33) area is currently below Forest Plan standards for forage quantity and quality.
• **Habitat Effectiveness Index (HEI):** The overall ratings of (HEI) indicate that two emphasis areas are currently above Forest plan standards: Taylor (0.42) and Minor Tribs (0.56). The overall HEI rating for Florence (0.47) is currently below Forest Plan standards.

Forage, Hiding, Thermal and Optimal Thermal Habitat, and Road Densities

Past harvest activities have shaped the landscape in terms of the juxtaposition and types of elk habitat. Harvest treatments were primarily regeneration, including clearcuts and shelterwoods. These harvested units once provided a wealth of quality forage for elk but have since grown into hiding and thermal cover. No specific data are available for the local elk/deer population within the three BGEAs for this project. Current ODFW biological data are not sufficient to provide an accurate estimate of the black-tailed deer population in western Oregon (ODFW 2002). Recent ODFW elk population estimates show that state management unit in the vicinity of the project area (McKenzie) have elk herds with population numbers near their current management objectives (Bill Castillo pers com; ODFW 2005).

Environmental Consequences—Big Game Habitat

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Current trends of elk habitat development would continue to occur naturally over time with Alternative A. Existing elk foraging habitat is expected to continue growing into hiding cover and then to thermal cover. Thermal cover would continue to grow toward optimal thermal cover. There would be no change to the current elk effectiveness ratings.

In ten years, forage availability would be expected to decrease in this area as current openings succeed into hiding cover. In the absence of additional harvest or wildfire, no new foraging areas would be created. The current optimal and thermal cover would not significantly change.

In 50 years, approximately 30% of the existing thermal cover would shift into optimal thermal cover. Hiding cover would succeed into thermal cover. Road density and big game security would not change. Overall habitat quality may decrease from the loss of forage. No foreseeable timber or fuels management activities are scheduled to occur in the analysis area that could contribute to incremental cumulative effects on big game habitat.

Alternatives B and C—Direct and Indirect Effects

The proposed thinning (approx 2,256 acres) and prescribed burning (approx 1,300 acres) for the Bridge Thin project would change the function of big game habitat from thermal cover to: either lower quality thermal cover, or hiding cover or foraging. Alternatives B and C propose 190 acres of wildlife thinning, intended to increase big game forage in the heart of the high emphasis Florence area where forage quality are currently lacking. In addition unit 80 (10 acres) in Alternative B only would propose a forage area intended for repeated underburning and manual treatment to maintain forage production. The proposed oak savanna treatments would restore approximately 30 acres of historic open oak savanna habitat with a dominated grassy forage understory. The remaining acres for the Bridge Thin project would provide a limited short-term (<5-6 years) benefit to forage from light to moderate thinning until the tree canopies close in as a result of tree crowns responding to reduced competition for sunlight. Road densities would not measurably change with the Elk Model with 0.2 miles of additional roads being closed with this project.

Alternatives B and C—Cumulative Effects

Past management activities initially resulted in an abundance of forage habitat with the many acres of regeneration harvesting that occurred. The more recent lack of regeneration harvest has allowed these forests to grow into hiding and thermal cover to create the current condition represented by the no action alternative in the Table 21. The overall impact of the proposed action is that thermal cover in the treated stands would be changed to lower quality thermal cover, or hiding cover or forage. There are no foreseeable actions that would modify habitat in these BGEAs.

Alternatives B and C—Conclusions

Proposed activities would increase habitat quality for elk and deer in all three BGEA emphasis areas. Open road densities would not measurably change. Forage quality would definitely increase on 233 acres in Alternative B and 223 acres in Alternative C. Beneficial effects to big game forage from thinning and prescribed burning proposed by this project are not significant in scale and are not expected to be reflected in individual or overall habitat effectiveness values in the elk model given the majority of acres in a thermal cover classification. A limited number of animals would benefit from the small-size openings that would be created by the project, so there would be little potential for any noticeable population response as a result of the proposed actions. Project effects to big game are essentially unquantifiable on an individual basis relative to the amount of habitat modified or disturbed against the amount available to these species on a daily basis in the affected BGEAs. Direct and indirect effects are largely limited to potential temporary displacement of individuals during implementation of proposed activities in big game habitat. Short and long-term increases in forage

habitat would be evident within the project area. In the context of the BGEAs, and adjacent 5th field watersheds, project effects would result in a minor contribution to cumulative effects that have already occurred from past management actions surrounding the project area. Given what is currently known about local deer and elk populations, the future viability of these species should be assured as long as habitat restoration opportunities continue to be implemented – especially when conducted at an appropriate scale.

Sensitive Species

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Threatened, Endangered, and Sensitive Species includes the project activity units and Forest Service lands within the McKenzie River/Elk Creek 6th Field sub-watershed.

Affected Environment—Wildlife

Sensitive species have specific requirements under the Willamette National Forest Plan to maintain viability. Protection includes managing habitat to minimize impacts, as well as prohibition of noise disturbance during the breeding season.

Table 22 lists the sensitive wildlife species on the Willamette National Forest (USDA Forest Service, 2004) and whether there is potential habitat in the planning area. Additional detailed information about these species is in Appendix D Biological Evaluation for Wildlife.

Table 22. Potential for Occurrence of Sensitive Species in the Project Area.

Species	Habitat Present in the Bridge Thin Project Area?
Amphibians and Reptiles	
Oregon Slender Salamander	Yes
Cascade Torrent Salamander	No
Foothill Yellow-legged Frog	No
Oregon Spotted Frog	No
Northwestern Pond Turtle	No
Birds	
Least Bittern	No
Bufflehead	No
Harlequin Duck	Yes
Northern Bald Eagle	Yes
American Peregrine Falcon	Yes
Yellow Rail	No
Black Swift	No
Tri-colored Blackbird	No
Mammals	
Baird's Shrew	No

Species	Habitat Present in the Bridge Thin Project Area?
Pacific Shrew	No
Wolverine	Yes
Pacific Fisher	No
Pacific Fringe-tailed Bat	Yes
Mollusks	
Crater Lake Tightcoil	Yes
Invertebrates	
Mardon skipper	No

Environmental Consequences—Wildlife

Alternative A—Direct, Indirect, and Cumulative Effects

Under this alternative, no actions would be implemented to change sensitive species breeding, foraging or dispersal habitat. Forest stands in the area would continue to grow following natural successional pathways. Fragmented forest blocks would aggregate into contiguous forest over time. Trees within younger stands would thin out naturally over a span of several decades. Due to the previous clearcuts and relatively tight spacing in plantations, trees would grow slower in diameter than if thinning were to occur. Self-thinning would take place over time mostly due to tree competition, some wind throw, and possibly from root rot over time. Down wood would be provided as tree mortality occurs. No foreseeable timber or fuels management activities are scheduled to occur in the analysis area that could contribute to incremental cumulative effects on sensitive wildlife species.

Alternatives B and C—Direct and Indirect Effects

Bridge Thin Alternatives B and C meet all applicable Standards and Guidelines from the Willamette National Forest Plan and the Northwest Forest Plan Standards and Guidelines. Under Alternatives B and C, changes in the amount or characteristics of required habitat for these species would be minimal and therefore maintain persistent populations of sensitive species.

Potential effects and impacts of alternatives of the Bridge Thin Project for sensitive wildlife species, and fish can be found in the Biological Evaluations in the Appendix D.

Alternatives B and C—Cumulative Effects

The wildlife species listed as MIS for the Willamette National Forest and present in the project area, are discussed elsewhere in this EA. Cumulative effects on deer and elk are also discussed above. There would be minimal additional incremental effects from the proposed action or alternatives actions, on sensitive species or their habitat within the project area, when considering the effects from all past actions. There is no foreseeable future habitat management actions planned within the Bridge Thin project area that would add to the cumulative effects of the past and currently proposed actions or action alternatives

Affected Environment— Sensitive, Rare, and Uncommon Plant Species

The Forest Service manual gives direction to ensure the viability of sensitive botanical species as well as preclude trends toward endangerment that would result in the need for Federal listing (Forest Service, 1991). There are no listed Threatened or Endangered plant species on the Willamette National Forest. Other rare plants, often not associated with older forests, are compiled on the Regional Forester's Sensitive Species List for the Willamette National Forest. These species and their habitats are often rare and limited in distribution.

During the early stages of project development, a pre-field review determined which sensitive species occur in the Bridge Thin Project area. From there, intuitive-controlled field surveys conducted during June and July of 2007 investigated potential habitat of sensitive plants. The pre-field review identified populations of *Cimicifuga elata* and *Romanzoffia thompsonii*. Aside from the aforementioned sensitive plants, the subsequent surveys identified 2 additional sensitive lichen species, and at least 15 unique special habitats in the Bridge Thin project area. See Table 23

Table 23. Sensitive Species in the Bridge Thin Project Area

Proposed Units	Sensitive Species	Buffer
2	*Cimicifuga elata*	180 ft.
86	*Romanzoffia thompsonii*	180 ft.
3, 26, 95	*Peltigera pacifica*	180 ft.
80, 95	*Usnea longissima*	180 ft.

Environmental Consequences—Sensitive, Rare, and Uncommon Plant Species

Alternative A—Direct, Indirect, and Cumulative Effects

This alternative would have some direct or indirect effect on sensitive plants or rare botanical species. Although there would be no ground disturbance or disturbance of the microclimate with this alternative, selecting Alternative A may affect certain species of sensitive fungi. Specifically, without management action, downed wood accumulation would likely increase over time and stands would become more at risk for high intensity fires. Landscapes with heavy fuel loads are at greater risk of high-intensity, stand replacing fire, which is more likely to sterilize the soil, thus destroying fungal spores and mycelium found in organic mater on the surface and uppermost soil horizons. No foreseeable timber or fuels management activities are scheduled to occur in the analysis area that could contribute to incremental cumulative effects on sensitive, rare, and uncommon plants.

Alternatives B and C—Direct and Indirect Effects

The action alternatives would have no direct or indirect effects on sensitive plants or rare botanical species. All known sensitive plant occurrences would be protected with a 180 ft. no-disturbance buffer to maintain the viability of the populations. The buffer would maintain the microclimate for those species requiring cover or moisture retention and aid in protecting other species from physical damage

during project implementation. This buffer applies to all harvest activities, ground disturbing activities, and fuels treatments. For further discussions on botanical species, see the Botany Biological Evaluation and Resources report in Appendix C.

It is also noted that fungi are difficult to identify in the field, often requiring chemical and microscopic spore analysis. Apart from taxonomy, fungal relationships in ecosystems and seemingly sporadic fruiting from year to year add to the complexity of fully understanding these organisms. As a result, there are no reliable survey methods to locate most fungi populations. Therefore, there are likely fungi populations in the Bridge Thin project area that are currently unidentified.

Indirectly, canopy removal would have the most impact to fungi that are sensitive to microclimatic change. Subsequent slash pile/fuels treatments have potential to affect some fungi species in Bridge Thin units. Despite limitations in survey reliability, the risk of the proposed project activities endangering the viability of sensitive fungi species is low.

Alternatives B and C—Cumulative Effects

The cumulative effects analysis area for sensitive and rare botanical species is the Forest Service lands within the Bridge Thin Project area. This area was chosen because activities outside the analysis area would have no effect on sensitive species or other rare botanical species potentially located within the project analysis area.

Implementation of Alternatives B or C would not have measurable cumulative effects on sensitive plants in the project area because of the no-disturbance mitigation and the lack of reasonably foreseeable future activities in the analysis area. Based on the analysis of this project there would be no incremental change to existing populations of sensitive species or other botanical species in the project area due to selecting any alternative detailed in the Bridge Thin Project EA.

Affected Environment—Special Habitats

Special habitats are non-forested habitats that are limited in size and distribution across the landscape. It is important to consider the biological diversity and ecosystem function of these small, scattered habitats for a number of reasons. Special habitats often play important roles for full-time wildlife residents of the sites, as well as for those who use them seasonally, or for only a portion of their lives. Special habitats also serve as potential habitat for many other plants on the Regional Forester's Sensitive Species list.

Numerous factors contribute to the creation or maintenance of special habitats. Among such factors, topography and hydrology often determine the microclimatic conditions at these sites.

A unique mix of special habitats and sizes were located in the Bridge Thin Project area during the summer 2007 surveys. They range in size from one-half acre up to 6 acres. Sensitive plant populations also exist in or adjacent to four documented special habitats in the project area. See Table 24 for locations of special habitats documented in the Bridge Thin Project area and the buffer sizes recommended in the Willamette National Forest Special Habitat Management Guide (J. Dimling, C.McCain, 1996).

Table 24. Special Habitats in the Bridge Thin Project Area

Proposed Units	Special Habitat	Buffer
26	Swamp	1 acre
95	Swamp	1 acre
95	Pond	1 acre
3	Pond	1 acre
85	Dry meadow	NA- underburn proposed/exposure recommended
86	Dry meadow	NA- underburn proposed/exposure recommended
31	Dry meadow	180 ft.
32	Rock outcrop	180 ft.
32	Dry meadow	180 ft.
80	Dry meadow (Usnea site)	1 acre
35/36	Dry meadow	180 ft.
37	Dry meadow/rock outcrop openings	½ acre around cluster
6	Rock outcrop	180 ft.
29	Swamp	1 acre
15	Rock outcrop	100 ft. around cluster
56	Rock outcrop and seep/wet meadow	180 ft.
11/ 12	Mesic meadow	180 ft.
43	Swamp/seep	180 ft. each
91	Swamp	1 acre

Environmental Consequences—Special Habitats

Alternative A—Direct, Indirect, and Cumulative Effects

Selecting the No Action alternative would allow for the same level of special habitat management annually programmed. This alternative would have no effect on special habitats. Alternative A would have no direct, indirect, or cumulative effects on special habitats in the project area

Alternatives B and C—Direct and Indirect Effects

The action alternatives would have no direct or indirect impact on special habitats. Special habitats would be buffered from harvest and ground disturbing activities. These buffers would maintain the microclimate, hydrology, and prevent damage to the areas during project implementation.

Alternatives B and C—Cumulative Effects

The cumulative effects analysis area for special habitat is the proposed activity units within the Bridge Thin Project area. This area was chosen because activities outside the analysis area would have no effect on special habitats located within the project analysis area.

Implementation of the proposed action or any action alternatives would have no cumulative effects on sensitive plants in the project area because of the no-disturbance mitigation and the lack of reasonably foreseeable future activities in the analysis area. Based on the analysis of this project there will be no incremental change to existing populations of special habitats in the project area as a result of selecting any alternative detailed in the Bridge Thin EA.

Migratory Land Birds

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Migratory Land Birds includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Migratory Land Birds

Altman and Hagar (2007) identify 93 bird species in the Pacific Northwest that regularly breed in conifer forests less than 60 years of age. Over half of these species are experiencing population declines. Thinning generally does not change habitat conditions so dramatically that bird species can do longer use the stand, but often temporarily increase or decrease bird abundance depending on species. Altman and Hagar (2007) summarize studies showing 21 species of migratory birds whose range overlaps the project area increasing in abundance following forest thinning treatments. Seventeen migratory bird species did not changed in abundance or had mixed responses in forests that were thinned, while 7 species generally decreased in abundance, at least temporarily, after thinning. Silvicultural treatments that promote understory shrub development, trees species diversity, deciduous trees, and the growth of larger trees; maintain snags and downed logs; and create gaps in the stand generally improve avian biodiversity in the stand. Thinning has not been shown to have long term effects on any sensitive bird species or species of special concern.

Environmental Consequences—Migratory Land Birds

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Alternative A does not propose management activities at this time and therefore would not alter habitat conditions for migratory landbirds. Existing vegetation conditions would continue to follow natural successional pathways, and bird populations would respond accordingly. No snag habitat used by certain species of migratory land birds would be lost from roadside hazard tree removal. Additional snag habitat would occur through natural mortality in forest stands currently at low

densities. Alternative A would have no direct, indirect, or cumulative effects on habitat of migratory landbirds in the project area

Alternatives B and C—Direct and Indirect Effects

Felling of trees associated with this project may unintentionally affect habitat for individual migratory birds, but is not expected to have a measurable effect on habitat because of the limited extent of habitat removal. Thinning and removal of stands may impact habitat for certain species such as Hutton's vireo, golden-crowned kinglet, hermit thrush, and Swainson's thrush by reducing suitable habitat. There would be areas of no harvest, such as riparian buffers, within some of the proposed stands providing structural variability and potentially less impact.

Species that use early seral-stages, such as the winter wren, American robin, and grouse, may benefit from thinning harvest. Species which would increase in number, as a result of thinning would include Dark-eyed junco, Warbling vireo, American robin, Hairy woodpecker, Townsend's solitaire, Evening grosbeak, Western tanager, and Hammond's flycatcher (Hayes, J. et al. 2003).

Some snag habitat used by migratory birds such as western bluebirds or swallows, would be lost due to roadside hazard tree removal under Alternatives B and C.

Alternative B—Direct and Indirect Effects

Alternative B would impact migratory landbird habitat by by thinning 2,256 acres of forest stand habitat. This alternative would include more acres of thinning and low intensity underburning than the other alternative. Those species that would be less affected as a result of moderate thinning, compared to heavy thinning, include Pacific-slope flycatchers, Hutton's vireos, and brown creepers (Hayes, J. et al. 2003). No old-growth habitat will be treated with this project.

Alternative C—Direct and Indirect Effects

Alternative C would impact migratory landbirds by thinning 2,080 acres of young forest stand habitat. Those species, which would be impacted more as a result of heavy thinning, compared to moderate thinning, include Pacific-slope flycatchers, Hutton's vireos, and brown creepers (Hayes, J. et al. 2003). It is expected that habitat for these species would increase once canopies close back in. bird species.

Alternatives B and C—Cumulative Effects

Past management activities within the Bridge Thin Project area have resulted in changes to the seral stage composition across the landscape altering habitat conditions for landbirds. Different species occupy different seral stage habitats and therefore the effects to habitat for each species depend on the type of change that occurred. The effects from the proposed harvest activities in the Bridge Thin Project area would be an increase in the acres of openings created across the landscape, which may impact some landbird habitat by reducing suitable, dense nesting habitat in very young trees. The more open nature of the remaining young trees may make nests more available to landbird nest predators, i.e. Stellar's jays or ravens. There are no other reasonably foreseeable future timber harvest activities for the project area.

Snags and Down Wood

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Snags and Down Wood includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Snags and Down Wood

The significance of the ecological role of snags and down wood in influencing ecosystem diversity and productivity is well addressed in the Willamette National Forest Land and Resource Management Plan (1990) and elsewhere (Brown et al. 2003). The significance of this relationship in coniferous forests of the Pacific Northwest is further emphasized by management Standards and Guidelines (S&G) under the Northwest Forest Plan ROD (1994, 2001) and elsewhere throughout published literature (Hagar et al. 1996, Hallett et al. 2001, Laudenslayer et al. 2002, Lewis 1998, Muir et al. 2002, Rose et al. 2001).

Under the Willamette Forest Plan as amended by the ROD, snag habitat shall be managed at levels capable of providing for at least 40% or greater potential populations of cavity-nesting species. Current science has tested the validity of the potential population approach to species management, yet it remains the basis for S&Gs (Standard and Guidelines) involving snag management. Strong support for identifying more appropriate amounts of snag and down wood habitat has resulted in the development of new approaches in addressing these habitat components. One such approach is DecAID - the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon (Mellen et al. 2006). DecAID has been created to help managers decide how much dead wood to provide for this part of a species habitat needs, and is designed to apply to salvage and green tree projects. A benefit of using DecAID during the planning process is that it determines if current dead wood levels are consistent with reference conditions. In addition, DecAID can be applied to identify dead wood management goals for projects that affect dead wood habitat throughout dominant habitat types. Snag and dead wood habitat levels were compared to DecAID recommendations and Forest Plan S&Gs based on population potential for this project

Interpretation and/or application of advice obtained from DecAID, pertaining to how the Bridge Thin Project may affect dead wood habitat is based on referencing information available in DecAID for the Westside Lowland Conifer-Hardwood habitat type in the Western Oregon Cascades with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S). The Bridge Thin Project is predominantly within this habitat type. All stands proposed for commercial thinning harvest are within this habitat type, and the Bridge Thin Project planning area (20,657 acres) is considered an appropriate sized area of similar habitat to consider when evaluating current and future levels of dead wood (Mellen et al. 2006).

Snags (Current Condition)

Estimates for current snag size and distribution are displayed in Table 25, and were made based on estimates from a combination of stand exam data, knowledge of previous snag creation activity and field reconnaissance. Snag levels for this project were compared against those listed in DecAID for Westside Lowland Conifer-Hardwood habitat type, in the Western Oregon Cascades, with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S). Current snag levels throughout the planning area are above average values of the 50% tolerance range representative for snags in unharvested areas in this habitat type and condition.

Table 25. Current Condition (Alternative A- No Action) and Estimated levels of Snag Habitat for Alternatives B and C in Comparison with DecAID

Snag Size	Current Snag/Acre	DecAID- WLCH_OCA_S	
		Un-harvested inventory plots (unthinned managed stands)	All inventory plots (previously thinned and unthinned managed stands)
≥10" dbh	≈≥13 snags/acre	66th percentile	85th percentile
≥20" dbh	≈≥6 snags/acre	67th percentile	83rd percentile

The majority of large standing snags are Douglas fir . The majority of smaller snags throughout the area is also Douglas fir , and is a result of mortality from growth competition. Snag distribution across the project area can be considered patchy and variable, and would be affected equally under either Action Alternative.

Down wood (Current Condition)

Down wood estimates for current size and distribution were made based on reasoned estimates using inventory and stand exams from unthinned managed stands throughout the planning area. Tree mortality largely associated with self-thinning competition, cull logs from previous harvest activity, localized breakout from snow loading, and in one area wildfire has resulted in down wood levels as shown in Table 26

Smaller logs are generally in decay class I and II, while larger logs are in decay class II and III. Many of the largest pieces of down wood (cull logs from initial harvest activity) exist in decay class III. Plot data and field reconnaissance indicate existing down wood occurs in a patchy rather than even distribution across the planning area.

Table 26. Current Condition (Alternative A- No Action) and Estimated levels of Down Wood for Alternatives B an C in Comparison with DecAID

Down wood Size	Stand Type	Tons/Acre
≥6" diameter	Thinned managed stands	22.7 tons/ac
≥20" diameter		18.4 tons/acre
≥6" diameter	Unthinned managed stands	38.1 tons/acre
≥20" diameter		24.8 tons/acre

In addition to dead wood levels associated with down logs, it is estimated that decaying wood habitat associated with stumps ≥20" diameter would cover less than 1% of areas treated under either Action Alternative. The amount is considered to be equal under either of these alternatives. Use of stumps throughout a range of decay classes has been documented for a wide variety of organisms (O'Neil et al. 2001, NatureServe 2006, Rose et al. 2001, Zabel and Anthony 2003). This type of dead wood provides a valuable, long-lasting habitat component that supplements the potential to maintain native biodiversity throughout the project area.

Down wood levels for this project were compared against those listed in DecAID for Westside Lowland Conifer-Hardwood habitat type, in the Western Oregon Cascades, with a Small/Medium Tree Vegetation Condition (WLCH_OCA_S). A review of DecAID data discloses current down wood levels throughout the planning area are above average values (within the 50% tolerance range) representative for dead wood in both harvested and unharvested areas within this habitat type and condition. How down wood levels in the Bridge Thin Project planning area compare to DecAID data is displayed in Table 27.

Table 27. Current Conditions (Alternative A – No Action) and Estimated Levels of Down Wood for Alternative B and C and in Comparison with DecAID

Down Wood Size	DecAID- WLCH_OCA_S	
	Unharvested inventory plots (unthinned managed stands)	All inventory plots (thinned and unthinned managed stands)
≥6" dbh	71st percentile	67th percentile
≥20" dbh	82nd percentile	78th percentile

Normal processes that influence these changes (dynamics) are highly variable in their ability to affect change (Rose et al. 2001). Natural fire interval for this area has been estimated at 50-200 years (USDA 1995). Insects and pathogens continually contribute to successional development; however, traditionally this occurs at a small scale in this area relative to the overall landscape. The area is not prone to flooding or landslides which may also affect changes on a small scale. Windthrow is yet another normal process that has occurred, and would continue to occur unpredictably, to influence stand dynamics in this area on a small scale. Because the overall condition of the project area is largely influenced by previous management activities that have simplified stand and landscape structure and diversity, additional stand management may be seen as a method to assist in restoring some landscape conditions, such as stand dynamics associated with creating more normal levels of snags and down wood. Snag creation in the 1990s through year 2006 have already contributed in this regard as an average of one snags/acre were created across approximately 12% of the project area.

A number of events throughout the watershed, as well as within the project area, have occurred to increase dead wood levels across the landscape. District fire records reveal that from 1970 to 2007, 46 small wildfires averaging less than one acre each have contributed to additional levels of dead wood in a patchy distribution throughout much of the WLCH habitat in four townships in the watershed immediately surrounding the project area. Any tree mortality associated with fires > 40 years ago is likely to currently function as down wood habitat. Mortality from fires within the past 40 years (n=46)

is likely currently functioning as snag habitat. Fire intensity has ranged from mild to moderate under burning. No salvage has occurred associated with any of these events.

In addition to dead wood levels increasing related to effects from wildfire, effects from insects, disease, and other natural events have further increased this habitat component across the landscape surrounding the Bridge Thin Project area. Annual aerial insect and disease detection surveys from 1986 through 2006 have documented several sites across the watershed (including locations within the planning area) where snag habitat is increasing in a patchy distribution from effects of these mortality agents (USDA 2005).

Reference information extrapolated from DecAID suggests current size, abundance, and distribution of snags and down wood exceeds average historic levels (50% tolerance) across the project area considering habitat type and vegetation condition. It should be noted that with respect to snags or down wood, the objective of the Bridge Thin Project is more directed at managing for an average historic dead wood habitat condition rather than focusing on specific dead wood requirements for individual wildlife species.

Environmental Consequences—Snags and Down Wood

Alternative A—Direct, Indirect, and Cumulative Effects

Alternative A does not propose management activities at this time and therefore would not alter snags and down wood. Existing vegetation conditions would continue to follow natural successional pathways, with snags and down wood responding accordingly. Snag would be created as insect and disease agents as well as suppression mortality continue. Alternative A would have no direct, indirect, or cumulative effects on snag and down wood in the project area

Alternatives B and C—Direct and Indirect Effects

Some loss of existing snag habitat would occur under either Action Alternative, due to safety issues. Some existing snags in proximity to harvest activities would present a serious safety risk to workers involved with implementing the silvicultural prescription. Snag loss would be greatest among sizes <10” dbh, intermediate for snags ≥10” - <20” dbh, and lowest among snags ≥20” dbh. All felled snags would be left as down wood. Depending on decay class and burning conditions, some felled snags may be fully or partially consumed during subsequent fuels reduction and prescribed underburning in selected areas.

Under the silvicultural prescriptions for this project green trees would be harvested from specified areas by variable density thinning. Following these prescriptions would result in a minimum range of 34-72 trees per acre being retained, some of which may have defects that would provide a dead wood habitat component distributed throughout the project area. The silvicultural prescription for Riparian reserves calls for protection and retention of habitat features such as hardwoods and the largest conifers, some of which possess decadent features providing an arboreal dead wood habitat component.

Implementing the fuels treatment prescription under either Action Alternative should not affect current snag levels. On these acres, less than 10% live tree mortality estimated from under burning

translates to approximately 3-7 snags/acre created in an area that involves approximately 40% of all acres thinned, and less than 1% of the planning area. However, it is also reasonable to assume some level of partial or full mortality associated with trees immediately adjacent to pile burning activity. Any such mortality would add to an existing patchy distribution of snag habitat throughout the planning area.

Within stand variability throughout the planning area influences current snag distribution. This variability would also influence the location of replacement snags, which would be provided for in a patchy rather than even distribution across the area. This prescription is common to each Action Alternative and would assure compliance with Northwest Forest Plan guidance to maintain 40% of potential populations of cavity nesting species (USDA, USDI 1994 page C-42).

Post treatment snag sizes and quantities would also be consistent within the range of average levels recently provided from plot data from unharvested stands in a Western hemlock vegetation series such as those influencing habitat throughout the project area (McCain 2006). These data are presented in terms of tolerance levels and tolerance intervals described in DecAID. They reveal that 50% of individuals in all populations of species using snags in a Douglas fir and Western hemlock series types can be expected to occur where a range of 4-7 snags per acre ≥ 20" dbh exist. Although these data apply to unharvested tree condition class stands, snag habitat throughout the Bridge Thin project area would fall within this range.

Based on current stand structure, composition, and habitat type there is generally sufficient site-specific potential to support application of the Northwest Forest Plan Standard and Guideline (ROD page C-40) to leave an average of 240 linear feet of logs per acre greater than or equal to 20 inches in diameter or material of the largest diameter class available across areas treated by the Bridge Thin Project under either Action Alternative.

Alternatives B and C—Cumulative Effects

The cumulative effects analysis area was the Bridge Thin project area. As mentioned above the project area (20,657 acres) is considered an appropriate sized area of similar habitat to consider when evaluating current and future levels of dead wood (Mellen et al. 2006) Approximately 42% of the project area is in non Forest Service ownership. Approximately 75%, or 6,400 acres, of these non Forest Service lands have been managed for timber production .

Past management actions related to timber harvest activity are generally responsible for the current condition of dead wood habitat throughout the planning area. These actions have affected the overall amount and distribution of dead wood habitat by reducing the amount of old-growth habitat and increasing the amount of mid-late seral habitat. There are no foreseeable actions that would affect dead wood habitat in this area. Current science and the changing trend in timber management that has occurred within the past decade, and projected for the future, should positively influence management of decaying wood as previously harvested stands redevelop, and more emphasis is placed on retention of key structural components in unharvested stands.

Data analysis reveals the amount and distribution of snag and down wood habitat would essentially remain unchanged or experience a slight increase under either Action Alternative.

Commercial thinning as proposed under either Action Alternative for the Bridge Thin Project is therefore likely to have little or no cumulative effect on dead wood habitat throughout the planning area. The action alternatives would allow trees to grow larger and faster, and to develop characteristics such as large limbs and crowns.

Dead wood habitat should exist in a sufficient amount and distribution to support the local wildlife community, including MIS such as pileated woodpecker, marten, and cavity nesters such that their ability to persist or become established would not be limited by this habitat component important to most members of the wildlife community in this area.

Alternatives B and C—Conclusions

Under either Action Alternative the Bridge Thin Project proposes commercial thinning in approximately 55% of mid-seral (stem exclusion) habitat throughout the planning area. This relates to approximately 18% of the entire planning area. Proposed openings associated with compaction areas under Alternative B are generally lacking in snags and down wood. There is essentially no difference between Action Alternatives and their effect on dead wood.

The silvicultural prescription calls for protection of existing snags and down logs. However, some amount of loss or disturbance of snags and down wood is inevitable as a result of safety and logging feasibility issues. Measures are identified to address this loss or disturbance. Effects analysis reveals that proposed activities in conjunction with mitigation measures would result in a stable or slight increase in dead wood levels associated with areas treated. Direct and indirect effects would be limited to an undeterminable number of snags and logs that may be unavoidably affected or created within harvest units.

DecAID relies on data from unharvested plots to assist managers in setting objectives aimed at mimicking natural conditions. Considering the current condition of snag and down wood habitat along with the information presented above, it is expected that dead wood levels throughout the planning area should remain above average in the natural range considered for similar habitat following thinning, prescribed fuels reduction, and underburning.

The Bridge Thin Project would result in maintenance and promotion of dead wood habitat throughout a managed forest that typifies the planning area at levels that would ensure its ongoing central role in the ecological processes affecting this type of forested habitat (Rose et al. 2001). The project would comply with S&Gs pertaining to snag and down wood management.

Management Indicator Species

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Management Indicator Species includes the project activity units and Forest Service land within the McKenzie River/Elk Creek 6th Field sub-watershed.

Affected Environment—Terrestrial Species

Management Indicator Species (MIS) were addressed in the Willamette Forest Plan. They include the spotted owl, pileated woodpecker, marten, elk, deer, cavity excavators, bald eagle, peregrine falcon, and fish. All of the management indicator species may occur in the Bridge Thin Project area.

Through Region-wide coordination, each Forest identified the minimum habitat distribution and habitat characteristics needed to satisfy the life history needs of MIS. Management recommendations to ensure their viability were incorporated into all WNF Plan Action Alternatives. Current conditions for the spotted owl and bald eagle are discussed in the Wildlife BE in Appendix C. Habitat for elk and deer is discussed in the Big Game Habitat section in this chapter.

Environmental Consequences—Terrestrial Species

Alternative A (No Action)—Direct and Indirect Effects

Under Alternative A, no change to habitat of management indicator species would occur; forest stands would continue to develop following natural successional pathways and aquatic resources would remain similar to current conditions. Alternative A would be expected to meet applicable Standards and Guidelines from the Willamette Forest Plan. Alternative A would have no direct, indirect, or cumulative effects on habitat of management indicator species in the project area

Alternatives B and C—Direct and Indirect Effects

Bridge Thin Alternatives B and C meet all applicable Standards and Guidelines from the Willamette Forest Plan. All alternatives of the Bridge Thin Project would meet Northwest Forest Plan Standards and Guidelines, and therefore maintain persistent populations of spotted owls, pileated woodpeckers, and marten (USDA Forest Service, USDI Bureau of Land Management. 1994. Appendix J2). Under Alternatives B and C, changes in the amount or characteristics of required habitat for these species would be minimal.

Impacts of alternatives of the Bridge Thin Project for the spotted owl, bald eagle, peregrine falcon, and fish can be found in the Biological Evaluations in the Appendices B and D. This project may affect, but is not likely to adversely affect, the northern spotted owl due removal of dispersal habitat in Alternatives B and C. The spotted owl is discussed further in the previous section. This project has no effects on bald eagles or peregrine falcons. Impacts of the Bridge Thin Project on elk and deer are discussed in the Big Game section.

While pileated woodpecker and marten may be displaced by harvest and burning activities in this area, populations throughout their range have not been identified as being in decline, as indicated by their absence from the Regional Forester's Sensitive Species List (USDA Forest Service. 2002).

Alternatives B and C—Cumulative Effects

The wildlife species listed as MIS for the Willamette National Forest and present in the project area, are discussed elsewhere in this EA. Cumulative effects on deer and elk are also discussed above.

The implementation of either action alternative would not result in significant, incremental effects on the remaining MIS species or their habitat within the project area (including pileated woodpeckers,

pine martens and non-TES fish), when considering the effects from all past actions in the analysis area. There is no foreseeable future habitat management actions planned within the Bridge Thin Project area that would add to the cumulative effects of the past and currently proposed actions or action alternatives.

Affected Environment—Fisheries

Management indicator fish species found in this area were described previously in the Aquatic Resources discussion. The MIS fish species described are spring Chinook salmon, bull trout, rainbow trout, cutthroat trout, mountain whitefish, and brook lamprey. Because the distribution and range of these MIS fish overlap and possess similar requirements in water and habitat quality, the analysis findings for spring Chinook salmon and bull trout (main stem McKenzie River), and cutthroat trout (small tributaries) were used to evaluate effects.

Environmental Consequences—Fisheries

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Under Alternative A, no change to habitat of management indicator species would occur; forest stands would continue to develop following natural successional pathways and aquatic resources would remain similar to current conditions. Alternative A would be expected to meet applicable Standards and Guidelines from the Willamette Forest Plan. Alternative A would have no direct, indirect, or cumulative effects on habitat of management indicator species in the project area

Alternatives B and C—Direct and Indirect Effects

Project effects summarized in the Fisheries Biological Assessment (Appendix B) describes potential effects of the project to Management Indicator Species and their habitat. Project direct, indirect, and cumulative effects would not adversely affect fisheries MIS. Water and habitat quality would be maintained meeting the objectives of the Willamette National Forest LRMP and Aquatic Conservation Strategy of the Northwest Forest Plan.

Alternatives B and C—Cumulative Effects

A review of the analysis area for past action, the proposed action, and any foreseeable future actions was completed. Previous road construction and timber management has affected the condition of fish habitat in the analysis area as discussed in Water Quality/Aquatic Resources effects. The proposed action and the action alternatives would not incrementally contribute to loss of aquatic habitat (in action alternatives, primarily through proposed drainage improvements to the existing road network). Timber management activities and their proximity to waterways were designed to maintain existing water quality and minimize potential disturbance to native aquatic biota (as sources of sedimentation). Potential to increase stream temperature with the proposed action and action alternatives does not exist, due to protection of sources of shade to perennial waterways.

Following examination of the cumulative effects from past actions along with the proposed projects, the additional management-induced effects from this project would not change the following:

1. The timing or magnitude of peak flow events (planning sub-drainage ARP remain above the Willamette Forest Plan recommended levels);
2. Instability of stream banks [recommended ARP midpoints are exceeded, and exclusion of bank destabilizing activity);
3. Adverse alteration of the supply of sediment to channels (localized increases of short duration would not adversely modify project area sediment supply);
4. Adverse alteration of sediment storage and structure in channels (current channel conditions would be maintained with proposed action alternatives).

Upstream passage measures at Cougar Dam are under NEPA evaluation (a trap-and-haul facility with evaluation by Army Corps of Engineers) and may be implemented following ACOE NEPA analysis. A favorable response by TES aquatic species would be anticipated with reconnection of the South Fork McKenzie River to project adjacent reaches of the McKenzie River, primarily through bull trout and spring Chinook salmon access to historic refuge areas.

No other foreseeable project planned in the Bridge Thin Project area would add incrementally such that the proposed activities, in combination, would adversely alter aquatic habitat conditions. This assertion includes the cumulative impacts of past actions. The quality of Critical Habitat important to listed aquatic species (spring Chinook salmon and bull trout) is expected to be maintained with implementation of the proposed action (Alternative B) or other alternatives (Alternative C). Similarly, the No Action Alternative would maintain habitat conditions currently available to ESA listed aquatic species.

Fire and Fuels

Scale of Analysis

The Bridge Thin Project area is within the McKenzie River / Elk Creek Subwatershed (6^{th} field) of the McKenzie River/Quartz Creek Watershed (5^{th} Field). Project models were used in the analysis that incorporated both project and landscape level data (see specialist report for details). This is related to the need to understand the role of fire as disturbance agent, and how fire moves across the landscape. To identify specific effects of fuels treatments, models focused on the proposed activity areas using field information and landscape level data.

Fire regimes and Fire Regime Condition Class (FRCC) were evaluated at the landscape level, with the most recent information from the Northwest Oregon Ecology work group with Jane Kertis, Fire Ecologist for the Siuslaw and Willamette National Forest. The Bridge Thin area is FRCC2, or moderately altered from the range of historic variability for this area.

Fuel loading (amount of fuel measured in tons per acre) was analyzed at the stand level. Fire behavior predictions were calculated using the predicted fuel loading with larger landscape level factors such as topography and weather. Detailed fuels analysis information is found in the Project Fire and Fuels Specialist Report in the analysis file.

Affected Environment—Fire Fuels

Fire History

Fire has and will likely continue to play an active and vital role in our forest ecology. Historically, fires occurred across the Willamette National Forest creating a mosaic pattern in vegetation. The variability that creates this mosaic pattern is related to differences in location and seasonality, which result in fires of varying intensity and severity. Fires were often caused by lightning, and there are references and stories of local Indigenous people historically using fire for managing resources and travel routes (Teensma 1987). Fire is a natural disturbance and the influences of human actions (development and resources) over the past century warrant management activities to aid in maintaining, providing, and reducing hazards. Teensma (1987) studied fire history in an area adjacent to the Bridge Thin, identifying the mean fire return interval (MFRI) for the area to range from <100 - 166 years.

Past management activities that have changed the fuel profile or fire behavior are grazing, timber harvesting, fuels treatments following timber harvests, and fire suppression. In 1920 management in National Forests began suppressing fires and managing for resource products which altered the natural regimes of fire. Forty-six fires occurred in the Bridge Thin project area during the period of 1970-2007. All fires were suppressed and most were contained to less than one acre, with the largest being five acres. Lightning accounted for 30% of the fires in the Project Area and the others were human-caused. Based on the recorded data from Willamette National Forest, the fire frequency is 1.24 fires per year, which implies that fire is a disturbance process in the forest ecosystem.

Grazing occurred through the Upper McKenzie Valley from the 1800's to 1948 (UMWA 1995). Grazing reduced fuels in the open meadow areas and curtailed regeneration of many conifer species. Currently many of these open areas have transitioned to encroaching conifers among the grass and oak or into conifer dominated stands. Many of the proposed Bridge Thin units have been previously managed. Earlier commercial harvest, mostly regeneration harvests, left non-merchantable large woody material and fuels were not treated. Later harvest methods included yarding merchantable material and broadcast burning. Prior to the 1970's, the scale of acres treated was much larger than the more recent practices. The number of acres harvested within the past 60 years in the Bridge Thin Project Area is approximately 3,711 acres. No natural fuels prescribed fire (prescribed fire without timber harvest) has occurred in the Bridge Thin Project Area in the past 50 years. Teensma's dissertation shows how the natural fire rotation changed from eras with Native American communities (AD 1772-1830), Anglo-settlements (AD 1851-1909), and current fire suppressors (AD 1910-current).

Fire Regimes

Fire regimes classes estimate the frequency that natural fire would occur on the landscape without human intervention (Agee 1993). At the national level, five fire regimes are used: I, II, III, IV, and V (Schmidt et al. 2002 and Hann et al. 2004). Within the Bridge Thin Project Area the following Pacific Northwest Region 6 Fire Regimes have been classified:

Fire Regimes in the Bridge Thin Project Area (See Figure 27)
• **Fire Regime I –** < 0-35 year fire return interval; low severity
• **Fire Regime IIIa –** < 50 year fire return interval; mixed severity
• **Fire Regime IIIb –** 50-100 year fire return interval; mixed severity
• **Fire Regime IIIc –** 100-200 year fire return interval; mixed severity
• **Fire Regime V –** 150+ year fire return interval; high severity

Of importance in the Fire Regimes description is the use of mixed severity. This term is used to describe the varying degrees of fire intensity that can occur over the landscape. Some factors contributing to mixed severity in Fire Regimes are: 1) the topography, 2) vegetation, 3) the ability of larger trees to withstand high-intensity fires. Variations in these factors result in different levels of tree mortality. Mixed severity fires are not stand-replacing but rather create a patchy mosaic of different mortality across the landscape (Kertis et al. 2007).

In addition to the frequency and severity, fire disturbance is categorized into Fire Regime Condition Class is (FRCC). FRCC (see Table 28) describes the degree of departure of current vegetation from the historic fire regime, and helps to establish reference and evaluate risks to the ecosystem (Hann, et.al. 2001). The Bridge Thin Project Area is categorized as a FRCC2 (See Figure 28).

Table 28. Fire Regime Condition Class (FRCC) Definitions

Condition Class	Departure of Fire Regime from Historic Range	Risk of Losing Key Ecosystem Components	Alteration of Vegetation Attributes form Historic Range
FRCC 1	Departure is not more than one return interval	Low	Functioning within the historic range
FRCC 2	Moderate change in size and intensity has resulted	Moderate	Moderately altered
FRCC 3	Dramatic changes in fire size has severity have resulted	Severe	Substantially

Fuel Profile

Fuel models describe the fuel profile in the Bridge Thin Project Area. Fuel models are a quantitative way to describe surface fuel loading (amount of fuel in tons/acre), arrangement, structure, and calculate predicted fire behavior. The primary fuel that carries fire is represented by the general classification fuel models, i.e. grass, brush, timber litter, or timber slash. Fuel loading and depth correlate to the fire intensity and rate of spread. Horizontal fuels refer to ground or surface fuels, while vertical fuels refer to the ladder fuels such as limbs on the bole of trees, crown base height (CBH), regeneration, and brush.

Fuel loading and fuel models are described below. Both are used to calculate and predict expected fire behavior. Fuel loading is measured using size of fuel that relates to time frames based on how the

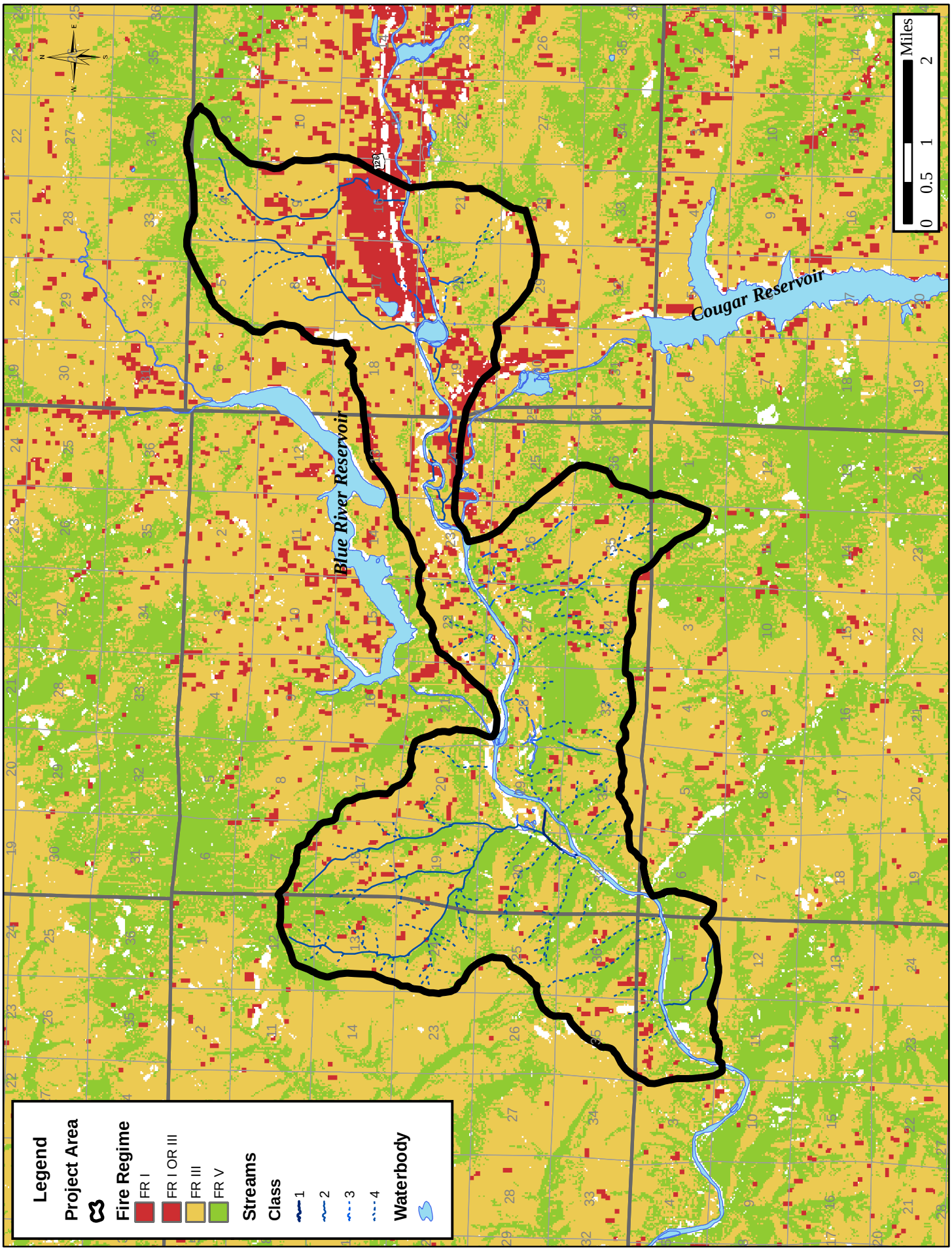

Figure 27. Fire Regime map.

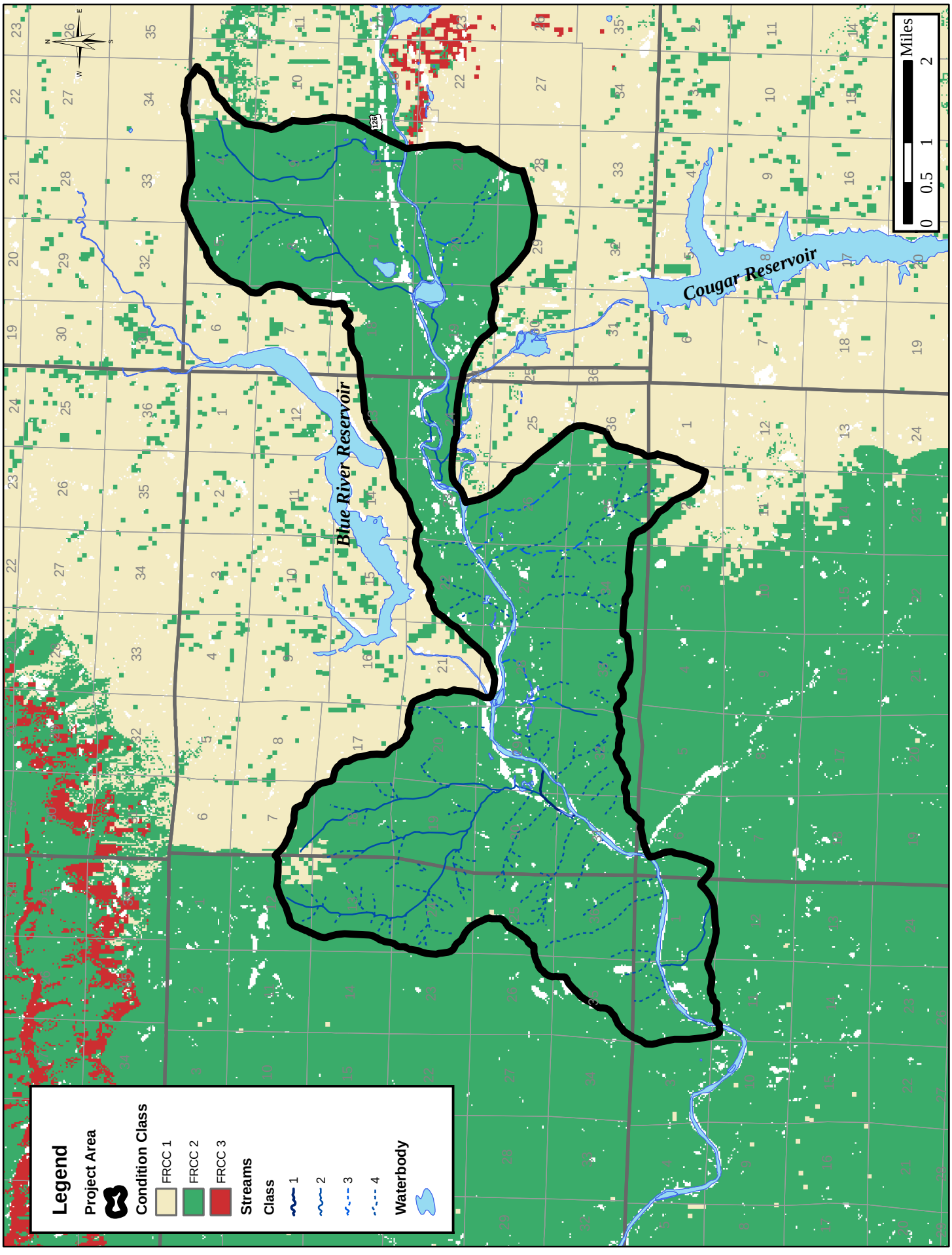

Figure 28. Fire Regime Conditon Class map.

fuel responds to moisture (how long it takes to dry and become consumable) and are then quantified using tons/acre. Measurements for fuel loading are:

- 0" – .24" diameter or 1 hour fuels
- .25" – .99" diameter or 10 hour fuels
- 1.0" – 2.99" diameter or 100 hour fuels
- ≥3.0" diameter or 1000 hour fuels

The Bridge Thin Project Area is represented by the following fuel models (FM):

Bridge Thin Project Area Fuel Models
• **FM 1**– Representative of grass meadows or openings. Fuel loading in the 0-3 inch diameter fuels is less than 1.5 tons/acre. Less than one-third of the area contains trees or shrubs. Fire spreads quickly in this fine fuel when it is cured or nearly cured. *Example – open oak savannah above Highway 126.*
• **FM 5** – Representative of timber plantations and natural regeneration between two and 10 feet tall. *Ceanothus velutinus* is the common understory brush. Shrubs or grass in the understory can carry the fire. Fuel loading in the 0-3 inch diameter for live and dead fuel is less than 3.5 tons/acre. *Example – second growth units under 30 years old that have trees ≤35' tall and a shrub component along the 1501 or 2633 Road.*
• **FM 8** – Mature short-needle conifer stands with light fuel loading in the 0-3 inch diameter fuels. This profile can be found in stands that were or were not previously harvested. Fire spread is generally slow with low flame lengths. Heavy fuel concentrations (jackpots) can flare up. Fuel loading in the 0-3" diameter for live and dead fuel is less than 5 tons/acre. *Example – area along Langasher Road with few understory shrubs or regeneration.*
• **FM 10** – Representative of mixed conifer stands with heavy concentrations of large down wood, > 9" diameter. Fuel loading in the 0-3 inch diameter for live and dead fuel is less than 12 tons/acre. Ground fire behavior is higher in intensity than fuel models 8 because of the heavier fuel loading and the ladder fuels. Torching of trees (fire in the crowns of trees) occurs more frequently. *Example – units on the south side of King Road on the SE portion of Bridge Thin Project Area.*
Private land has FM11 and 12 (but they were not analyzed on the ground) and these would also explain fuels post harvest on National Forest land.
• **FM 11** – Light slash load resulting from light to moderate partial cuts or harvests which yard tops of trees attached to the last log. Fuel loading in the 0-3" diameter for live and dead fuel is <12 tons/acre. The continuity of the slash can increase fire behavior.
• **FM 12** – Moderate slash loads resulting from moderate or heavy partial cuts. Fuel loading in the 0-3" diameter for live and dead fuel is < 35.6 tons/acre. Fire behavior can be rapidly spreading, especially with red needles still on the branch wood.

Table 29. Existing Condition - Fuel Model within Bridge Thin Project Area *.

	FM 1	FM 5	FM 8**	FM 10**
Acres within Bridge Thin Project Area	471	5,092	9,015	5,833

**:Data derived from2000 FSVeg.*
***:Some private lands are not identified as FM12, they are identified as FM 8 & FM10.*

The term hazardous fuel is used in current publications, such as the National Fire Plan. Current and potential hazardous fuels in the Bridge Thin Project Area are presented below.

Current and Potential Hazardous Fuels
• Fine fuels (1, 10, and portions of 100 hour) generated following timber harvest;.
• Forested areas that have been excluded from disturbance processes;
• Vegetation structure with fine fuels on the ground, shrubs and small trees in the understory, lichen on larger trees, and tight canopy closure all contributing to rapid horizontal and vertical movement of fire;
• Continuous fuel near structures that could easily cast embers on to rooftops.

Fire Behavior

The Bridge Thin Project Area has a fire frequency of 1.24 fires per year. Fire behavior was modeled using BehavePlus3 with inputs that correspond to the Bridge Thin Project Area, and summer fire weather data representing hot, dry fire weather (97th percentile) similar to summer weather experienced in 2003 and 2006. Areas with light fuel loading, such as FM 8, exhibit low intensity fires with low severity (low mortality of dominant vegetation). Fuel Model 10 exhibits high fire intensity and high severity including crown fire with mortality. Fuel Model 5 is also high fire severity and fast rates of spread. FM10 and FM5 are difficult to contain because:

- flame lengths exceed the safety of hand tooled firefighters (flame lengths over 4 feet in height require mechanized equipment, air resources, or indirect attack);
- rates of spread over 6 chains/hour (1 chain = 66 feet) and this exceeds the capability of a 20 person crew.

Larger fuels, > 9" diameter, are not often considered the carrier of fire. Large 1000 hour fuel would create longer lasting intensity, higher flame lengths and enable crown and high severity fires to progress. Standard fire suppression operations would require mechanized suppression resources when flame lengths reach heights over four feet. Firefighters are not able to safely suppress fires directly if the flame lengths exceed four feet.

Wildland Urban Interface (WUI)

The Bridge Thin Project Area surrounds private land along the McKenzie River, the Town of Blue River, the development of Rainbow, and several groups of homes and structures. These areas are considered Wildland Urban Interface (WUI) which is defined as a vicinity of 1.5 miles around structures (Silvis Lab, website). These communities are in Lane County and are part of the Lane

County Community Wildfire Protection Plan (CWPP). This CWPP was developed by communities in Lane County and the Oregon Natural Hazards Workgroup in 2005, and adopted by the Lane County Board of Commissioners. The implementation of this plan has not begun in all communities in Lane County but should be in the near future (http://www.co.lane.or.us/Planning/CWPPtoc.htm). Many of the cabins leased from the Forest Service do not have defensible space as specified in *Living with Fire* or the Firewise website (www.firewise.org). Private homes have not been evaluated by Forest Service employees, but also appear to lack defensible space.

Open Oak Savannah

Oregon white oak is located above Highway 126 on the south facing slopes. The area is identified as a unique and rare habitat in Management Area 9d and exhibits the characteristics of Fire Regime I. A series of aerial photographs dating from 1936 to 2006 illustrate the expansion of conifers into the open oak savannah. The encroachment of conifers and the loss of open oak dominated hillside may be due to the lack of fire disturbance because fire is considered the major natural disturbance in this habitat (Johnson, 2001).

Environmental Consequences—Fire Fuels

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Alternative A would not support returning fire as a natural disturbance process to the ecosystem due to fire suppression responsibilities and life, structure, and resource priorities. Through time, fuel loading would continue to increase and vegetation would continue through successional pathways. Stands would continue to grow increasing fuel loading on the ground and canopy closure thus escalating potential wildfire behavior. Areas near private residences would not have any reduction in fuels to aid in reducing wildfire intensity and mitigating hazards for firefighters. In the absence of prescribed fire and treatments, ladder fuels and canopy closure would be high, thus providing propellants for severe, high intensity wildfires. FRCC would not be maintained at a FRCC1, again reducing the natural forest resiliency to fire disturbance. Alternative A would not create the desired future condition, reduce firefighting risks, or be cost effective due to suppression of high severity fires. No foreseeable prescribed fire management activities are scheduled to occur in the Bridge Thin Project Area that could contribute to incremental cumulative effects

Alternatives B and C—Direct and Indirect Effects

Harvests increase fuel loading in a unit, which increases the wildfire behavior potential. Following the harvest a greater hazardous fuels condition exists for 0-5 years because of the lofty, red-needle slash. This slash has high ignition and spread potential, but this would be reduced with the fuels treatment 1-2 years post harvest. The lack of variability in the horizontal and vertical fuel profile across the landscape also increases the spread potential and intensity of wildfire. The proposed fire and fuels actions in Alternative B and C would change the fire and fuels environment by implementing the actions listed below.

Actions to Change Fire and Fuels Environment
• Returning the historical disturbance process of fire with prescribed fire treatments; • Reducing hazardous fuels to Forest Plan standards and guidelines levels and create variability in the horizontal and vertical profile; • Creating a mosaic and distribution of seral stages present in a mixed severity fire regime taking steps towards change from FRCC2 → FRCC1; • Incrasing fire tolerant conifers and shade tolerant conifers. • Creating safe and cost effective conditions for protection of life, structures, and resources through reducing the risk of potential high severity fires.

All prescribed fire treatments would create variability across the landscape and return a vital disturbance process to the ecosystem. The distribution of seral stages that determine the FRCC would not completely change the Bridge Thin Project Area from a FRCC2 to a FRCC1. However, the treatments would move towards reaching a FRCC1. Future treatments would need to take place in order to reach that goal and create the early, mid, and late seral stage distribution that is required under a FRCC1.

The proposed action timber harvests would create varying amounts of timber slash in each unit. The increased fine fuel loading may reduce the success of initial attack suppression operations due to the fast rate of spread and the flame lengths at >4 feet. Activity fuels (slash) treatments would reduce the amount of fuel created from the harvests to the S&G fuel loading of 7-11 tons/acre for 0-3" diameter fuel. Fuels treatments are schedule to occur within 1-2 years after the harvest. A reduction in fuel loading would reduce the potential wildfire behavior.

Table 30 displays the changes in fire behavior within the unit of treatment for existing, post harvest, and post fuels treatment conditions. Fire behavior that exceeds 4 feet flame lengths require machinery or aerial support to reduce the risks to tooled firefighters.

Table 30. Existing fire behavior

	Rate of spread (chains/hour)	Flame length (feet)	Crown fire with % mortality*	Spotting potential (miles)
FM5	117 ch/hr	13 feet	Active 99% mort	Yes at 0.6 miles
FM10	38 ch/hr	11 feet	Active 37% mort	Yes at 1.5 miles
FM12	37 ch/hr	13 feet	Active 97% mort	Yes at 0.6 miles
Post Fuels Treatment**	5 ch/hr	2 feet	Active 12% mort	Yes at 0.6 miles

**:Crown fire activity is displayed as Active, which means that fire is present in both the surface fuels and canopy fuels.*
***:Post fuels treatment examines the fire behavior as FM8 because units would have lower fuel loading, higher CBH, and varying canopy density.*

Forest Plan Standards & Guidelines to be met in fuel treatment units:
• reducing fuel loading of 7-11 tons/acre for 0-3" diameter fuel; • maintaining duff coverage of 85% or more; • weight of equipment and machinery would be with in range;

- downed woody debris minimum of 240 linear feet of 20” DBH;
- IDT decision to keep mortality at 10% or less.

Underburns in Units 84, 85, 86, and 87 aim to restore the unique and rare habitat of the open oak savanna. The open oak savanna would benefit from being burned every 5-15 years to reach and maintain the goal of reducing conifer encroachment and maintaining oak as the dominant species (Regan and Agee 1996). With the lack of disturbance, the faster growing conifers would overtake the oak in theses areas. Returning fire disturbance and reducing competition from conifers would support the restoration and subsequent maintenance of this unique habitat.

Fuels thins would occur in Units 50, 95-99,101-103; and all of these units are in WUI. Potential wildfire behavior would be reduced, due to a decrease in surface fuel loading, an increase in crown base height through the reduction of ladder fuels, and an increase in vegetation variability continuity post treatment. Chipping/mulching would not remove the fuel from the site, but it would change the fuel loading to a more compact profile, condensing the lofty fuels where rates of spread would be less. These changes create part of the defensible space next to the private land and along the highway where human caused fire, such as a burning cigarette thrown from a car, can ignite wildfires. Following the treatments the fuel profile would aid in protecting the private property if a wildfire were to approach the area and reduce the risks to firefighters.

The proposed treatment of Unit 100 would be a natural fuels underburn. This unit is also along King Road next to private land. A natural fuels underburn would reduce hazardous fuels, decrease the movement of wildfire from the ground to the canopy by reducing the ladder fuels, and creating variability in the canopy cover. Mortality in these stands would be approximately 20% or less. Underburning would change the fire behavior from FM10 to FM8 in wildfire conditions. Underburning is a preferred method of treatment not only to reduce hazardous fuels but to return fire to the ecosystem. However, a fuel thin may be the first treatment in these areas, due to the close proximity of houses.

Treatments in units located near private residences aim to protect and increase the defensible space in the WUI. The proposed treatments would occur on 142 acres and reduce the spread of a wildfire near the homes through the reduction of ground and ladder fuels. This decreases the potential for ground fire to carry into the canopies and produce embers that can land on roofs, which is one of the main ignition sources in the WUI. Life, private property/structures, and resources are the highest priority to protect during wildfire suppression.

Direct and Indirect Effects Unique to Alternative B

Units 80, 81, 82, 83, 88, and 91 are proposed to be underburned post harvest. These units are located above Highway 126 and are within WUI. The fuels and variability in the horizontal and vertical profiles would change, thus reducing the potential severity of wildfire behavior. Being in the WUI this would also reduce the risks and hazards during fire suppression.

Alternatives B and C—Cumulative Effects

Cumulative effects are based on management activities that have or would occur in the Bridge Thin Project Area. The area analyzed display the direct and indirect effects of fire on the treated units, which translates to the variation of fuel profiles over the larger area. No other hazard reduction projects have been identified in the Lane County CWPP within the Bridge Thin planning area. Oregon Department of Forestry defensible space surveys of homes within the WUI area are currently underway and may identify projects on private property suitable for hazard reduction grants. No foreseeable future fuels management activities that would contribute incrementally to the cumulative effects from past or currently proposed activities are planned within the Bridge Thin Project Area.

Proposed fuel treatments, in concert with harvest activities, would help to diversify the fuel profile across the landscape. This would aid in decreasing the severity of a wildfire within treated stands in the Project Area. No adverse effects on the fuel profile or on fire behavior would result from the proposed fuel treatments.

Alternatives B and C—Conclusion

Alternatives B and C fuels treatments would be conducted following Forest Plan S&Gs. Hazardous fuels would be reduced to meet the desired future conditions, and the current FRCC 2 would be moved closer to FRCC 1. WUI units would aid in creating safer conditions for firefighters and home owners, and all the treatments would reintroduce the disturbance process of fire to the ecosystem.

Air Quality

Scale of Analysis

The area defined for direct, indirect, and cumulative effects analysis is the treatment units in the Bridge Thin Project area, as well as, the larger landscape where smoke emissions can travel. These are the location of the Design Areas and the Class I Airsheds.

Affected Environment—Air Quality

The State of Oregon has been delegated authority for attainment standards set by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments. To regulate these standards, the state developed the Oregon Smoke Management Plan and the State Implementation Plan. These are guidelines and regulations for prescribed fire smoke emissions in Oregon. The Willamette National Forest has adopted this plan for emission control in Oregon (LRMP, 1990).

Designated Areas and Class I Airsheds are priority areas regulated in order to protect air quality. The Willamette Valley (at the eastern side, Leaburg) and Oakridge are the closest Designated Areas to Bridge Thin Project Area (15 and 35 miles respectively). Three Sisters Wilderness and Mt. Washington Wilderness are the closest Class I Airsheds to the Bridge Thin Project Area (3 and 11 miles respectively). Class I Airsheds must be protected from visibility impairment July 1 through September 15. Management activities on the MRRD have maintained air quality within these guidelines for the last 20 years.

Environmental Consequences—Air Quality

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

If no management actions take place in the Bridge Thin Project Area, no air quality impacts would occur in a scheduled timeframe. However, the risk of wildfire would still exist. In the event of a wildfire, air quality impacts are considerably higher than prescribed fire. Smoke emissions are not short term and can often last for many weeks or months, as witnessed during the Puzzle and GW Fires in 2006. Smoke emissions from wildfire are more likely to heavily impact communities and contribute to harmful, concentrated levels of Particulate Matter PM 2.5 and PM 10. Table 30 displays emissions are considerably higher than prescribed fire emissions, posing risk to community residents, forest users, and firefighters. Acreage used for the above wildfire calculation was 2,463 acres, the number of harvest and treated acres in Alternative B. No foreseeable prescribed fire management activities are scheduled to occur in the Bridge Thin Project Area that could contribute to incremental cumulative effects.

Alternatives B and C—Direct and Indirect Effects

Prescribed fire of activity fuels in the Bridge Thin Project Area would comply with Oregon Smoke Management Plan regulations. Smoke emissions can be mitigated based on the timing of the burns, seasonality, forecasted transport wind direction, and weather. Regulations enforce specific days which are suitable to burn in relation to other land owners burning or weather forecasts. Prescribed fire would most likely be avoided between July 1 and September 15 in order to protect visibility standards for Class I Airsheds.

Recreationists and residents near the Bridge Thin Project Area may be temporarily impacted by smoke from prescribed fire underburns or pile burning. In the Oregon Smoke Management Plan, non-harmful concentrations of drift smoke are considered nuisance smoke (Oregon SMP 1995). Mitigation measures, such as signing along the road or near the treatment area, would be taken in order to reduce the amount of nuisance smoke and notifications to the public would be made prior to burning.

Smoke emissions were predicted using the estimates from the debris prediction tables and FOFEM (First Order Fire Effects Model version 5.0). This model calculates particulate matter emitted based on the amount of fuel consumed. Fuel inputs were from the predicted post harvest data and based on a percentage of fuels that would most likely be consumed given the prescribed fire window. That is, weather and fuels dryness would be measured to achieve the objective of reducing the fuel profile across the unit. From past experience, fuels treatments consume an average of 80% of the fine fuels (0-1 inch diameter), 60% of the 1-3 inch fuels and only about 20% of the 3-9 inch. LWD >9 inches is most often too wet to be consumed. FOFEM however consumes 100% of 1, 10, and 100 hour fuels in spring-like conditions. Table 31 summarizes particulate matter predicted for fuels treatment activities.

It is important to note these emissions levels do not occur at one time. Usually prescribed fire operations occur one unit at a time (in one day). For example, Unit 80 is predicted to have 24.3 tons/acre of 0-3” diameter fuel post-harvest. During the prescribed fire underburn, emissions are estimated at 2.37 tons/unit of PM 10 and 2 tons/unit of PM2.5.

Table 31. Summary of particulate matter emissions for Bridge Thin Project Area for all treatments

	Alternative A – Wildfire	Alternative B	Alternative C
PM 2.5 total	1735 tons/acre	517 tons	484 Tons
PM 10 total	2048 tons/acre	610 tons	572 Tons

Alternatives B and C—Cumulative Effects

No adverse effects on the air quality would result from the proposed fuel treatments. Smoke emissions would be short duration and mitigation measures would reduce the quantity of emissions during prescribed burns. Past management activities do not cumulatively add to air quality impacts from the proposed treatments. Proposed maintenance burns of Unit 80 should produce less smoke emission than before due to the quick prescribed fire return interval. No other foreseeable management activities are scheduled to occur in the Bridge Thin Project Area.

Invasive Plants_____

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Invasive Plants includes the project activity units, associated and adjacent roads, and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Invasive Plants

The Willamette National Forest categorizes invasive plants into three groups, and control strategies will differ depending on species' classification.

Invasive Plant Groups
• **Potential invaders** are those species located in adjacent National Forest or other lands that have a high probability of being detected on the Forest in the foreseeable future (next 15 years) because potential habitat exists here.
• **New invaders** are those weed species just entering the National Forest and whose populations are possible to eradicate.
• **Established infestations** include weed species that are so widespread on the Forest they are not likely to eradicate. Some species, such as blackberry, can have both new invader populations that are less than 10 plants and are outliers as well as established infestations such as those that are found bordering streams at lower elevations.

Nine new invader species exist in the Bridge Thin project area. Some of these species are shade-tolerant and more difficult to control than others are. However, all of them are capable of adverse

impacts by easily populating disturbed areas and establishing monocultures by out-competing the native vegetation. The new invader species known to occur in the Bridge Thin project area are listed below in Table 32.

With the exception of false brome and English ivy, most invasive plants found in the project area are shade-intolerant and generally confined to roadsides and open areas. One of many ecological advantages of invasive or non-native plants is the lack of native competition to keep populations balanced. More so, prolific propagation and the ability to disperse large amounts of seed is probably the greatest advantage invasive plants have in native ecosystems.

Even without past or present management actions, invasive plants would still be present from natural and biological vectors. Invasive plants are present on the properties of adjacent landowners and along the Highway 126 corridor. However, past harvest and road maintenance activities within the Bridge Thin project area have provided additional opportunities for establishment and spread of invasive plants. Some management actions, such as harvest and yarding, result in short-term disturbance conducive for invasive plant establishment. The effects of these actions are greatest at the onset of implementation and often decrease over time and with stand succession.

Other management activities like road construction or maintenance often result in longer-term effects to invasive plant infestations. This is because roads serve dual functions by acting as suitable ground for the establishment of invasive plants and by providing the plants access to a host of potential vectors. The close proximity of the Bonneville Power Administration (BPA) transmission line corridor to proposed haul routes also serves as a vector of invasive plants in the Bridge Thin project area.

Table 32. Invasive Plants in the Bridge Thin Project Area

Invasive Species	Proposed Units	*Recommended treatments (in addition to Ch. 2 mitigation measures, design criteria, and BMPs)
False brome (*Brachypodium sylvaticum*)	2, 3, 19, 26, 29-32, 42, 43, 91, 95	Mechanical Chemical
Spotted knapweed (*Centaurea maculosa*)	6, 9, 19, 22, 32, 71	Mechanical Chemical
Field Bindweed (*Convolvulus arvensis*)	43	Mechanical Chemical
Yellow toadflax (*Linaria vulgaris*)	40	Manual/Mechanical/Chemical
Deadly nightshade (*Solanum dulcamara*)	26, 95,	Mechanical Chemical
Everlasting peavine (*Lathyrus latifolius*)	27, 91, 102	Mechanical Chemical

Invasive Species	Proposed Units	*Recommended treatments (in addition to Ch. 2 mitigation measures, design criteria, and BMPs)
English ivy (*Hedra helix*)	3	Manual/Mechanical/Chemical
Deptford pink (*Dianthus armeria.*)	6, 68, 103	Mechanical Chemical
**Evergreen blackberry (*Rubus laciniatus)*	82, 83	Manual/Mechanical/Chemical

*: **Manual**=hand pulling/digging before seed production
Mechanical=mowing/cutting just after flowering has ended, *but* before seed matures
Chemical=use of one or more herbicides approved for application in the Willamette National Forest Integrated Weed Management EA (March 2007)
:Established species, but considered new invader population**

Environmental Consequences—Invasive Plants

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Selecting this alternative would allow the same level of invasive plant control as currently programmed. New and potential invader plant populations documented in the Bridge Thin project area would remain highest priority in receiving treatment and monitoring.

The No Action Alternative would not provide an opportunity to further contain or control invasive plant populations, or reduce the current rate of spread of these species within the project area. This alternative does nothing to manage established new invader populations along forest road 1900-408. Further, the No Action Alternative may ultimately reduce the ability to contain or eradicate invasive plants in this area in the future because the new invader populations are capable of exponential growth and can produce seed that is viable for decades.

Alternatives B and C—Direct and Indirect Effects

Alternatives B and C propose similar acres of harvest and fuel treatments, as well as miles of road maintenance (See Tables 2 and 5). These proposed activities would produce ground disturbance and provide suitable conditions for invasive plants to establish or out-compete native vegetation.

Most of the invasive plant populations in the Bridge Thin project area are established along roads and are mainly spread by vehicular traffic. Alternatives B and C propose similar amounts of road maintenance activities and identical amounts of temporary road construction. It is also noted that false brome and English ivy occur in units proposed for harvest, ground-based yarding, and underburning fuels treatments. The risk of spreading invasive plants in the project area through harvest is highest in ground-based yarding units. Alternative B (770 acres) and C (760 acres) propose almost identical amounts of ground based harvest treatments. Skyline-based yarding poses a lesser risk, mainly centered around landings and access roads, which could serve as vectors of invasive plant introduction to units. Alternative B (960 acres) proposes 130 more acres of skyline-based yarding that Alternative

C (830 acres). Helicopter-based yarding units pose little risk of spreading invasive plants. Alternatives B (520 acres) and C (500 acres) propose similar amounts of helicopter-based yarding.

Mitigation measures (See Chapter 2) would remove or significantly reduce the risk of further spreading or introducing invasive plants or spreading invasive plants onto adjacent properties by hauling across ownership boundaries.

Any action alternative selected would have a high risk of increasing invasive plants populations in the Bridge Thin project area. Mitigation measures (see Chapter 2) would remove or significantly reduce the risk of further spreading or introducing invasive plants onto adjacent properties. However, the risk of increasing invasive plant populations is greater with either of the action alternatives regardless of mitigation measures, design criteria, or best management practices. This determination is based on the extent of the existing infestations and the ability of the invasive species present in the project area to outcompete native vegetation

Alternatives B and C—Cumulative Effects

The cumulative effects analysis area for Invasive Plants is the entire Bridge Thin project area, associated and adjacent roads. This analysis area was selected for its known distribution of invasive plants and because it contains likely travel routes for the proposed project.

Past management activities in the last 50 years include road construction, road maintenance, and timber harvest on public and private land in the project area. Included in these activities are the Bonneville Power Administration power line corridor and vegetation management activities. Because of the design criteria and mitigation measures proposed to contain and eliminate the spread of invasive plants, there would be no anticipated incremental cumulative effects on invasive plants from road maintenance or harvest activities. The potential integrated management opportunities afforded by this project would also provide additional resources to treat the new invader species in the Bridge Thin project area, and assist in reaching the goal of control and eventual eradication of new invader plants.

Roads and Access

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Roads and Access includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Roads and Access

The project area includes approximately 12 miles of State Highway 126, 6.3 miles of County roads, 12.7 miles of Bureau of Land Management roads, 22.7 miles of private roads and driveways, and 61.5 miles of Forest roads for a total of 115.2 miles within the McKenzie River Ranger District.

Past management activities in and near the Bridge Thin Project area have provided the current network of Forest Roads, mainly from timber sales. The current system of roads provides sustainable access to the area for administration, protection, public recreation, and forest product utilization,

consistent with the Willamette Forest Plan. This section incorporates by reference the Willamette National Forest Road Analysis Report (USDA Forest Service. 2003), which provides detailed information regarding the Forest roads, describing maintenance levels, maintenance costs, and management direction.

Existing Condition of the Road System

Forest road 1500, known as the Blue River Road, and Forest road 1900, known as Aufderheidi Drive, are double-lane paved surfaced roads that provide the primary access to the project area from State Highway 126. Other important Key Forest roads that provide access to the area include Forest roads 1501, known as the Lower Lookout Road, and 1500-105, which are both tributary to Forest road 1500, and Forest roads 2611, known as the Mt. Hagan Road, 2618, known as Quartz Creek Road, and 2633, known as Mill Creek Road, which are all tributary to State Highway 126. There are several local Key Roads that provide access to important facilities within the project area. These Key Roads and numerous secondary roads are predominately surfaced with crushed rock.

Approximately 20.7 miles of the Forest roads in the project area are currently closed with gates, berms or other structures, or by vegetation.

The current road system allows the Forest Service administrative access to conduct a wide variety of forest management and fire protection activities in the area. Access is also provided for inspection and maintenance of the Bonneville Power Administration and Eugene Water and Electric Board hydropower and powerline facilities. Specifically, the Forest roads provide access to Forest Service administrative facilities at Blue River, the BPA's Cougar Reservoir Hydroelectric facilities, a cellular communications and mobile radio repeater site at Mt. Hagan, public recreation opportunities at Blue River and Cougar reservoirs, Delta campground, and the King Castle Trail. Numerous dispersed campsites are accessible by roads in the project area. In addition, current roads provide the means to transport timber products from the National Forest. These roads also allow public use of firewood and special forest products.

The road system receives annual maintenance in accordance with established road management objectives. However, over the last decade, a limitation on road maintenance funds on the Forest has resulted in a backlog of maintenance work to reduce brush, clean out drainages, and repair road surfaces on many of the Key and secondary roads in the project area.

Environmental Consequences—Roads and Access

Alternative A (No Action)—Direct,Indirect, and Cumulative Effects

Alternative A would not change the use pattern of roads, or correct existing road erosion problems. Without timber harvest related road maintenance, the existing budgetary trend makes it unlikely that funding would be available to support adequate road maintenance, which could eventually result in unsafe traveling conditions for public and administrative traffic, as well increasing the possibility of resource damage. There is currently a backlog of road maintenance and some local roads are becoming impassible due to fallen trees or the growth of brush. Culverts that are not maintained

because of impassible roads could plug and cause washouts. Current rates of the spread of invasive plants could continue on roads not maintained.

Alternatives B and C—Direct and Indirect Effects

Road maintenance as identified in Chapter 2 would occur under all action alternatives, and would protect the road infrastructure, improve safety of the road, improve drainage, and reduce the spread of Invasive Plants. Action alternatives may cause a temporary increase in sedimentation while the work is being done, but in the long term, would decrease the volume and velocity of water that carries sediments into creeks. Newly graded or surfaced roads, improved drainage structures, and upgraded culverts could increase sediment production until road surfaces stabilize.

Maintenance activities could cause some short-term delays or detours for road users while roadwork is being performed. Road reconstruction or maintenance would protect the existing road infrastructure, improve safety of the road, decrease sedimentation, and reduce the spread of Invasive Plants. Brushing roads increases sight distance to increase visibility for safe driving. Blading, ditch maintenance, culvert replacement, surface rocking, and installing dips or waterbars corrects or improves water drainage. Removing ditch slough, or accumulated soil, to predetermined disposal locations would reduce the likelihood of spreading Invasive Plants. Designated water sources for filling water tankers for compaction and dust abatement operations are not expected to affect stream flows.

After the road closures and decommissioning, the open road density within the project area would be reduced from approximately 42.8 miles to 42.6 miles in all action alternatives (B and C). Proposed road closures with gates or earth berms would decrease access (public, administrative and commercial), decrease the current effective open road density, reduce existing road erosion problems, and reduce road maintenance costs. Roads closed by the project would be left in a condition to drain properly and protect water quality.

There would be fewer roads for public and administrative vehicle access for recreation, reforestation, fire and noxious weed control. Removing berms to access roads for fires suppression would take additional time and equipment. It would cost more to treat weeds if vehicle access is prevented (walking in to the treatment areas would be required). Future access on closed roads would have the additional cost of reopening and later re-closing the road. However, the cost of maintaining a road that has been effectively blocked to traffic and has self-maintaining water drainages is less costly than keeping it open.

Alternatives B and C—Cumulative Effects

The effect of past management actions have created a 61.5 mile Forest Service road system within the Bridge Thin Project area that requires consistent road maintenance levels to provide adequate resource protection. Alternatives B and C would provide this necessary road maintenance on the haul routes. An additional 41.7 miles of non-Forest Service roads also exists in the project area of which private roads (22.7 miles) are the majority. The incremental cumulative effect of all action alternatives would be to reduce the miles of road available within the project area for public access by approximately 0.2

miles. There are no additional foreseeable future Forest Service management actions that would add to or subtract mileage from the current roaded condition of the project area.

Recreation

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Recreation resources includes the project activity units and the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Recreation

The project area is popular for both dispersed and developed recreational activities including: scenic viewing, driving, hiking, boating, fishing, and camping in the summer. Portions of the West Cascades National Scenic Byway and the McKenzie River Corridor are within the project area.

The forested slopes along the McKenzie River form an important scenic backdrop to the National Scenic Byway that includes the portion of State Highway 126 adjacent to the project area. The McKenzie River and its adjacent lands are a favorite location for fishing, hunting, hiking, biking, photography, picnicking, and boating.

The King Castle Trail and Delta Old Growth Trail are located along the southeast portion of the project area.

Developed recreation sites within or adjacent to the project area include: Delta Campground, McKenzie Campground, Bruckart Bridge Boat Launch, Forest Glenn Landing Boat Launch and Saddle Dam Boat Launch along Blue River Reservoir.

The project area outside the designated river corridor receives light to seasonally heavy recreation use. Recreational activities include hiking, horseback riding, berry picking, viewing scenery, dispersed camping, and hunting. Hunting is particularly heavy for deer and elk in the fall. In the summer, Blue River Reservoir is popular for fishing, swimming, and boating.

Recreation residences (summer homes) in tracts Delta A and B are located within or adjacent to the project area. These residences are located on National forest land and are under a special use permit.

Recreation Opportunity Spectrum (ROS)

The Forest Service uses a land classification system to inventory and describe a range of recreation opportunities called the Recreational Opportunity Spectrum (ROS) from the Willamette Forest Plan FEIS, page III-93. This system seeks to identify recreation settings of varying characteristics that range from small, remote, undeveloped areas to large, easily accessed highly developed sites. Settings are described in the following five ROS Classes: Primitive, Semiprimitive Non-motorized, Semiprimitive Motorized, Roaded Natural, and Roaded Modified. Whereas Primitive falls on the most unmodified natural environment end of the spectrum and Roaded Modified falls on the most

substantially modified end of the spectrum. Table 33 displays the ROS for those Management Areas within the project area.

Table 33. Recreation Opportunity Spectrum for the Project Area

Willamette Forest Plan Management Areas	ROS Class	Unit(s)
5a – Special Interest Areas	ROS – Roaded Natural	95, 97, 98, 100, 102, and 103.
9d – Wildlife Habitat, Special Areas	ROS – Roaded Natural	1, 3, 6, 7, 8, 10, 21, 84, 85, 86, 88, 841
11a – Scenic – Modification Middleground	ROS – Roaded Modified	26,29, 30,32, 35, 41,42, 43, 44, 45, 46, 47, 48, 52, 53, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 70.
11c – Scenic – Partial Retention Middleground	ROS – Roaded Natural	1, 2, 4, 5, 6, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 23, 25, 27, 28, 35, 36, 37, 38, 39, 40, 41, 44, 49, 50, 51, 54, 55, 56, 58, 59,67, 68,69, 70, 71, 72, 80, 81, 82, 83, 84, 89, 91.
11e – Scenic – Retention Middleground	ROS – Roaded Natural	29, 30, 31, 32, 33, 34, 35,36, 37, 56, 57, 58, 59, 60, 69
11f – Scenic – Retention Foreground	ROS – Roaded Natural	27, 28, 80, 81, 82, 83, 84, 87, 88, 89, 91, 95, 96, 97,98, 99, 100, 101, 102, 103

Recreational Driving

The most noticeable driving for pleasure (sightseeing) occurs along the West Cascades National Scenic Byway that includes the portion of State Highways 126 and Forest Road 19, adjacent to the project area, but some use occurs along Forest roads too.

Approximately 3 miles of State Highway 126 is adjacent to the planning area. It receives heavy traffic from motorcycles, RV's, logging trucks, passenger cars and pickups, as well as bicycles. Fewer vehicles travel the Forest roads off of Highway 126 with the later traffic use decreasing in the winter months due to the snow levels.

The use of Forest road system varies from very light use on most dead end roads, to moderate use on secondary and connector and heavy use along Forest Road 19 to Cougar Reservoir. Secondary and connector roads receive increased use during the hunting and winter snow play season. These roads were primarily constructed and maintained for future timber harvest and other land management activities.

Dispersed Camping

A moderate number of dispersed campsites are located within the project area. The number and location of sites may vary somewhat as road closures limit access to some areas, and as new roads open others. The more popular sites are often found on open roads and landings. The dispersed sites are usually associated with favorite hunting areas and get-away-spots, and are often near water. Some dispersed sites are located along Blue River Reservoir and Cougar Reservoir.

Day Use

Blue River Reservoir and Saddle Dam Boat Launch are popular summer day use areas in the project area. Overnight camping is not allowed in the boat launch area at Blue River Reservoir, however, dispersed camping and access to the reservoir is from this area

Developed Sites

Delta Campground is the only developed camping site within the project area, however, McKenzie Campground is located just east of the project area boundary.

Trails

King Castle Trail and Delta Nature Trail are the only active system trails within the project area. King Castle trail crosses the southwest portion of Unit 100. Delta Nature Trail is south of Unit 841.

Environmental Consequences—Recreation

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Recreation use of the National Forest in the project area would remain unchanged with the no action alternative. The recreating public would continue to use the project area for recreational purposes, and would continue current use of dispersed sites, day use areas, developed sites, trails, and roads. Alternative A does not manage forested stands within recreation areas and there are no ongoing or reasonably foreseeable projects in the area. Therefore, Alternative A would have no direct, indirect, or cumulative effects on recreation within the project area

Alternatives B and C—Direct and Indirect Effects

Short terms effects of proposed timber harvesting, log truck hauling, and fuel treatments would be localized road closures; disruption to hunting, hiking, camping, and driving in some areas. The logging activity, hauling, and fuel treatments could cause noise and dust or smoke disturbance. The duration of these effects would only last for the duration of implementing the stand treatment. It is unlikely that all recreation use in the area would be affected at the same time.

The effects of summer timber harvest and associated activities south of Blue River Reservoir area could increase pressure on other water-related areas.

Alternatives B and C—Cumulative Effects

Past activities in the Bridge Thin Project area included timber harvest and road construction, creating a network of roads. These activities have opened vehicle access to Forest lands where dispersed recreation activities may occur.

The incremental effects of the proposed and all action alternatives would be to reduce approximately 0.5 miles of road, as discussed in Chapter 3, Roads and Access, to vehicle access open to public where dispersed recreational activities may occur.

There is no foreseeable future management action planned, which would add cumulative effects to the recreation uses condition in the project area.

Scenic Quality

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Scenic Quality includes the project activity units within Forest Plan Management Allocations MA-11a, MA-11c, MA-11e, MA-11f in the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Scenic Quality

The landscape within and adjacent to the project area is generally characterized as being a Douglas fir dominate forest. From the road, river, and reservoir corridors views are made up of an even-aged or uniform appearing over story of Douglas fir trees, hemlock and hardwood understory tree species, and common shrubs such as rhododendron, vine maple, and Oregon grape. Past and present natural and human caused disturbances/modifications (including: fire, disease, timber harvest, fire suppression, and road and facility development) are visible within and adjacent to the project area.

There are openings in the project area from past timber management activity (within last 60 years) in the visually sensitive landscape (MA-11a, MA-11c, MA-11e or MA-11f). Some older existing openings are visible in the scenic viewshed (MA-11a and MA-11c) but these stands are considered vegetatively recovered, as defined by Willamette Forest Plan standards and guidelines. Some management created openings above the river are visible from State Highway 126.

Visual Quality Objectives (VQO)

The Forest Plan establishes Visual Quality Objective (VQO) categories to describe degrees of acceptable alteration of the natural landscape when considering timber stand management (Forest Plan FEIS, page III-112). Objectives range from allowing ecological change only to allowing for human activity to dominate the characteristic landscape. The five VQO categories are: Preservation, Retention, Partial Retention, Modification, and Maximum Modification. Following is a description of each category:

Visual Quality Objectives
Preservation: Provides for ecological change only.
Retention: In general, human activities are not evident to the casual forest visitor.
Partial Retention: In general, human activities may be evident but must remain subordinate to the characteristic landscape.
Modification: Human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture, and appear as natural occurrence when viewed in foreground or middleground.
Maximum Modification: Human activity may dominate the characteristic landscape but should not appear as a natural occurrence when viewed as background.

Table 34. Visual Quality Objective Categories for the Project Area.

Willamette Forest Plan Management Areas	VQO category	Unit
5a - Special Interest Areas	VQO – Retention	95, 97, 98, 100, 102, and 103.
9d – Wildlife Habitat, Special Areas	VQO – Retention	1, 3, 6, 7, 8, 10, 21, 84, 85, 86, 88, 841
11a – Scenic – Modification Middleground	VQO - Modification	26,29, 30,32, 35, 41,42, 43, 44, 45, 46, 47, 48, 52, 53, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 70.
11c – Scenic – Partial Retention Middleground	VQO – Partial Retention	1, 2, 4, 5, 6, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 23, 25, 27, 28, 35, 36, 37, 38, 39, 40, 41, 44, 49, 50, 51, 54, 55, 56, 58, 59,67, 68,69, 70, 71, 72, 80, 81, 82, 83, 84, 89, 91.
11e – Scenic – Retention Middleground	VQO - Retention	29, 30, 31, 32, 33, 34, 35,36, 37, 56, 57, 58, 59, 60, 69
11f – Scenic – Retention Foreground	VQO – Retention	27, 28, 80, 81, 82, 83, 84, 87, 88, 89, 91, 95, 96, 97,98, 99, 100, 101, 102, 103

West Cascades National Scenic Byway

In 2000, the West Cascades Oregon Scenic Byway was federally designated as a National Scenic Byway by the Federal Highway Administration and extends approximately 220 miles from Estacada to Westfir, Oregon. The West Cascades National Scenic Byway traverses the western edge of the Cascade Mountains and a segment of the route includes Highway 126 from its junction with Highway 20 south to Forest Road 19.

Approximately 3 miles of the byway near McKenzie Bridge is located within the project area. The 3 miles totals approximately 1% of the entire length of the byway. Units 96, 97, 98, and 99 are adjacent to the highway and are in Management Area 11f – Scenic Retention Foreground.

Environmental Consequences—Scenic Quality

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Scenic quality along the West Cascades National Scenic Byway would remain unchanged. The No Action Alternative would not harvest timber stands in any visual management areas in the Bridge Thin planning area, and there are no ongoing or reasonably foreseeable projects in the area. All visually sensitive Management Areas remain consistent with Forest Plan standards and guidelines, and VQOs are met. Alternative A would have no direct, indirect, or cumulative effects on scenic quality in the project area

Alternatives B and C—Direct and Indirect Effects

Short term effects to visual quality for the Bridge Thin Project area would be limited to exposed stumps from harvested trees, less dense forested stands (increasing depth of view), slash or underburned areas, and possibly dust from transporting forest products from the forest on unpaved Forest roads. Long term effects would include fewer exposed stumps due to vegetation recovery (3-6 years and after), and larger diameters and larger crowns of residual trees due to increased growing space. Intermediate harvest treatments, including fuels treatment, are expected to accelerate stand development toward a more natural range of conditions and scenic diversity in the project area. More visually interesting structure, depth of view, and mix of vegetative species are likely long term effects of proposed vegetation entry.

Units within the 11F management area would not require flush cut stumps. Units with commercial harvest that are located in 11F are on steep slopes above Highway 126 and should be no more or less visible from flush cutting. Flush cutting stumps on the slopes will also create material that could pose a hazard during harvest operations on steep slopes. Units 95-103 will not have commercial harvest and stumps will be cut low to the ground in an effort to remove small material to minimize residual fuels.

Alternatives B and C—Cumulative Effects

Considering that Alternatives B and C would include thinning of a small portion (less than 1%) in each of the MA-11a, MA 11-c, MA11-e, and MA11f visual management areas for the Western

Cascades National Scenic Byway, there would be no adverse effect on the scenic quality. Short term acceptable effects from the thinning are recognized.

The proposed action and Alternative C would not contribute additional adverse effects to the other visually sensitive areas located along Highway 126. These modifications would still maintain modest scenic quality as required in the Forest Plan, and may result in visually interesting stand structure, depth of views, and mix of trees and understory species.

Therefore, no long-term adverse incremental cumulative effects to scenic quality are anticipated considering the direct and indirect effects from the proposed action and the action alternatives. Also, no reasonably foreseeable future management actions are planned for the project area which would result in additional cumulative effects to the scenic quality.

Roadless and Unroaded Areas

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Roadless and Unroaded areas includes the project activity units and Forest Service lands in the McKenzie River/Elk Creek 6th Field sub-watershed, which is also the Bridge Thin Project area.

Affected Environment—Roadless and Unroaded Areas

The Bridge Thin Project Area includes approximately 2,600 acres of the Mount Hagen Inventoried Roadless Area (IRA). However, no project activities are proposed within the Mount Hagen IRA. The closest activity unit is located approximately 1.5 miles from the IRA, and the nearest activity unit containing unroaded areas is approximately 2.5 miles from the Mount Hagen IRA. The project area also contains about 4,287 acres of contiguous unroaded areas 1,000 acres or more in size as analyzed in the Willamette Pilot Roads Analysis, 2003 (USDA Forest Service. 2003). These unroaded areas do not exist in large blocks due to extensive road building in this area over the past 50 years, which resulted in 61.5 miles of Forest Service system roads in the project area. Existing roads provide access to a majority of proposed harvest units. None of the harvest units have portions that are greater than 1/2 mile from an existing road or a previously harvested stand.

Timber harvest would only affect Adaptive Management Areas from the amended Willamette Forest Plan. Harvest units within unroaded areas are the same for both action alternatives. Table 35 displays harvest units and approximate acres within unroaded areas greater than 1,000 acres.

Table 35. Units within Unroaded Areas*.

Harvest Unit #	Acres within Unroaded Areas
13	21
14	27
15	74
17	24

Harvest Unit #	Acres within Unroaded Areas
18	27
20	13
56	15
57	15

***** All units are within Adaptive Management Areas.

Environmental Consequences—Roadless and Unroaded Areas

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Alternative A would not implement any management actions within the project area. Natural processes and forest successional pathways would continue. Alternative A does not manage forested stands within unroaded areas and there are no ongoing or reasonably foreseeable projects in the area. Therefore, Alternative A would have no direct, indirect, or cumulative effects on unroaded areas or on any roadless values that currently exist within the project area.

Alternatives B and C—Direct and Indirect Effects

Soil, Water, and Air

The effects of the action alternatives on water quality, soils, and air are discussed elsewhere in this chapter (Aquatic/Riparian Habitat and Soils). Stands within the unroaded areas managed with thinning or group select harvest treatments would not adversely affect roadless characteristics derived from these resources. Applying thinning or group select timber harvest to stands within the unroaded areas is not expected to affect the current ability for this area to function as a source of public drinking water to communities downstream.

Diversity of Plant and Animal Communities

Because of the heavily roaded condition of the project area, the proposed harvest units do not contain the diversity of plant and animal species that would be found in large, natural unmanaged stands where there would be no disturbance from roading and forest management activities. None of the action alternatives are expected to result in any decrease in such diversity of plant and animal species. The effects on sensitive plant and animal species are discussed elsewhere in this chapter.

Habitat for TES species and biological strongholds

No suitable habitat for the northern spotted owl would be either downgraded or removed within the unroaded areas (see the Threatened Northern Spotted Owl section). Effects on the spotted owl are consistent with Standards and Guidelines from the Willamette Forest Plan. Through informal consultation, the U.S. Fish and Wildlife Service concurs with the Biological Assessment, that the Bridge Thin Timber Sale would not jeopardize the continued existence of the spotted owl.

None of the proposed harvest units are located in Late Successional Reserves. Effects of the proposed units on the habitat for other Threatened, Endangered, or Sensitive species are also discussed elsewhere in this chapter.

The areas are not considered interior habitat because of the existing roaded condition of the project area. The proposed action is not expected to affect areas that would function as biological strongholds or refuges for species that depend on large undisturbed areas, such as the Threatened northern spotted owl.

Primitive, Semi-Primitive Non-Motorized Classes of Recreation

With clear evidence of past forest management, the landscape in the Bridge Thin Project is characterized as a patchwork of natural stands and second growth conifer plantations. As stated elsewhere in this chapter, the proposed partial cutting in this proposal, and the other action alternatives, would all remain within Forest Plan standards and guidelines for ROS and VQO, and would not adversely affect the existing scenic quality of the landscape.

Landscape Character and Scenic Integrity

There are limited opportunities for recreation activities that depend on remoteness and wilderness-like experiences in this area, as discussed elsewhere in this chapter (see Recreation and Scenic Quality). Roads are either visible or vehicles can be heard on roads from any location in the project area. Except for short term noise and traffic occurring during project implementation, the proposed action and other action alternatives would have not diminish any sense of remoteness or solitude that currently exist within any unroaded areas in the project area.

Traditional Cultural Properties and Sacred Sites

As discussed later in this chapter, there are no known cultural sites within any of the stands where timber harvest operations would occur, including managed stands within the unroaded areas. There would be no effect on traditional cultural properties or sites from the proposed action or any other action alternative.

Alternatives B and C—Cumulative Effects

The area of consideration for the unroaded area analysis is the 20,657 acre Bridge Thin Project Area. Timber sales have modified approximately 3,711acres within the project area with primarily regeneration harvest since the 1950s (see Table 13). Timber sales (and State and Federal Highway development) have also contributed to the development of a 115-mile network of roads on the area. As a result, there are now roughly 4,300 acres of contiguous unroaded areas 1,000 acres or more in size.

Both action alternatives would include approximately 216 acres of thinning and group select timber harvests within unroaded areas. No alternative includes permanent or temporary road construction within unroaded areas..

Considering past effects on unroaded areas by timber management, road development, and post-harvest treatment over the last 50 years, the thinning and group select timber harvests in both action alternatives would affect an additional 5% of the 4,300 acres considered unroaded and without management. No other management actions are planned for the project area that would result in additional affects to unroaded areas.

Social/Economics

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Social/Economic issues includes the project activity units is the Bridge Thin Project area and the surrounding communities that would be affected by the proposed project.

Affected Environment—Social/Economics

The Bridge Thin Project area is situated along Oregon State Highway 126, between the communities of Nimrod to the west, and McKenzie Bridge to the east. The communities of Blue River and Rainbow, Oregon are also located within or adjacent to the project area. Highway 126, a major travel route for commercial and recreation traffic passing through these communities, follows along the McKenzie River, bisecting the Bridge Thin project area.

The economy of the local communities from the Springfield urban-growth boundary to McKenzie Bridge depends on a mixture of tourism, recreation, timber industry, and Forest Service jobs for stability. Local businesses that rely on tourism and recreation include Hoodoo Ski Bowl, and the many inns, lodges, restaurants, stores, gas stations, and the outfitters and guides. Timber industry jobs include a variety of woods and mill jobs. Forest Service jobs in the Willamette and Deschutes National Forest vicinity are located at McKenzie Bridge, Sisters, Detroit, and Sweet Home Ranger Stations. Tourism and recreational activities connected with National Forest lands have been on the increase in recent years for the upper McKenzie River area. Employment connected with tourism and recreation-related services have also increased.

The current level of timber harvesting on the Willamette National Forest has dropped substantially from the levels of the mid-1980s. This decrease has contributed to a decline in the number of local jobs associated with the wood products industry in the area.

Environmental Consequences—Social/Economics

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

The no-action alternative would not harvest any timber, and therefore, would not support direct, indirect, and induced employment. It would not result in increased income to the regional or local economy. Current levels of employment in the wood products sector would not be affected by this project.

Alternatives B and C—Direct, Indirect, and Cumulative Effects

All action alternatives are economically viable, considering current selling values, timber volume per acre, yarding systems required, the proposed temporary road construction and system road maintenance needed, and the identified post-timber harvest projects identified in this analysis. The economic analysis run to make this determination is available in the Bridge Thin Project analysis file at the McKenzie River Ranger District office.

In general, the primary effect on timber harvest-related employment would occur from commercial timber harvest associated with the action alternatives over the next two to four years. As the alternative volume tables in Chapter 2 indicate, Both action alternatives would provide a relative moderate level of opportunity for timber harvest-related employment, and higher revenues. The proposed action, Alternative B, would provide slightly higher revenues than Alternative C. Table 36 discloses costs and revenues and the estimated present net value of each of the action alternatives, based on an average base period price of $39.19/CCF (100 Cubic Feet).

Though the combined economic benefit from implementation of any of the action alternatives is expected to be positive, each of the alternative from the Bridge Thin Project would have a moderate and localized beneficial effect for the socio-economic environment of western and central Oregon.

Table 36. Estimated Present Net Value of Alternatives.

	Alternative A No Action	Alternative B Proposed Action	Alternative C
Volume (MBF / CCF)	0	45,510 / 87,519	42,509 / 81,748
Discounted Costs	$0	$20,311,805.	$18,317,856
Discounted Revenues*	$0	$20,950230	$18,762,971
Present Net Value (PNV)	$0	$638,425	$445,116
PNV per Acre	$0	$338.87	$260.76
Benefit/Cost Ratio	0	1.0314	1.0243

* Discounted Revenues based on July 2008, selling values.

Heritage Resources

Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Heritage Resources includes the project activity units in the Bridge Thin Project area.

Affected Environment—Heritage Resources

Archaeological materials recorded within the Bridge Thin project area represent Native American lithic scatters and historic period logging debris. The archeological sites within the project area are considered potentially eligible to the National Register of Historic Places (NRHP) and would be protected from project activities. The proposed Bridge Timber Sale has the potential to affect two of the known cultural sites within or near the project area. To protect these potentially eligible sites the project was redesigned by dropping portions of timber sale stands.

Prehistoric Use

Ethnographic research indicates that highly mobile prehistoric and early historic aboriginal groups, probably the Molala, Kalapuya, and their ancestors used the western Cascade Mountains for the main purpose of seasonal hunting, fishing, and plant gathering.

Ethnographic evidence also suggests that the Molala Indians were indigenous to the area and lived during the winter along low elevation streams, accessing the uplands during the summer and fall to hunt game and gather berries and other important plant resources. The Molala are linguistically related to Willamette Valley groups, but are thought to be a montane-based band that were living in the western Oregon Cascades during the historic period. The Molala generally are known to be split into two subgroups: the Northern Molala located in the vicinity of Mount Hood's drainage systems and the Southern Molala located west of the Klamath Lake area. Little is known of a third group, referred to as the Upper Santiam/Santiam band of Molala known to have occupied Linn and Lane counties in areas between the Northern and Southern groups. The Molala are also often culturally grouped with the Kalapuya who were based in the Willamette Valley but probably made seasonal forays to the Cascades for large game and berries. Many of the Molala and Kalapuya were removed to the Grand Ronde Reservation in western Oregon after the signing of the Dayton and Molalla Treaties of 1855). Other Molala shifted to the Siletz Reservation along the Oregon coast, the Klamath reservation to the south and east into Central Oregon where they were absorbed into the Confederated Tribes of Warm Springs Reservation of Oregon.

Flaked obsidian bifaces, flake tools, and lithic debris are the most abundant prehistoric Native American artifacts found in the area. These stone artifacts represent a range of activities, including stone tool production and use, which was generally related to hunting and gathering activities. Past and current stone tool analyses support the previously noted position that this portion of the Cascades was occupied primarily by highly mobile people indigenous to the Cascades.

Historic Land Use

Historic accounts document the presence of horse-mounted Warm Springs Indians traveling into and through the area in the late 1800s and early 1900s (Williams 1988); these seasonal travels were motivated by the need for forage for horses, huckleberry gathering, inter-tribal contacts and visiting, hunting, fishing, trading with white settlers, and travel to seasonal cash employment, such as picking hops in the Willamette Valley (Williams 1988; Bergland 1992).

The earliest recorded permanent Euro American settler in the area was John Templeton Craig, who homesteaded at Craig's Pasture (now McKenzie Bridge) in the 1860s. The prospect of a toll road over the McKenzie Pass began to draw settlers into the area after 900 cattle and nine wagons made it over the pass on a rough track (the Scott Wagon Road) in the fall of 1862 (Williams 1988).

The town of Blue River was founded in 1886 (Williams 1988). Subsistence hunting, farming, and stock raising were the primary lifestyles of the early settlers. A greater influx of people into the area was encouraged by the passage of the Forest Homestead Act in 1906, which allowed homesteaders to claim land set aside as national forest. The first sawmill in the region was opened on the lower McKenzie in 1851 however systematic logging of huge tracts of forest did not occur until the 1890s.

Historic Administrative use appears in the form of trails and early logging activity. The Santiam NF Maps (1913, 1931) and the Cascade National Forest 1925 map depict several historic or prehistoric trails crossing through the project area. These include the Castle Rock Trails and trails to Deathball Rock and Thors Hammer. Several historic structures clustering around the Blue River, McKenzie

Bridge, and Rainbow areas are visible on Forest Service maps dating back to the 1920s. A historic ranger station at McKenzie Bridge, along with the Paradise and Blue River Guard stations, is also noted on Forest Service maps between 1913 and 1931. The Belknap CCC camp was located at the present site of the McKenzie River Ranger Station (Gauthier et. Al 2007).

Environmental Consequences—Heritage Resources

Alternative A (No Action)—Direct, Indirect, and Cumulative Effects

Under Alternative A, no effects to cultural resources are expected since no ground disturbance activity would occur.

Alternatives B and C—Direct and Indirect Effects

Both action alternatives for the Bridge Thin Project would result in ground disturbance over 25,500 feet of temporary road and 34 miles of road maintenance. Ground disturbance related to harvest activities would be slightly greater in Alternative B (approximately 2,256 acres) than Alternative C (approximately 2,080 acres), which would produce slightly greater amounts of potential disturbance. Since appropriate and approved surveys and cultural site protection measures are already in place for this project, the potential direct effects would be in the form of inadvertent damage to the integrity of cultural resources which were not discovered during initial survey. Any sites identified during implementation of the project would require the application of mitigation measures described in Chapter 2.

Alternatives B and C—Cumulative Effects

There are no known additional incremental effects to cultural resources from implementing either action alternative. There are also no foreseeable future management activities within the Bridge Thin Project area involving ground disturbing activities that could add to the cumulative effects of past management in the area.

Compliance with Other Laws, Regulations and Executive Orders

This section describes how the action alternatives comply with applicable State and Federal laws, regulations and policies.

State Laws:

Oregon State Scenic Waterway – Segments of the McKenzie River within this project area are also in portions of the Oregon State Scenic Waterway, which is administered by the Oregon State Parks and Recreation Department. The State Scenic Waterway segments have a dual classification, with the west side of the McKenzie River is classified as Scenic River Area and the east side of the river classified as Recreation River Area. Scenic Waterway Act and Commission rules require the evaluation of proposed development within ¼ mile from each side of the river.

No timber harvest or any other actions are proposed within the State Scenic Waterway-Scenic River Area.

Federal Laws and Executive Orders:

The Preservation of Antiquities Act, June 1906 and the National Historic Preservation Act as amended, October 1966 – Before project implementation, State Historic Preservation Office consultation is completed under the Programmatic Agreement among the United States Department of Agriculture, Forest Service, Pacific Northwest Region (Region 6), the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer regarding Cultural Resource Management on National Forests in the State of Oregon, dated June 2004. Field surveys where ground-disturbing activities would occur in the Bridge Thin Project area have been completed. All known archaeological sites in the project area are protected by avoidance.

Should previously unknown sites be found during ground disturbing activities, contract provisions would provide protection and the McKenzie River District Archaeologist would be immediately notified.

These various measures resulted in a determination of **No Historic Properties Affected**. Because cultural resources would not be affected by proposed activities under any action alternative.

The Endangered Species Act (ESA), December 1973 – The ESA establishes a policy that all federal agencies would seek to conserve endangered and threatened species of fish, wildlife and plants. Biological Evaluations for plants and wildlife have been prepared, which describes possible effects of the proposed action on sensitive, and other species of concern that may be present in the project area. A Biological Assessment (BA) was prepared for the northern spotted owl, and for the bull trout, and spring Chinook salmon.

Clean Air Act Amendments, 1977 – The alternatives are designed to meet the National Ambient Air quality standards through avoidance of practices that degrade air quality below health and visibility standards. This project is consistent with by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments (see Fire and Fuels).

The Clean Water Act, 1987 – This act establishes a non-degradation policy for all federally proposed projects. Compliance with the Clean Water Act would be accomplished through planning, application and monitoring of Best Management Practices (BMPs).

There are no streams in the Bridge Thin Project Area listed by Oregon Department of Environmental Quality as 303(d), as water quality limited based on water temperature during the summer season. (See Water Quality/Riparian Resources).

Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164. Development of Rock Quarrys would conform to the requirements of the act, which sets forth mandatory safety and health standards for each surface metal or nonmetal mine. The purpose for the standards is to protect life by preventing accidents and promoting health and safety.

Magnuson-Stevens Fishery Conservation and Management Act, 1976 (MSA) – The Bridge Thin Project area is located in the McKenzie River Watershed, which is included in the waters designated as Essential Fish Habitat for spring Chinook salmon by the Pacific Fishery Management Council (PFMC). The proposed action is not likely to adversely affect aquatic systems, recreational fisheries, or designated Essential Fish Habitat (see Chapter 3, Water Quality/Aquatic Resources.)

Wild and Scenic Rivers Act, 1968 – Alternatives in this proposal are designed to maintain the Outstandingly Remarkable Values of the McKenzie River Wild and Scenic River. Moderate partial cutting in unit 3 (41 acres) is included within this Congressionally Reserved designation. However, timber harvest as prescribed is consistent with the allowable timber harvest specified in the McKenzie River Wild and Scenic River Plan (USDA Forest Service 1993). See Scenic Quality.

Inventoried Roadless Areas and Wilderness – There are no actions proposed within Inventoried Roadless Areas (IRAs) or Wildernesses in the Bridge Thin Project, and no actions would affect these designations.

Executive Orders 11988 and 11990: Floodplains and Wetlands – Executive Order 11988 requires government agencies to take actions that reduce the risk of loss due to floods, to minimize the impact of floods on human health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. Proposed harvest treatments would not occur within 100-year floodplains.

Executive Order 11990 –requires government agencies to take actions that minimize the destruction, loss, or degradation of wetlands. Streamside riparian reserves, seeps, springs, and other wet habitats exist in the Bridge Thin Project Area. These areas would be either avoided, or managed according to Riparian Reserve Management Guidelines in Chapter 2 to comply with amended Willamette Forest Plan Standards and Guidelines. Riparian reserves would also be protected with Mitigation Measures also detailed in Chapter 2. As a result, proposed harvest treatments would be consistent with Executive Orders 11988 and 11990.

Executive Order 12898: Environmental Justice – Executive Order 12898 requires that federal agencies adopt strategies to address environmental justice concerns within the context of agency operations. With implementation of the proposed action or any of the alternatives, there would be no disproportionately high and adverse human health or environmental effects on minority or low-income populations. The actions would occur in a remote area, and nearby communities would mainly be affected by economic impacts connected with contractors implementing harvest, road reconstruction, tree thinning, planting, fuels treatment activities. Racial and cultural minority groups could also be prevalent in the work forces that implement timber harvest, road reconstruction, tree thinning, planting, and fuels treatment activities. Contracts contain clauses that address worker safety.

Executive Order 12962: Recreational Fishing – The June 7, 1995, Executive Order requires government agencies to strengthen efforts to improve fisheries conservation and provide for more and better recreational fishing opportunities, and to develop a new policy to promote compatibility between the protection of endangered species and recreational fisheries, and to develop a comprehensive Recreational Fishery Resources Conservation Plan.

Executive Order 13186: Neotropical Migratory Birds – There are 85 bird species recognized as neotropical migrants on the Willamette National Forest. Thirty-five of these species found on the Willamette have been identified as species of concern (Sharp 1992). A Memorandum of Understanding was signed between the USFS and USFWS to complement the January 2001, Executive Order.

The Bridge Thin Project Area contains populations of migratory landbirds typical of the western Cascades. See Migratory Landbird above for further discussion of effects on neotropical migratory birds.

The National Environmental Policy Act (NEPA), 1969 – NEPA establishes the format and content requirements of environmental analysis and documentation. Preparation of the Bridge Thin Project EA was done in full compliance with these requirements.

The National Forest Management Act (NFMA), 1976 –All proposed timber harvest units are planned to occur on suitable land. If regeneration harvest is implemented the sites would be capable of restocking within 5 years of harvest by either natural or artificial means. All units were considered for potential uneven-aged management. Proposed commercial thinning would increase the rate of growth of remaining trees. Some locations would favor species or age classes most valuable to wildlife. The resultant reduced stress on residual trees would make treated stands less susceptible to pest-caused damage. Mitigation measures have been identified to protect site productivity, soils, and water quality.

The burning of activity fuels would reduce long-lasting hazards from wildfire over the project area as a whole, while air quality would be maintained at a level that would meet or exceed applicable Federal, State, and local standards. All proposed activities would provide sufficient habitat to maintain viable populations of fish and wildlife. Critical habitat for threatened or endangered species would be protected through avoidance. The alternatives include proposed actions that accelerate development of forest habitats that are currently deficient within the analysis area to enhance the diversity of plant and animal communities in the long-term. See discussions under the applicable resource sections above, for further support that proposed activities would comply with the seven requirements associated with vegetative manipulation (36 CFR 219.27(b)), riparian areas (36 CFR 219.27(e)), and soil and water (36 CFR 219.27(f)).

Forest Plan Consistency – Actions analyzed in the Bridge Thin EA are consistent with a broad range of Forest Plan Standards and Guidelines that have been discussed and disclosed throughout the document. The timber stand treatments associated with the Bridge Thin Project are consistent with the goals and management direction analyzed in the Willamette National Forest Land and Resource Management Plan FEIS and Record of Decision. Road improvements that address watershed restoration needs are designed to be consistent with the 1994 Northwest Forest Plan amendments to the Forest Plan and the Aquatic Conservation Strategy objectives.

Other Jurisdictions – There are a number of other agencies responsible for management of resources within the Bridge Thin Project Area. The Oregon Department of Fish and Wildlife is responsible for

management of fish and wildlife populations, whereas the Forest Service manages the habitat for these animals. The Oregon Department of Fish and Wildlife has been contacted regarding this analysis.

Proposed harvest treatments within riparian areas have been designed to comply with "Sufficiency Analysis for Stream Temperature – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (USDA Forest Service and USDI BLM, 2004). This document was prepared in collaboration with Oregon Department of Environmental Quality and United States Environmental Protection Agency to provide documentation of Northwest Forest Plan compliance with the Clean Water Act with regard to state water quality standards for stream temperatures. As such, it redeems several of the Forest Service responsibilities identified in "Memorandum of Understanding between USDA Forest Service and Oregon Department of Environmental Quality To Meet State and Federal Water Quality Rules and Regulations" (USDA Forest Service and Oregon DEQ, May 2002). The Sufficiency Analysis provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing young stands for riparian objectives other than shade, such as production of large wood for future recruitment.

Oregon Department of Environmental Quality and the Oregon Department of Forestry are responsible for regulating all prescribed burning operations. The USDA Forest Service Region 6 has a Memorandum of Understanding with Oregon Department of Environmental Quality, Oregon Department of Forestry, and the USDI Bureau of Land Management regarding limits on emissions, as well as reporting procedures. All burning would comply with the State of Oregon's Smoke Management Implementation Plan and, for greater specificity, see the memorandum of understanding mentioned above.

Energy Requirements and Conservation Potential – Some form of energy would be necessary for proposed projects requiring use of mechanized equipment: Commercial thinning and some partial cutting units would involve both heavy and small machines for yarding logs during the implementation period. Projects such as road reconstruction and maintenance could require heavy machinery for a small amount of time. Both possibilities would result in minor energy consumption. Alternatives that harvest trees could create supplies of firewood as a by-product, which would contribute to a supply of energy for the local community for home heating.

Prime Farmland, Rangeland, and Forestland – No prime farmland, rangeland, or forestland occurs within the analysis area.

Unavoidable Adverse Effects – Implementation of any of the alternatives, including the No Action alternative, would inevitably result in some adverse environmental effects. The severity of the effects would be minimized by adhering to the direction in the management prescriptions and Standards and Guidelines in Chapter IV of the Willamette Forest Plan, and additional Mitigation Measures and Design Measures proposed in Chapter 2 of this document. These adverse environmental effects are discussed at length under each resource section.

Irreversible and Irretrievable Effects – "Irreversible" commitment of resources refers to a loss of future options with nonrenewable resources. An "Irretrievable" commitment of resources refers to loss of opportunity due to a particular choice of resource uses.

No new construction of permanent roads is planned. Temporary road would be constructed, but would be obliterated following operations. Log landings would produce irretrievable changes in the natural appearance of the landscape as well. Rock used to surface roads would be an irreversible commitment of mineral resources.

The soil and water protection measures identified in the Forest Plan Standards and Guidelines, Mitigation and Design Measures in Chapter 2, and Best Management Practices are designed to avoid or minimize the potential for irreversible losses from the proposed management actions.

Concerning threatened and endangered plant, wildlife, and fish species, a determination has been made that the proposed actions would not result in irreversible or irretrievable commitment of resources that foreclose formulation or implementation of reasonable or prudent alternatives.

With all Action Alternatives (B and C)*:* Tree removal would result in an irretrievable loss of the value of removed trees for wildlife habitat, soil productivity, and other values. Log landings would produce irreversible changes in the natural appearance of the landscape. The visual effect of log landings would be somewhat reduced by mitigation measures and design measures to reduce soil compaction and erosion (scarification, seeding and waterbarring for example). Little irreversible loss of soil should occur due to extensive mitigation associated with timber harvest and prescribed fire (tractor harvest only on slopes less than 35 percent, skyline yarding with partial or full suspension to meet Forest Plan Standards and Guidelines, etc.).

With Alternative A (No Action): There would be an irretrievable loss of growth within the untreated, overstocked forest. The ability to protect forest within the analysis area from catastrophic fire could be irretrievably lost as well. There would be the potential for irreversible loss of timber value due to declining tree diameter growth related to crowded stand conditions, and loss of potential growth from insects and disease.

Monitoring

Invasive Plants

Post-sale invasive plant surveys would be completed by District personnel as a mitigation measure to determine if the weed treatments were effective. The monitoring survey would occur one year after treatments with results reported to the district Botanist. Bermed and decommissioned roads would be monitored for Invasive Plants for three years after the road treatment is completed. Follow up treatments would occur if necessary.

Logging Operations

During logging, operations would be monitored for adherence to contract specifications including thinning specifications, bole damage to residual trees, retention of down wood and snags, skid trail

spacing and use of designated skid trails. Contract compliance monitoring would be performed by Timber Sale Administrators.

Reforestation

First, third and fifth year survival/stocking examinations to monitor seedling survival, natural regeneration, animal damage and need for release or replanting within planted groups would be conducted for harvested stands.

Forest Plan Implementation Monitoring

A district timber sale review with the District Ranger, IDT Members and Resource Specialists would be conducted within one year of timber sale completion to determine if the prescribed treatments were successfully applied. The effectiveness of the prescribed treatments would be evaluated, providing valuable information for future projects. The Forest Supervisor's Staff performs annual project monitoring at each Ranger District, and compiles the results in the yearly Forest Monitoring Report. Timber sales from this project would be likely candidates for Forest Plan Implementation monitoring. Post-harvest stand density would require sampling of units prior to monitoring. Other implementation monitoring subjects may include temporary road decommissioning, system road closures and decommissioning for watershed restoration.

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