Chapter 2 - Alternatives

This chapter describes and compares the alternatives considered for the Bear Creek Saddle thinning project. It includes a description of each alternative considered. Maps of the alternatives are in the map package included with this document. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a basis for choice among options by the decision maker and the public.

Process Used to Develop Alternatives

The Proposed Action was developed with an attempt to minimize resource concerns through a variety of ways, including the following:

- reducing the need for new road construction by using of existing road grades and helicopter logging,
- decommissioning unclassified/abandoned roads to a better condition after use,
- incorporating design criteria and mitigation measures, and
- identifying additional restoration opportunities within the planning area that could be funded by revenue from the project.

To further address the key issues while still considering the Purpose and Need for the project and the feasibility of implementing the alternatives in the project area, an alternative to the proposed action was developed and refined by resource specialists on the project team. This alternative is considered in detail in Chapter 3. Other alternatives were considered, but eliminated from further study.

Alternatives not considered in detail

Public comment and concerns identified by the interdisciplinary project team were considered in determining what alternatives would be carried forward. The alternatives eliminated from detailed consideration, along with rationale for their dismissal, are as follows:

Temporary Bridge across Bear Creek: This alternative would consider building a bridge across Bear Creek to access approximately 233 acres to the south of Bear Creek. Approximately 2 miles of decommissioned and abandoned roads would be used to harvest those units. The cost of installing a temporary bridge across Bear Creek, however, was comparable to helicopter logging. Additionally, because installing and removing the temporary bridge would cause sediment erosion and transport, affecting downstream aquatic habitat, this alternative was eliminated from further consideration.

Thinning units dropped from consideration: Twenty-one forest stands (approximately 617 acres) in the project area initially considered for thinning were eliminated from further consideration. Reasons for their elimination are based on stand conditions that would not be improved through commercial thinning. Specific reasons include stands being older or already diverse; stands that are too young or brushy to make a viable commercial thin; extent of potentially unstable riparian areas that would require no cut buffers; and stands requiring too much road construction for the size of the area to be accessed.

Alternatives

Alternative A (No Action)

The National Environmental Policy Act (NEPA) requires a No Action alternative. This alternative is designed to provide a baseline of the existing condition for comparison with the action alternatives.

This alternative would retain all roads, both authorized and unauthorized, in their current condition, and forest stands in the proposed project area would remain untreated.

Alternative B (Proposed Action/Preferred Alternative)

This alternative aims to accelerate the development of late-successional characteristics in second-growth stands. Existing roads and unclassified, abandoned roads are used where possible, and consideration was given to the opportunity to improve the condition of existing roads and better decommission unclassified, abandoned roads as part of the project.

Forest Stand Treatment

Commercial thin approximately 2,189 acres, with about 1,354 acres in AMA and 835 acres in LSR lands. There would be about 983 acres in Riparian Reserves within proposed treatment units. Actual Riparian Reserve treated acres would be about 199 acres less, or 784 acres, to account for the acres within the no-cut riparian buffers where there would be no treatment. This is about 7.2 percent of the total Riparian Reserve acres in Forest Service land within the planning area three 6th field watersheds. Approximately 507 acres would be harvested by helicopter, 918 acres cable-logged, 691 acres ground-based logged, and 73 acres harvested using a combination of cable and ground-based logging. (Table 2)

Thinning Objectives

In conifer stands, the thinning objectives would be to reduce stand density and add structural and spatial complexity; increase crown and branch size and diameter growth of individual trees; introduce an understory of seedlings/saplings, shrubs, and herbs; increase the number of snags and snag recruitment trees suitable for cavity nesters; and contribute to coarse woody debris recruitment. In alder-dominated and patchy alder/conifer stands, the thinning objective would be to release healthy understory conifers and more resilient hardwood species. Pure conifer patches would be thinned while retaining a hardwood component throughout the stands.

Table 2: Alternative B treatment units

Unit	Unit Acres	Forest Plan Allocation	Logging System Acres	Acres within RR *
8	83	AMA	Ground base - 9 Cable - 29 Helicopter - 45	29
9	25	AMA	Ground base - 5 Cable - 20	19
10	8	AMA	Helicopter - 8	5

14	73	AMA	Ground base and cable - 73	29
16	65	AMA	Cable - 64	45
		LSR	Cable - 1	
17	122	AMA	Ground base - 58	50
			Cable - 64	
18	21	AMA	Cable - 21	4
19	52	AMA	Ground base - 40	26
			Cable - 12	
20	30	AMA	Helicopter - 30	23
22	60	AMA	Helicopter – 60	42
23	143	AMA	Helicopter - 143	94
24	69	AMA	Cable - 66	28
		LSR	Cable - 3	
26	20	AMA	Cable - 14	13
			Helicopter - 6	
27	20	AMA	Ground base – 6	13
			Cable - 14	
29	10	AMA	Cable - 10	3
30	30	AMA	Cable - 30	9
31	62	AMA	Cable - 62	37
32	35	AMA	Cable - 20	23
		AMA	Helicopter - 1	
		LSR	Cable - 1	
		LSR	Helicopter - 13	
33	24	LSR	Ground base - 21	17
			Cable - 3	
34	37	LSR	Cable - 27	10
			Helicopter - 10	
35	73	LSR	Ground base - 44	27
			Helicopter - 29	
36	23	LSR	Ground base - 7	8
			Cable - 16	

Unit	Unit Acres	Forest Plan Allocation	Logging System Acres	Acres within RR *
37	37	LSR	Ground base - 28 Cable - 9	8
38	78	LSR	Ground base - 29 Cable - 49	9
39	53	LSR	Cable - 16 Helicopter - 37	18
40	61	LSR	Ground base - 6 Cable - 25 Helicopter - 30	29
41	55	LSR	Cable - 47 Helicopter - 8	17
43	36	LSR	Ground base - 6 Helicopter - 30	11
44	48	LSR	Ground base - 4 Cable - 33 Helicopter - 11	27
45	79	LSR	Ground base - 13 Cable - 66	23
46	9	LSR	Ground base - 5 Cable - 4	1
47	63	LSR	Ground base - 29 Cable - 29 Helicopter - 5	20
48	81	LSR	Ground base - 7 Cable - 51 Helicopter - 23	33
50	33	LSR	Ground base - 8 Cable - 17 Helicopter - 8	3
51	11	AMA LSR	Ground base - 4 Cable - 1 Ground base - 1 Cable - 5	5
52	21	LSR	Cable - 21	16
53	25	AMA	Cable - 25	5
55	8	AMA	Ground base - 4 Cable - 4	7
56	10	AMA	Helicopter - 10	8
57	18	AMA	Ground base - 5 Cable - 13	16
58	22	AMA	Ground base - 15 Cable - 7	17
59	32	AMA	Ground base - 14 Cable - 18	15

Unit	Unit Acres	Forest Plan Allocation	Logging System Acres	Acres within RR *
60	40	AMA	Ground base - 40	7
61	38	AMA	Ground base - 38	0
62	85	AMA	Ground base - 85	13
63	42	AMA	Ground base - 42	25
64	91	AMA	Ground base - 91	68
65	28	AMA	Ground base - 28	28

* Includes acres within riparian no-cut buffers.

Treatment Boundaries

The edge of the unthinned, dense, plantation, western hemlock/Douglas-fir/red alder stand type and proximity to streams and wetlands would be used to locate treatment boundaries. Portions of proposed treatment units that have older forest characteristics (such as in units 39 and 51) would not be treated. Boundaries would be kept at the slope breaks of channel inner gorges, headwalls, or potentially unstable slopes, the stand type or vegetation change, or a distance from the stream bank that is determined appropriate by the district fisheries biologist. Wetlands would be similarly protected by no-treatment buffers. Many streams have individual no cut buffer prescriptions as designated by the district fisheries biologist based on field reviews. However all streams would have no cut buffers using the criteria identified in the following Riparian Buffers section of this Chapter.

The proposed treatment units as shown on the attached Alternative B map indicate gross acres of stand types that were determined to be suitable commercial thinning candidates to meet Forest Plan ecological objectives. No-treatment areas within units (such as no-cut riparian buffers) are not displayed on the map. These no treatment areas would be identified on the ground during sale layout using direction in this EA. Based on experience with similar commercial thinning projects on the Forest, the actual treatment acreage would be less than the amounts shown in Table 2, possibly as much as 25 percent less.

Thinning

This would be done by “thinning from below” where smaller diameter trees are removed to create additional growing space for the remaining larger trees. The contract specification that would be used to implement this thinning from below prescription was developed on the Willamette National Forest and adapted for use in several projects on the Pacific Ranger District. The contract specification utilizes a spacing guide so that the logger selects cut- and leave-trees on a purely mechanical basis, eliminating any judgment calls that could violate the intent of the National Forest Management Act. The technique results in variably spaced trees and a wider range of leave-tree diameters than a strict thinning from below prescription, but generally removes smaller trees and leaves larger trees.

Thinning would generally be done without regard to tree species, except that all cedars and minor hardwood species would not be cut. Douglas-fir, Pacific silver fir, and Sitka spruce would not be favored by the designation specifications, but would be left in the stand at a higher rate than hemlock because they tend to be larger in diameter than their hemlock neighbors.

Approximately 120-180 trees per acre would remain in the post treatment stands, with a range of 60% - 90% crown closure with an average diameter at breast height (dbh) of at least 11 inches.

In alder-dominated or mixed alder/conifer stand, alder would be removed to release hemlock, spruce, western redcedar, Pacific silver fir, and Douglas-fir; while retaining a component of alder in the stand as well as maple, cottonwood, bitter cherry, and any other minor species. To accomplish the partial removal, but retain a component of alder in the stand, alders (generally 8 inches and greater dbh) would be removed from within a set distance (to be determined on an individual stand basis) of live conifers that are 4 inches dbh and greater in size.

Cut-tree diameter limits

In LSR, no trees exceeding 20 inches dbh would be designated for cutting unless they are located in a "gap" (see below) (Regional Ecosystem Office 1996). If cut they must remain on site as coarse woody debris. Trees of this size may be converted to snags, if needed. In general, there will not be an upper diameter limit on thinning in the AMA; however, based on individual stand conditions, an upper diameter limit may be specified in some cases.

All trees under 6-8 inches dbh would not be cut.

Damaged trees

Leave trees would be selected irrespective of whether the tree has any damage, so that trees with defects, potential cavity or nesting trees and other similar features of structural diversity may be retained in the stands. In this case, the term "damage" refers to breakage, double tops, crooks, heart rots, ants, etc., that cause loss of wood volume, but usually don't kill the tree. Similarly trees with fading crowns or bleeding boles indicative of root disease that may kill some trees and create snags and coarse woody debris over time would not be discriminated against in this prescription. The exception would be root sprung or bent over trees that would not be considered for selection as leave trees.

Cedar and hardwoods

All western redcedar would be retained, this species would not be shown as included timber in the timber sale contract. No Pacific yew was found during stand examination, but any existing within the stands would be retained and protected, as would any cascara, willows, and other minor hardwoods. Groups of five or more alders (where alders are within 15 feet of another alder) would be left unthinned for mollusk and neo-tropical migrant bird habitat when located outside of existing skid trails that would be used for this treatment. Otherwise alder would be thinned to release conifers and more resilient hardwood species. Except where necessary for yarding, vine maple would not be cut in order to maintain existing species diversity and to help provide a continuous "column of vegetation that includes low shrubs, tall shrubs, and midstory trees" (Carey and Johnson, 1995). Additionally, a 10-foot unthinned buffer would be left around vine maple clumps (generally large, established clumps of 5 stems or more as opposed to small, single stems).

Downed wood and snags

Coarse woody debris of all sizes would remain on site and would not be removed during thinning operations. Large pieces that are moved during construction of temporary roads would be placed in the forest stand or placed on the scarified road after the thinning is complete, and the road is decommissioned.

All snags would be protected. If logging safety is jeopardized, snags may be felled and then left in the stand as coarse woody debris.

Skips

Skips are no-cut patches intended to add heterogeneity to the stands, located to retain some existing habitat conditions or provide additional resource protection as needed. No thinning areas considered for skips include vine maple buffers, riparian buffers, wetlands and headwalls, pure alder stand components, and other areas that are steep, brushy or otherwise unsuitable for commercial thinning. Additional skips ranging from 0.2 to 1.0 acre would be designed in areas that lack these features, as needed. Skips would be identified through signing and painting boundaries, utilizing a no-cut radius from a designated center tree, or by description.

Gaps

System and temporary roads and landings would provide adequate numbers of gaps (small clearings) in the thinned stands at the mid to upper size range. Occasional blowdown and snapped tops would provide small to mid-sized gaps. The thinning treatment would also create gaps at the lower end of the range of gap sizes, the most prevalent gap size found in late-successional stands (Spies et al. 1990). Thus, the need to create additional gaps is not currently anticipated, but additional mid to upper size gaps (0.1-0.5 acre) could be designed in areas protected from wind and away from roads and landings, if desired.

Logging systems

Logging system options include ground based, skyline cable, and helicopter. Selection of the most appropriate logging system depends on several factors including: resource issues (e.g. potential for detrimental effects to soils) and operational issues (e.g. economics). In some cases a combination of logging systems is proposed. Logging systems were designed by the interdisciplinary team's logging systems specialist, in coordination with the other resource specialists on the team.

Ground based systems – General guidelines for these systems include some or all of the following conditions: slopes less than 35 percent, ground based harvested in previous entry, shorter yarding distances, and good road location. The average yarding distance would be approximately 600 feet or less.

Skyline cable systems – General guidelines include: slopes generally over 35 percent, longer yarding distances (average distance about 900 feet or less), uphill yarding to a landing, and more limited road access. Skyline units are generally designed to have parallel corridors where there is adequate road access at the top of a unit. They can also have a wheel spoke configuration when more than one skyline corridor comes to a single landing.

Helicopter systems – These systems are used where there is limited or no road access to a unit, or sometimes where the road access is at the bottom of a unit which would require a downhill skyline system. The average yarding distance should be about 1320 feet. Units with stable soil conditions and slopes generally less than 60 percent could be "pre-bunched" using a track-mounted harvester. Pre-bunching means the mechanical felling, limbing, bucking, and bunching of trees to improve the efficiency of helicopter logging and making it more economical. The track-mounted machine would travel up and down (single-use paths perpendicular to the slope and about 50 feet apart) the hillside on favorable slopes while "walking" on slash generated from its limbing operations.

Riparian buffers

As previously described under the Management Direction section in Chapter 1 of this document, Riparian Reserve areas as delineated in the Forest Plan overlay all land allocations. The Sol Duc Pilot Watershed Analysis and the Deep Creek and East and West Twin Rivers Watershed Analysis describes the determination of Riparian Reserves boundaries. Site potential tree heights were used to determine appropriate reserve distances and vary depending on Plant Association Groups (PAGs).

Riparian buffers (no-cut/no entry areas that do not necessarily eliminate skyline corridors needed to achieve necessary suspension requirements) were determined on a case-by-case basis by fisheries specialist (see Appendix B). These no cut areas would be implemented to protect known sensitive areas such as fish-bearing streams, perennial and intermittent non-fish bearing streams, potentially unstable areas, and seeps and wetlands. To do so, the fish biologist classified streams into categories (e.g., significant non-fish bearing, minor non-fish bearing) to be used in determining riparian buffers by considering characteristics such as the size of stream (discharge = drainage area), connectivity to fish bearing streams, topography, indications of instability, soils and susceptibility to disturbance, sediment delivery potential to fish habitat, and general riparian vegetation development. He concurrently assessed the current conifer growth within the first 66 – 100 feet of stream channels, the distance within which 80% - 99% of all in-channel large woody debris is recruited (cited in Washington Forest Practices Board 1995). Unless otherwise indicated in Appendix B, the general guidelines below would apply to protect fish habitat or water quality from ground disturbance might occur (such as on steep slopes, old inner gorge failures, etc.) or to not thin areas where conifers along stream channels were larger and more vigorous than the surrounding stand. The guidelines apply to both intermittent and perennial streams.

In all cases slope stability, shading, sedimentation potential, and water quality considerations were the primary drivers for determining riparian buffer distances. But where near stream conifer growth was similar to the more upland, dense overstocked conifers, site specific recommendations were made where thinning might occur closer to the stream channel in order to promote the growth of large trees for later recruitment as large woody debris in the stream.

While riparian buffers for all known fish-bearing streams, as well as non-fish streams greater than 10 feet, are included in Appendix B, where no site-specific prescription is given, buffers would be implemented as follows:

- 100' or slope break (whichever is greater) no cut riparian buffer for fish-bearing streams/rivers;

- 66’ buffer or slope break (whichever is greater) for significant non-fish bearing streams; and
- 33’ no cut buffer or slope break (whichever is greater) for minor non-fish bearing streams, smaller tributaries, and small wetlands.

Slope break is defined as a significant gradient change, and in many cases, a change in vegetation (e.g., >70% hardwoods to >70% conifers).

Roads

Roads proposed for use include the following:

- open Forest system roads;
- closed roads;
- Bonneville Power Administration (BPA) access roads;
- unclassified, abandoned roads (remnant of historic logging activities); and
- new temporary roads.

The list below is a breakdown of approximate mileage by road classification and post-harvest treatment. More information on the roads proposed for use may be found in Appendix C.

- 21.1 miles of existing, open Forest system roads would be used and kept open after project. If necessary, these roads would be brought up to safe hauling standards during project implementation.
- 5.4 miles of BPA access roads (1.5 miles within Riparian Reserves) would be used and then left open after project completion.
- 6.1 miles of closed forest system road (1.8 miles within Riparian Reserves) would be used and then reclosed following project implementation. If KV funds are available, these roads may be decommissioned as proposed in the Olympic National Forest Access and Travel Management (ATM) Plan.
- 5.5 miles of unclassified, abandoned road (1.9 miles within Riparian Reserves) would be used and then decommissioned following project implementation.
- 0.9 mile of new temporary road (0.2 mile within Riparian Reserves) to be constructed and then decommissioned following project implementation.

Short spur roads of approximately 100 feet in length would be made as necessary off of public roads and powerline access roads for public and worker safety purposes. These spurs would be decommissioned and blocked from vehicle access following project implementation.

Reconstruction of existing open roads to bring them to a standard for safe log haul is expected to have a secondary benefit of improving drainage and fish passage, thereby reducing impacts to aquatic resources.

Further elaboration on road treatment definitions may be found in Appendix D.

Bonneville Power Administration Access Roads

In 1960, the Forest Service and Bonneville Power Administration (BPA) entered into an agreement that authorized the use of National Forest lands in Region 6 for the purpose of

constructing, operating, and maintaining power transmission lines and access roads. This general agreement was supplemented in 1964 by a subsequent agreement to construct a 115 kV aerial powerline on the Olympic National Forest in the Middle Sol Duc, West Twin, and Deep Creek drainages. This construction was a segment of a larger project that extended from Port Angeles west to Sappho. The supplement to the Memorandum of Understanding authorized the clearing of timber from a corridor averaging about 100 feet in width and the construction of a number of roads providing access from FS Road 30 to the powerline corridor. The power transmission line and many of the access roads were constructed in 1964 and 1965. Maintenance of the powerline corridor and the access roads is the responsibility of the Bonneville Power Administration under the terms of the Memorandum of Understanding and its supplements.

Figure 1. Picture of a BPA road in project area.

Approximately 5.4 miles of powerline access roads would be used for haul of rock and timber under the Bear Saddle project. Some of the roads are in a condition suitable for use, while others would require improvements such as brushing, addition of surfacing material, and drainage structure upgrades. The Forest Service would acquire permission from the Bonneville Power Administration for use and improvement of these roads, and for conducting tree falling and yarding operations in the vicinity of the power transmission line. These roads would remain open following project implementation as per the Memorandum of Understanding with the Bonneville Power Administration and its supplements.

Unclassified, abandoned roads

The unclassified, abandoned roads proposed for use in this project are old road grades from when these forest stands were last harvested. These roads are not considered to be part of the Forest road system and have not been maintained since their initial use. As a result, road surfaces are generally well vegetated, with scattered to numerous trees and brush. The road

profile still exists on most of these roads, but the road surface is less visually dominant. Cuts and fills have vegetation similar to the adjacent forest environment. Work needed to bring these roads to a useable standard range from light clearing and grubbing to minor excavation; removal of vegetation that has re-established in the road prism; drainage improvements; and surfacing. Unclassified, abandoned roads proposed for use in this project would be treated as temporary roads. As such, these roads would be decommissioned following project implementation.

Figure 2. Picture of an unclassified, abandoned rd in project area.

New temporary roads

As specified under the Project Design Criteria and Management Requirements, Best Management Practices, and Mitigation section, all new temporary roads would be constructed to minimize resource impacts while allowing for safe operations. Roads would be located and designed to minimize disruption to hydrologic flows, follow the contour of the terrain where possible, and minimize clearing widths to what is necessary for safe haul and prevent loss of overhead canopy cover. Following use, temporary roads, as with landings and skid trails, would be decommissioned. Below are pictures of temporary roads during use and following decommissioning.

Figure 3. Pictures of temporary roads during use

Figure 4. Pictures of temporary roads after decommissioning and surrounding thinned forest.

See attached map of Alternative B

Alternative C

This alternative aims to further address potential environmental impacts identified by the interdisciplinary team. These concerns include the uncertainty of conducting management activities within a spotted owl activity center that overlaps units 43, 44, 45, and part of 41. While there have been no detections of any spotted owls since 2001, which means that the site is now technically "vacant" (USDA 2004b), this alternative could provide benefits for wildlife (especially if the owls are there and not detectable or if they should return). Additionally to further reduce sedimentation and impacts to soils the logging system on approximately 75 acres is changed from ground-based to helicopter logging to further reduce sedimentation and impacts to soils; and road use would be decreased by 0.4 miles of closed forest system road, 1.6 miles of unclassified, abandoned roads, and 0.2 miles of new temporary road.

Forest Stand Treatment

Commercially thin approximately 2,136 acres, with about 1,353 acres in AMA and 783 acres in LSR lands. There would be about 965 acres in Riparian Reserves within proposed treatment units. Actual Riparian Reserve treated acres would be about 196 acres less, or 769 acres, to account for the acres within the no-cut riparian buffers where there would be no treatment. This is about 7.1 percent of the total Riparian Reserve acres in Forest Service land within the planning area three 6th field watersheds. Approximately 582 acres would be harvested by helicopter, 853 acres cable-logged, 628 acres ground-based logged, and 73 acres harvested using a combination of cable and ground-based logging. (Table 3)

This alternative differs from Alt. B by dropping Unit 43 and the portions of units 36 and 44 to eliminate about 53 acres of treatment, including areas proposed for helicopter logging which would create the largest potential disturbance within the activity center. As a result, approximately 0.4 miles of the unclassified, abandoned road 3000579 would not be used. Other minor adjustments such as changing logging systems are also included to further address other potential resource impacts, particularly to soils and aquatics.

Outside the changes noted above, the proposed thinning treatment for stands included in this alternative would follow the same prescription as detailed in Alternative B.

Logging systems

Alternative C would use the same suite of logging systems as Alternative B. However there are differences in what particular logging system is proposed for individual units. Changes in unit logging systems between Alternative C and B are for units: 16, 18, 34, 36, 44, 64, and 65. Generally there is an increase in the amount of helicopter logging.

Riparian buffers

Alternative C would use the same riparian buffer prescription as Alternative B.

Table 3: Treatment units proposed in Alternative C

Unit	Unit Acres	Forest Plan Allocation	Logging System Acres	Acres within RR *
8	83	AMA	Ground base - 9	29
			Cable - 29	
			Helicopter - 45	
9	25	AMA	Ground base - 5	19
			Cable - 20	
10	8	AMA	Helicopter - 8	5
14	73	AMA	Ground base and cable - 73	29
16	65	AMA	Cable - 47	45
		AMA	Helicopter - 17	
		LSR	Cable - 1	
17	122	AMA	Ground base - 58	50
			Cable - 64	
18	21	AMA	Helicopter - 21	4
19	52	AMA	Ground base - 40	26
			Cable - 12	
20	30	AMA	Helicopter - 30	23
22	60	AMA	Helicopter – 60	42
23	143	AMA	Helicopter - 143	94
24	69	AMA	Cable - 66	28
		LSR	Cable - 3	
26	20	AMA	Cable - 14	13
			Helicopter - 6	
27	20	AMA	Ground base – 6	13
			Cable - 14	
29	10	AMA	Cable - 10	3
30	30	AMA	Cable - 30	9
31	62	AMA	Cable - 62	37
32	35	AMA	Cable - 20	23
		AMA	Helicopter - 1	
		LSR	Cable - 1	
		LSR	Helicopter - 13	
Unit	**Unit Acres**	**Forest Plan Allocation**	**Logging System Acres**	**Acres within RR ***

33	24	LSR	Ground base - 21 Cable - 3	17
34	37	LSR	Helicopter - 37	10
35	73	LSR	Ground base - 44 Helicopter - 29	27
36	17	LSR	Cable - 17	3
37	37	LSR	Ground base - 28 Cable - 9	8
38	78	LSR	Ground base - 29 Cable - 49	9
39	53	LSR	Cable - 16 Helicopter - 37	18
40	61	LSR	Ground base - 6 Cable - 25 Helicopter - 30	29
41	55	LSR	Cable - 47 Helicopter - 8	17
44	37	LSR	Ground base - 4 Cable - 33	25
45	79	LSR	Ground base - 13 Cable - 66	23
46	9	LSR	Ground base - 5 Cable - 4	1
47	63	LSR	Ground base - 29 Cable - 29 Helicopter - 5	20
48	81	LSR	Ground base - 7 Cable - 51 Helicopter - 23	33
50	33	LSR	Ground base - 8 Cable - 17 Helicopter - 8	3
51	11	AMA	Ground base - 4 Cable - 1	5
		LSR	Ground base - 1 Cable - 5	
52	21	LSR	Cable - 21	16
53	25	AMA	Cable - 25	5
55	8	AMA	Ground base - 4 Cable - 4	7
56	10	AMA	Helicopter - 10	8
57	18	AMA	Ground base - 5 Cable - 13	16

Unit	Unit Acres	Forest Plan Allocation	Logging System Acres	Acres within RR *
58	22	AMA	Ground base - 15 Cable - 7	17
59	32	AMA	Ground base - 14 Cable - 18	15
60	40	AMA	Ground base - 40	7
61	38	AMA	Ground base - 38	0
62	85	AMA	Ground base - 85	13
63	42	AMA	Ground base - 42	25
64	91	AMA	Ground base - 54 Helicopter - 37	68
65	28	AMA	Ground base - 14 Helicopter - 14	28

* Includes acres within riparian no-cut buffers.

Roads

Roads proposed for use include open Forest system roads; closed roads; Bonneville Power Administration (BPA) access roads; unclassified, abandoned roads (remnant of historic logging activities); and new temporary roads.

The list below is a breakdown of approximate mileage by road classification and post-harvest treatment. More information on the roads proposed for use may be found in Appendix C.

- 21.1 miles of existing Forest system roads would be used and kept open after project. If necessary, these roads would be brought up to safe hauling standards during project implementation.
- 5.4 miles of BPA access roads (1.5 miles within Riparian Reserves) would be used and then left open after project completion.
- 5.7 miles of closed forest system road (1.6 miles within Riparian Reserves) would be used and then reclosed following project implementation. If KV funds are available, these roads may be decommissioned as proposed in the Olympic National Forest Access and Travel Management (ATM) Plan.
- 3.9 miles of unclassified, abandoned road (1.2 miles within Riparian Reserves) would be used and then decommissioned following project implementation.
- 0.7 mile of new temporary road (0.1 mile within Riparian Reserves) to be constructed and then decommissioned following project implementation.

Short spurs of approximately 100 feet in length would be made as necessary off of public roads and powerlines for public and worker safety purposes. These spurs would be decommissioned and blocked from vehicle access following project implementation.

Reconstruction of existing open roads to bring them to a standard for safe log haul would include work that would also improve drainage and/or fish passage.

Further elaboration on road treatment definitions and may be found in Appendix D.

See attached map of Alternative C

Project Design Criteria and Management Requirements, Best Management Practices, and Mitigation

Project design criteria and Management requirements were developed to address the potential significant issue of impacts from roads and mitigation measures were developed to ease some of the potential negative impacts the action alternatives may cause to other resources. The mitigation measures apply to all action alternatives. Best management practices are listed as well.

Botany Measures

- In order to maintain canopy cover and minimize habitat disturbance, institute a one tree length no treatment buffer around the *Tetraphis geniculata* site in Unit 62. Also directional fall trees away from this site and avoid designating skid trails in the vicinity.

Fisheries

The following requirements serve to minimize and mitigate impacts to fish habitat.

- Follow all applicable general provisions listed on pages 8-10 of Memorandum of Understanding (MOU) between the Washington Department of Fish and Wildlife and USDA Forest Service, Pacific Northwest Region, Regarding Hydraulic Projects Conducted by USDA Forest Service, Pacific Northwest Region (January 2005).
- Follow all applicable specific provisions listed in Appendix A of Memorandum of Understanding (MOU) between the Washington Department of Fish and Wildlife and USDA Forest Service, Pacific Northwest Region, Regarding Hydraulic Projects Conducted by USDA Forest Service, Pacific Northwest Region.
- All instream work would occur between July 15th and September 30th for streams in the Deep Creek and West Twin River drainages, and July 15th to August 15th for streams in the Bear Creek drainage under the work periods set forth in Table 1, Appendix D of the Hydraulic Project Approval (HPA). Other timing may be allowed on a site-specific basis if the Forest Service fisheries biologist and Washington Department of Fish and Wildlife Area Habitat Biologist agree that it would not be harmful to fish and fish habitat.
- A site-specific erosion control plan will be developed for each project in accordance with current Olympic National Forest standards. The plan will identify key or sensitive areas and implementation restrictions. Erosion control provisions are consistent with the requirements of the project hydraulics permit (HPA), the Memorandum of Agreement (MOA) between the Washington Department of Ecology and the US Forest Service Pacific Northwest Region (2003), and Best Management Practices (USDA 1988), including Washington Administrative Code (WAC) 222-24 provisions. The protocol will be implemented during and following construction in accordance with the schedule that is defined in the plan.

- Stream crossing fill removal activities shall be designed to minimize inputs into stream channels. Where feasible, the natural floodplain would be restored.
- Metal culverts removed from stream crossings and ditches, will be transported off-site by the contractor to be recycled, reused or disposed of at a landfill.
- Outsloping of the roadway surface is preferred unless outsloping would increase sediment delivery to streams or where outsloping is infeasible. Route road drainage away from potentially unstable channels and hillslopes.
- A watershed specialist or fish biologist shall be consulted prior to modifying any of the project design criteria that could impact aquatic resources.
- Directionally fall trees away from streams. If a tree ends up in a stream, leave it.
- Under Alternative B, when the two temporary stream crossing culverts on FSR 3100010 are removed following the harvest of the western part of Unit 64, the stream banks will be restored to natural contours and woody debris will be placed in channel at crossings. Restoration of the stream channel crossings will incorporate design features to prevent Off Highway Vehicles (OHVs) from using them as fording sites.
- Designate no-cut riparian buffers as specified by the district fisheries biologist in Appendix B.

Fuels

The following requirements serve to minimize risk of fire and resistance to control in areas of possible ignition sources and near areas such as powerlines and adjacent to state and private boundaries.

- Activity fuels (logging slash) will be minimized in a strip 60 to 100 feet wide along the powerline right-of-ways, state and private boundaries, and existing roads that will be open to public motorized vehicle use after treatments are completed. Directional felling will be used to prevent the accumulation of activity fuels within the 60 to 100 foot wide strip. Total fuel loading within these strips will be continuously less than a total of 8 tons per acre for 1-hour (less than 0.25 inch diameter), 10-hour (0.25 inch to 1 inch diameter), and 100-hour (1 inch up to 3 inch diameter) fuel sizes. Any remaining activity fuels will be transported back into the thinning unit or treated by other methods that will leave concentrations within the strip no deeper than 1 to 1.5 feet. Fuels transported into the unit from the strip should not create continuous or excessive fuel concentrations in any area.
- Activity fuels will be piled and burned within the first 200 feet of treated areas next to private resident boundaries.
- No activity fuels, to the extent practical, will remain to create additional continuous fuel bed at log landings. Fuels transported into the unit from landings should not create a continuous fuel concentration.

Heritage/Cultural Resources

- If subsurface archeological evidence or previously unidentified cultural resources are located during implementation of this project, activities will cease pending an

evaluation of cultural significance by a qualified archeologist, who will determine appropriate mitigation measures, if any. The Forest will fulfill its consultation requirements in accordance with 36 CFR 800.11.

Invasive Plants

Prevention and control measures shall follow the Pacific Northwest Region Invasive Plant Program (USDA 2005b) and the 2008 Olympic National Forest Beyond Prevention: Site-Specific Invasive Plant Treatment Project (USDA 2008).

- When practical, treat existing invasive plant infestations with appropriate herbicide, mechanical, or manual methods before roads are reopened for use, decommissioned, or otherwise made impassable.
- Clean all off-road equipment of dirt/mud, seeds, and other plant parts before being moved onto National Forest System land. If operating in an area infested with invasive plants, clean all equipment before moving between sites or leaving the project area.
- All material (e.g. soil, gravel, sand borrow, aggregate, etc.) transported onto National Forest System land or incorporated into the work shall be weed-free.
- A Forest Service invasive plant specialist shall inspect proposed material sources to determine weed-free status to ensure all material is free of invasive plant seeds before use and transport. Fill material generated from a project site, containing or suspected to contain invasive plants, shall be stockpiled within the project area and as close to the infested source area as possible.
- Weed free hay, straw, or other mulch materials used on the project shall be weed-free. The Contracting Officer may request written documentation of methods used to determine the weed-free status of any and all materials furnished by the contractor. Contractor-provided expertise and methods to establish weed-free status must be appropriate for the weeds on the current Washington State noxious weed list (http://www.nwcb.wa.gov/weed_list/weed_list.htm). Refer to the North American Weed Free Forage Program standards, Regional EIS, Appendix O. (Construction specification FSSS 713.05: Regional Standard 3)
- Site restoration planning shall include an evaluation of the need to seed a site. When needed, use weed free straw and seed mixes/plantings with local native species. (Regional Standard 13)
- Monitor all ground-disturbing operations in invasive plant infested areas at least once within two years following completion and treat any new infestations of concern.

Roads, Landings, and Skid Trails

The following requirements for roads, landings, and skid trails serve to minimize and mitigate resource damage, particularly to soil and water, as well as to ensure safety.

- The reopening of old skid trails and temporary roads shall be used where possible and as approved by Sale Administrator over the construction of new roads if they are located in areas that would prevent sediment delivery to streams.

- All new temporary spurs shall be located and designed to minimize disruption to natural hydrologic flow paths and sediment delivery. Design appropriate drainage for each road site.
- Unless prohibited by other mitigation measures, new temporary road construction, reopening unclassified, and Level 1 roads will occur during the dry season (June through September) or upon approval of the Timber Sale Administrator, to minimize surface erosion and sedimentation. If roads are left open through extended wet weather, ensure the maintenance of erosion and sedimentation control measures. During operation on these roads outside the standard operating season, spot rock as needed to reduce off-site erosion and sedimentation risk.
- Construct temporary roads to contour with the terrain and roll grades where possible to reduce clearing limits and excavation. Consider curves to eliminate geometric patterns created by roads. On soft soils, use puncheon (small logs) where appropriate within the road surface for strength and drainage, as well as reducing fill material needed. Minimize clearing widths to what is necessary for safe haul (generally widths of 16 feet on level ground, 20 feet for curves, and slightly more for steeper grades).
- Decommission temporary roads and landings after last entry by purchaser. Methods may vary, but as a standard, roads will at least receive treatments of backblading, waterbars, culvert removal and barriers to vehicular traffic. If determined necessary for erosion control and seedbed preparation, the surface shall be scarified to a depth of seven inches. Pullback of fills may be necessary and the original slope returned to grade. Further activities can be used to achieve full decommissioning. These methods include deep subsoiling, the return of all disturbed Coarse Woody Debris, and the placement of slash such that it is contiguous with the surrounding debris. Stumps may also be placed on decommissioned roadbeds. Use timber sale contract clause CT5.1 (Option 1) Temporary Road and Landing Construction.
- Subsoil compacted and rutted soils in landing areas as necessary to the depth of the rut, plus six inches, to provide seedbed. Restore disturbed coarse woody debris. Pull back excavated material on slopes to re-establish the slope for erosion control as needed.
- On skid trails where rut depth exceeds 10 inches, the following actions will be required: 1) subsoiling the full width of the trail to the depth of the rut plus six inches, 2) returning all displaced soils on adjacent berms and any excavated material to the skid trail to approximate original soil contours, 3) replacing any disturbed large coarse woody debris as closely as possible to its original position, and 4) placing slash and stumps onto the trail so that it is contiguous with the surrounding area. Install erosion control devices such as backblading and waterbars, as necessary, on all other skid trails.
- Place vehicular barriers at road or skid trail junctions to prevent public usage. Closed roads, decommissioned temporary roads, safety spurs, and skid trails should be tank-trapped at road junctions, water barred as necessary, and otherwise be made impassable for motor vehicles and all-terrain vehicles following project implementation.

- Ground-based yarding equipment shall generally be limited to slopes less than 30% (unless otherwise approved by the soil scientist) to minimize soil disturbance and shall be confined to designated skid trail systems approved by the timber sale administrator. Skid trails should not exceed 15 feet in width and should have slash placed on them prior to use by equipment whenever possible.
- Space ground-based skid trails no closer than 110 feet apart, center-to-center. Use existing skid trails where possible. If a processor is used, it may be allowed to make one crossing between skid trails and occasional "pokes" off the skid trail, using existing openings between trees. Avoid locating skid trails in wet areas and near snags 17+ inches diameter at breast height (dbh).
- On helicopter operations where a mechanical feller/buncher is used to pre-bunch logs, prior approval will be required with coordination with the soil scientist. The tracked feller/buncher will be limited to slopes less than 60 percent and soils considered stable. The machine will travel perpendicular to the slope (except for single crossings between feller/buncher paths) and on a mat of slash generated from its limbing operations.
- Use existing landings where possible. Build skyline cable and helicopter landings in areas away from streamcourses, wet areas, and where unstable cutbanks exist. Use short landing extensions to reduce and control potential run-off.
- Minimize construction of new helicopter landings within Riparian Reserves. Any new helicopter landings within Riparian Reserves will be coordinated with an aquatic specialist to protect water quality and riparian values.
- Incorporate new helicopter landings that are needed within Riparian Reserves into designed gaps within timber harvest units where possible.
- A designated helicopter service landing for aircraft fueling and maintenance will be approved by the sale administrator to insure public safety and protect water quality from potential contamination from fuel spills.
- Require one-end suspension for skyline cable and ground-based inhaul. Avoid yarding across streams and wetland areas. If yarding across streams is necessary, logs must be fully suspended over creeks and the immediate slope above creeks to the break in the topography or end of riparian vegetation. Locate skyline corridors to use natural openings in riparian areas where possible.
- If ground-based logging systems are used, use designated skid trails to maintain less than 20% of the stands' area in an adversely impacted condition (USDA 1990a, p. IV-52). Where soil is displaced by skidding operations, pull soil back into the skid trail location when operations are completed.
- Leave unmerchantable portions of cut trees in units. Within ground-based yarding units, place slash from landing on skid roads to reduce the risk of erosion, compaction and runoff and other adverse soil conditions, as well as provide wildlife habitat.
- BPA requirements for reconstructing access roads and working near powerlines shall be followed. These requirements would be identified in the permit BPA issues to

permit activities to proceed, but are outlined in a letter from BPA, dated December 19, 2005, contained in the project file.

- During commercial thinning operations, protect the Calvin White domestic waterline and settling box from damage. The buried domestic water transmission pipeline is located on National Forest land in Section 24 of T. 30 N, R. 12 W., within planned commercial thinning unit 061. The intake for the water system is located just north of the Bonneville Power Administration powerline, in a small stream. The line runs south for about 500 feet to a settling box, and then continues on for about 1,000 feet to the Calvin White residence on private land.

Vegetation/Habitat

The following requirements serve to retain desirable habitat components in the thinned stands.

- In LSR, no trees greater than 20 inches dbh would be designated for cutting unless they are located in a "gap" (REO 1996). If cut, they must remain on site as coarse woody debris. In general, there will not be an upper diameter limit on thinning in AMA. Based on individual stand conditions, however, an upper diameter limit may be specified in some areas.
- Retain approximately 120-180 trees per acre that average at least 11 inches dbh with a range of 60-90% canopy closure.
- Retain all western redcedar; this species would not be shown as included timber in the timber sale contract. No Pacific yew was found during stand examination, but any existing within the stands would be retained and protected, as would any cascara, willows, and other minor hardwoods. Groups of five or more alders would be left unthinned for mollusk and neo-tropical migrant bird habitat when located outside of existing skid trails that would be used for this treatment. Otherwise alder would be thinned to release conifers and more resilient hardwood species. Vine maple should not be cut, except where necessary for yarding, in order to maintain existing species diversity and to help provide a continuous "column of vegetation that includes low shrubs, tall shrubs, and midstory trees" (Carey and Johnson, 1995). In addition, leave a 10-foot unthinned buffer around vine maple clumps (generally large, established clumps of 5 stems or more as opposed to small, single stems).
- Coarse woody debris existing on the site prior to treatment exceeding 6 inches in diameter may be moved for access, but may not be removed from the site. Minimize disturbance to coarse woody debris. Keep big, old stumps intact whenever possible and avoid uprooting.
- All snags would be protected. If logging safety is jeopardized, however, snags may be felled and then left in the stand as coarse woody debris.
- Skip areas will include vine maple buffers, riparian buffers, wetlands and headwalls, pure alder stand components, and other areas that are steep, brushy, or otherwise unsuitable for commercial thinning. Additional skips ranging from 0.2 to 1.0 acre will be designed into the treatment in areas that lack these features.

- Logging operations are restricted during bark slippage (March 1 to July 30) to prevent scarring to residual trees. A standard of at most 5% of stems exceeding 16 sq. in. of damage and 7% total stems damaged should be in effect during all operations. Damage can be defined as loss of bark, exposing or breaking the cambium layer of the stem or roots. Douglas-fir can withstand careful yarding during bark slippage, whereas hemlock is more prone to logging damage. Operations can be allowed to proceed during bark slippage as long as the above standards are met. Damaged trees should not be removed by the logger, but left alive to potentially develop rot columns over time. They may have future value as cavity nester habitat. The loggers may be required to apply "Tree Saver" paint to damaged trees as means of educating and sensitizing their personnel to the importance of minimizing damage to the residual stand.
- Keep cable corridors and roads out of skips and away from snags when possible.
- Limit skyline corridors to 12 feet in width and include guy trees as part of the thinning prescription to reduce impact to residual stand. Tail trees that are damaged during operations would contribute to coarse woody debris on site.

Wildlife

- Helicopter operations in units proposed for helicopter logging (units 20, 21, 22, and 23 and the helicopter portions of units 32, 34, 35, 39, 40, 45, 46, 47, 48, and 50) must occur only between August 6 and February 28 to minimize harassment of late-succession species which may be occupying suitable habitat within one mile of the units, unless otherwise approved by the district wildlife biologist and the U.S. Fish and Wildlife Service (If a helicopter that produces a noise level at or below 92 decibels is used, some helicopter work during the early season – March 1 to August 6 – may be approved. The additional acres of harassment would be requested from the U.S. Fish and Wildlife Service). Falling can take place outside of this window except for the four units affected by the owl activity center (units 41, 43, 44, and 45) where all activity (within the nesting core) must take place between August 6 and February 28. For three proposed helicopter units within one mile of an eagle foraging area (units #8, 10, and 56), work may only occur between March 16 and October 30 (outside of the eagle wintering period), or sooner if the biologist determines that eagles are not using the foraging site or if a helicopter with the same noise level as a K-Max is used.
- No potential nest trees for murrelets (trees at least 21 inches dbh with at least one branch at least 4 inches in diameter that is at least 33 feet from the ground (McShane et al. 2004) that can function as a platform by having a flat surface, moss, lichen, mistletoe, or a deformity) will be cut during the early or late murrelet breeding seasons (April 1 – September 15).
- No potential nest trees for spotted owls (trees at least 21 inches dbh with nesting structures such as cavities, broken tops, large branches, or hawk nests) will be cut during the early or late spotted owl breeding seasons (March 1 – September 30).

- In units adjacent to suitable murrelet habitat (Units 33-41, 43-48, 50, and 52-53), project activities shall not commence until two hours after sunrise and shall cease two hours before sunset from April 1 through September 15.
- Burning during the early breeding season for spotted owls (March 1 to July 15) or early breeding season for murrelets (April 1 to August 5) will be conducted at least 0.25 miles away from suitable nesting habitat (This may affect units 10, 16-19, 24, 33-41, 43-48, 50, 52-53.). Burning during the nesting season for bald eagles (January 1 to August 15) or during the wintering period (October 31 to March 15) will be conducted at least 1 mile away from any bald eagle use area (This may affect units 8-10, 55-57.).
- If an active raptor nest is located during thinning operations, contact the Forest Service wildlife biologist for appropriate mitigation measures.
- Protect and retain trees with inactive raptor nests to provide nesting quarters for opportunistic (non-nest building) raptors.
- The Forest Service wildlife biologist will review any incidental removal of hazard trees greater than 21 inches during the breeding season for any listed species. Such review would occur for removal at any time of a tree greater than 36 inches.
- Seasonal restrictions around known, active fisher denning sites (should they be located) would be implemented between mid-March and late May for motorized, mechanized activities. Protection would include a 0.25 mile buffer from disturbance for those activities that are long in duration, such as timber harvest and associated activities (e.g., felling, yarding, and road building), as well as road construction. Seasonal restrictions would not be applied for hauling or for general road traffic. Adjustments for the buffer would be based on local conditions such as topography (USDI 2007b).

Table 4. Monitoring and Adaptive Management Actions Common to Action Alternatives[1].

Resource Area	Monitoring	Who	Adaptive Management

[1] *Monitoring may be dependent on available funding.*

Resource Area	Monitoring	Who	Adaptive Management
Heritage Resources	Note any previously unknown heritage resource sites discovered during project planning, layout or implementation.	Forest Service Workers on the Project	Report new sites to the appropriate District Heritage Resource Specialist who will determine mitigation needed. Stop work until cleared by specialist.
Plant and Animal Species of Concern[2]	Note new populations of species of concern discovered during project planning, layout or implementation. Active spotted owl, marbled murrelet, or bald eagle nests found during breeding seasons will effect an immediate shutdown of operations within the harassment distances as outlined in Table G-1, G-2, or G-3 of the August 2003, amended 2004, Programmatic Biological Opinion.	Forest Service Workers on the Project	Report new sightings to the appropriate District Biologist who will determine mitigation needed. Stop work until cleared by biologist.
Fish	Walk roads to be closed and/or decommissioned following use but before closure. Develop criteria for stream bottom widths following road decommissioning.	Hydrologist/ Fish Biologist	Develop stream rehabilitation specifications for road decommissioning following use.
Invasive Plants	Survey for presence/spread of invasive plants.	Botanist or Botany Technician	Identify and treat noxious weed populations of concern.
Soil and Water	Ensure adverse detrimental soil conditions do not exceed 20% of each unit the project area following treatment.	Timber Sale Administrator	Increase spacing between skid trails/skyline corridors, wet season closures.
Soil and Water	Ensure EA mitigations are implemented.	Timber Sale Administrator	Use all available contract administration tools.
Vegetation/ Habitat	Review sale area for snag density and coarse woody debris coverage 3 to 5 years after harvest.	Forester/ Wildlife Biologist/ Technician	Develop vegetation treatments as needed using the most current analytical tools (such as DecAid).
Wildlife	Review sale area post-thinning to ensure that stands still meet the definition of dispersal habitat (11 inch average dbh trees and 40% canopy cover).	Forest and District Biologists	Adjust thinning prescriptions in future projects.

Additional Monitoring

A long term cooperative study, the Rainy Creek Biodiversity Project, has been established under the guidance of Dr. Dan Underwood of Peninsula College, Port Angeles, Washington.

[2] *Species of Concern are those listed under the State or Federal Endangered Species Acts or Regional Forester's Sensitive List. Additional species of concern may be noted by the US Fish and Wildlife Service.*

The overall objective is to evaluate the extent to which complex silvicultural manipulations (e.g. commercial thinning) of forest structure affect productivity. Focal points include soil ecosystems, ground vegetation, invertebrates, small mammals, and forest composition and structure. The impacts of gap and skip size, and commercial thinning on these focal points will be studied. The study will also look at net carbon sequestration as a function of silvicultural prescription and end use of forest products. As part of this study in applied forest ecology permanent sample plots have been established and vegetative data collected. Annual data will be compiled for at least 5 years subsequent to the ground management.

Potential KV Opportunities

Revenue from timber sale receipts may be retained under the Knudson-Vandenberg (KV) trust fund to do resource enhancement work in the sale area. Below is a list of restoration opportunities that were identified in the planning area and that may be implemented, depending on the amount of KV funds generated from the sale. Priority for implementation in a given sale area would be determined by the Responsible Official. This list merely identifies restoration opportunities in the project area and does not imply that KV funding is the only means to implement these activities if other funding sources are available.

Aquatics/Fish Passage

- Large woody debris placement in Bear Creek
- Conifer release, understory planting in units 55, 56, 57, and 58, where appropriate
- Conifer release and understory planting in the general planning area
- Large woody debris (LWD) placement in 2 fish tributaries in/near unit 64

Fuels

- Pile and burn pre-existing slash within the first 100 feet of treated areas next to private resident boundaries to reduce fire risk.

Invasive Plants

- Multi-year treatment and monitoring of invasive plant populations in the project area.

Roads

Road decommissioning opportunities in the area as proposed in the Olympic National Forest Access and Travel Management (ATM) Plan

Table 5. KV Road decommissioning opportunities.

Road #	Mileposts	Relative Priority
3000220	0 - 2	Low

Road #	Mileposts	Relative Priority
3000222	0 – 0.8	Low

Road #	Mileposts	Relative Priority
3000225	0 – 0.89	Low
3000227	0 – 0.16	Low
3000235	0 - 0.7	Low
3000237	0 - 0.1	Low
3000320	0 - 0.4	Low/Moderate
3000330	0 - 1.19	Moderate
3000370	0 - 0.4	Low
3000401	0 - 1	Moderate
3000415	0 - 0.8	Low
3000490	0 - 2.1	High
3000590	0 - 1.4	High
3000600	0 - 1.8	High
3000800	0 - 1.9	Moderate
3000810	0 - 0.13	Low/Moderate
3000815	0 - 0.15	Low/Moderate
3000830	0 - 0.26	Low/Moderate
3000840	0 - 0.8	Moderate
3000842	0 - 0.28	Low/Moderate
3000845	0 - 0.19	Low/Moderate
3000850	0 - 0.22	Low/Moderate
3000852	0 - 0.03	Low
3000011	Not shown in ATM, near Unit 58	Low/Moderate
3000385	Not shown in ATM, in Unit 33	Moderate
3000295	Not shown in ATM, in Unit 26	High
3067 spur	Not shown in ATM, near -050 junction	High

Road Closures/Stabilizations/Drainage Improvements

Table 6. KV opportunities for road closure/stabilization/drainage improvements.

Road #	Mileposts	Relative Priority
3000250	3.9 - 6.9	Low
3000300	0.0 - 3.5	Low
3000395	0.0 - 0.2	Low/Moderate?
3000400	2.3 - 4.5	High
3006011	0.0 - 1.3	Moderate
3100010	0.0 - 1.53	High
3100300	5.0 - 5.8	(unknown)

Stream Crossing Upgrades and Drainage Improvements

The following is a list of roads with culverts in need of culvert upgrading. Some culvert replacements would improve fish passage.

- 30 (near Units 46, 47, 53)
- 3000300 spur
- 3000200

Roads in need of drainage improvement3006

- 3000200
- 3000300
- 3000400
- 3000580
- 3000581
- 3000599

Aquatics/Fish passage

- 30 (at MP 4.6 and crossing at Deep Creek).
- 3100010 stream crossing removals on 2 fish tributaries in/near unit 64.

Wildlife

- Snag creation in thinned units -- Based on information provided by DecAID (see DecAID Analysis, page **Error! Bookmark not defined.**), snag enhancement would focus on managing natural conditions rather than targeting specific species. Therefore, a range of sizes (dbh and tree height), species, and decay stages would be sought, in clumps and distributed throughout the stands. Methods may include topping, girdling, or inoculation.
- Nest tree enhancement.
- Wetland enhancement in Unit 24 to reduce encroaching vegetation.
- Native plant browse enhancement in helicopter landings and temp road corridors after closure.

- Coarse Woody Debris/Brush Pile Placement in units lacking large downed wood. Similar to snag creation, natural conditions for downed wood habitat would be mimicked with a range of species and sizes with longer logs being left, singly or in the form of log pyramids.

Summary Comparison of Alternatives[3]

	Alt. A	Alt. B	Alt. C
Timber			
Total Acres proposed for thinning	0	2,189	2,136
Acres proposed for thinning within RR	0	784	769
Acres proposed for ground-based logging	0	691	628
Acres proposed for ground-based or cable logging	0	73	73
Acres proposed for cable logging	0	918	853
Acres proposed for helicopter logging	0	507	582
Roads			
Total miles of road used for access and log haul	0	38.9	36.8
Total miles of forest system road used	0	29.4	29.0
Miles of forest system roads to be used and reclosed that are available for decommissioning, if KV funds generated from project are available.	0	6.1 (1.8 miles within RR)	5.7 (1.6 miles within RR)
Miles of BPA access rds used (2.14 miles are also forest system rd)	0	5.4 (1.5 miles within RR)	5.4 (1.5 miles in RR)
Miles of unclassified, abandoned road used (all to be decommissioned after project)	0	5.5 (1.9 miles in RR)	3.9 (1.2 miles in RR)

[3] *Values given are approximate and based on computer mapping and other calculations. These values may differ from actual project layout and implementation.*

Miles of new temporary road constructed (all to be decommissioned after project)	0	0.9 (0.2 mile in RR)	0.7 (0.1 mile within RR)
Soils			
Potential for accelerated erosion and sediment delivery, loss of soil productivity	No direct effects. Detrimental soil conditions would remain unchanged at 6%. Sediment above natural levels would continue to be generated from poorly maintained open road system and abandoned roads.	Detrimental soil conditions estimated to be approx. 11%. Some short-term sedimentation would result from road construction, log hauling, and decommissioning activities. Overall sedimentation and risk of mass-wasting would decrease 1-2 yrs following project implementation.	Detrimental soil conditions estimated to be approx. 10%. Some short-term sedimentation would result from road construction, log hauling, and decommissioning activities. Overall sedimentation and risk of mass-wasting would decrease 1-2 yrs following project implementation.
Aquatics - habitat indicators			
Temperature	Maintain (all watersheds)	Maintain (all watersheds)	Maintain (all watersheds)
Sediment	Maintain –degraded (DC, BC)[4]	Maintain (WT); Degrade-short-term (BC, DC)	Maintain (WT); Degrade-short-term (BC, DC)
Physical barriers	Maintain – degraded (BC)	Restore (BC); Maintain (WT, DC)	Maintain (all watersheds)
Pool quality	Maintain (all watersheds)	Maintain (all watersheds)	Maintain (all watersheds)
Width to depth ratio	Maintain – degraded (DC, BC)	Maintain (WT); Restore (BC, DC)	Maintain (WT); Restore (BC, DC)
Streambank condition	Maintain – degraded (DC, BC)	Maintain (WT); Degrade-short-term (BC, DC)	Maintain (WT); Degrade-short-term (BC, DC)
Function of riparian reserves	Maintain (all watersheds)	Maintain / Restore (all watersheds)	Maintain / Restore (all watersheds)
Drainage network increase	Maintain – degraded (WT, DC)	Maintain/Restore (WT); Degrade-short-term/ Restore (BC, DC)	Maintain/Restore (WT); Degrade-short-term/ Restore (BC, DC)
Road density and location	Maintain – degraded (WT, DC)	Maintain/Restore (WT); Degrade-short-term/ Restore-long term (BC, DC)	Maintain/Restore (WT); Degrade-short-term/ Restore-long term (BC, DC)

[4] *DC = Deep Creek Watershed, BC = Bear Creek Subwatershed (within Middle Sol Duc Watershed), WT = West Twin River Watershed*

Fish and Wildlife			
Total Acres proposed for thinning within owl activity center	0	137	94
Acres proposed for ground-based logging in owl activity center	0	10	4.4
Acres proposed for cable logging in owl activity center	0	90	90
Acres proposed for helicopter logging in owl activity center	0	37	0
Effects on Threatened & Endangered species (Endangered Species Act determinations)	No direct effect Indirect effect of foregoing opportunities to improve habitat on 2,189 acres. (No Effect)	81 acres of harassment to owls and murrelets, with an additional 257 acres of harassment if helicopter use is allowed during the early breeding season in units that are adjacent to suitable habitat. (May Affect, Likely to Adversely Affect)	81 acres of harassment to owls and murrelets, with an additional 185 acres of harassment if helicopter use is allowed during the early breeding season in units that are adjacent to suitable habitat. (May Affect, Likely to Adversely Affect)
Effects on Sensitive wildlife species (Sensitive species effects determination)	No effect. (No impact)	Potential short-term direct effect on Van Dyke's salamander and bald eagle. Potential long-term benefits to Van Dyke's salamander, Townsend's big-eared bat and Pacific fisher from road decommissioning and other restoration work. (May impact individuals, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.)	Potential short-term direct effect on Van Dyke's salamander and bald eagle. Potential long-term benefits to Van Dyke's salamander, Townsend's big-eared bat and Pacific fisher from road decommissioning and other restoration work. (May impact individuals, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.)

Effects on Management Indicator species	No direct effect Indirect effect of foregoing opportunities to improve habitat on 2,189 acres.	Potential short-term disturbance impacts to spotted owls, foraging pileated woodpeckers, and other primary cavity excavators. Long-term indirect benefits of improved habitat for species, including big game.	Potential short-term disturbance impacts to spotted owls, foraging pileated woodpeckers, and other primary cavity excavators. Long-term indirect benefits of improved habitat for species, including big game.
Effects on Sensitive fish species (Sensitive species effects determination)	No direct effect Indirect effect of foregoing opportunities to improve fish passage and restore failed stream crossings. (No impact.)	No direct effect to habitat in Deep Creek and West Twin River. Potential short-term effects in Bear Creek, followed by long-term improved fish passage. (Would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species)	No direct effect to habitat in Deep Creek and West Twin River. Potential short-term effects in Bear Creek, followed by long-term improved fish passage. (Would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species)
Botany			
Effects on federally listed vascular plants, bryophytes, fungi, or lichen species	No effect.	No effect. There are no documented or suspected locations of federally listed plants, bryophytes, fungi or lichens.	No effect. There are no documented or suspected locations of federally listed plants, bryophytes, fungi or lichens.
Effects on Sensitive/ other rare or uncommon vascular plant species (Sensitive species effects determination)	No effect. (No impact)	No effect. No Sensitive or other rare or uncommon plants were found in the project area. (No impact)	No effect. No Sensitive or other rare or uncommon plants were found in the project area. (No impact)
Effects on Sensitive/ other rare or uncommon bryophytes (mosses and liverworts) (Sensitive species effects determination)	No effect. (No impact)	No effect. Single documented site of *Tetraphis geniculata* would be protected. (No impact)	No effect. Single documented site of *Tetraphis geniculata* would be protected. (No impact)

Effects on Sensitive/ other rare or uncommon fungi (Sensitive species effects determination)	No effect. (No impact)	No known sites of any other rare or uncommon fungi were found in the project area. (For unsurveyed species: May impact individuals, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.)	No known sites of any other rare or uncommon fungi were found in the project area. (For unsurveyed species: May impact individuals, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.)
Effects on Sensitive/ other rare or uncommon lichen (Sensitive species effects determination)	No effect. (No impact)	No effect. No sensitive or other rare or uncommon lichens were found in the project area. (No impact)	No effect. No sensitive or other rare or uncommon lichens were found in the project area. (No impact)
Effects on Invasive Plants	Existing infestations of invasive plants would continue to spread.	Mitigation measures before, during, and after project activities would prevent spread and treat current infestations of invasive plants.	Mitigation measures before, during, and after project activities would prevent spread and treat current infestations of invasive plants.
Economics			
Estimated volume (MBF)	0	32,838	31,854
Estimated value of wood products	$0	$1.45 million	$1.20 million
Estimated implementation costs	$0	$1.02 million	$0.99 million
Net present value (estimated revenue - estimated cost)	$0	$436,000	$210,000
Benefit/cost ratio	0	1.43	1.21
Heritage Resources			
Effects on Heritage Resources	No effect	No effect. There are no identified sites of cultural or historical important in the project area.	No effect. There are no identified sites of cultural or historical important in the project area.