BIOLOGICAL ASSESSMENT

Project Name:
Bridge Thin Project

NEPA Document Name:
Bridge Thin Environmental Assessment, Draft

Watershed Analysis:
Quartz Creek and Minor Tributaries, Willamette National Forest, 1998

Other ESA Consultation:
Formal and informal consultation on FY 2007-2008 projects within the Willamette Planning Province which may affect bald eagles, northern spotted owls, and/or spotted owl critical habitat due to habitat modification and disturbance [FWS *reference*: 1-7-06-F-0179 and 1-7-06-I-0192].

Administrative Unit:
Willamette National Forest, McKenzie River Ranger District

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Date Sent For Electronic Review:
January 14, 2008

ESA Unit, Critical Habitat, and EFH Addressed in this BA:

LISTED SPECIES or HABITAT	ESA STATUS	ESA / EFH DETERMINATION
Upper Willamette River Chinook Salmon - Evolutionarily Significant Unit (ESU)	Threatened	May Affect, Not Likely to Adversely Affect
Upper Willamette River Chinook Salmon – Critical Habitat	Designated	May Affect, Not Likely to Adversely Affect
Upper Willamette River Chinook Salmon – Essential Fish Habitat	Designated	Will Not Adversely Affect
Columbia River Bull Trout – Distinct Population Segment (DPS)	Threatened	May Affect, Not Likely to Adversely Affect
Columbia River Bull Trout – Critical Habitat	Designated	May Affect, Not Likely to Adversely Affect

Project Location:

USGS HYDROLOGIC UNIT CODE (HUC)	HUC SCALE	HUC NAME	NW Forest Plan Key Watershed
17090004	HUC4	McKenzie River	No
1709000405	HUC5	McKenzie River/ Quartz Creek	No
170900040502	HUC6	McKenzie River / Elk Creek	No

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I. INTRODUCTION

The McKenzie River Ranger District of the Willamette National Forest proposes to thin approximately 2,502 acres of previously managed stands up to 80 years of age (2,096 acres) and fire regenerated stands up to 120 years (406 acres) within the McKenzie River/Elk Creek 6th Field subwatershed. The purpose of the action is to improve stand conditions in terms of species composition, density, and structure over the long term.

The Bridge Thin Project is located in a watershed currently providing habitat for spring Chinook salmon (*Onchorhynchus tshawytcha*) in the Upper Willamette Evolutionarily Significant Unit. This species is listed as Threatened and is protected under the Endangered Species Act. This Biological Assessment (BA) evaluates the effects the project may have on this fish, its habitat or designated Critical Habitat, and evaluates the effect of the project on Essential Fish Habitat (EFH) as designated by the Magnuson-Stevens Fishery Conservation and Management Act.

The Bridge Thin Project is in a watershed that also provides habitat for bull trout (*Salvelinus confluentus*), part of the Columbia River population segment that is listed as Threatened and protected under the Endangered Species Act of 1973 (as amended). On June 13, 1997, the US Fish and Wildlife Service published in the Federal Register (62 FR 32268) a proposed rule to list the Klamath River population segment of bull trout as an endangered species, and the Columbia River population segment of bull trout as a threatened species. On June 10, 1998, a final rule was published in the Federal Register (63 FR 31647) determining the Klamath River and Columbia River population segments of bull trout to have Threatened status under the Act. At the time of listing, the Service, made the finding that critical habitat was not determinable for these populations because their habitat needs were not sufficiently well known (63 FR 31647). For a further summary of previous Federal actions, see 64 FR 58916.

On January 26, 2001, the Alliance for the Wild Rockies, Inc. and Friends of the Wild Swan, Inc. filed a lawsuit in the U.S. District Court of Oregon challenging the Service's failure to designate critical habitat for bull trout. A settlement agreement was reached on January 14, 2002, which stipulated that the Service would make critical habitat determinations for the five population segments of bull trout (Civil Case No: CV 01-127-JO). For the Klamath River and Columbia River populations, the Service agreed to submit for publication in the Federal Register a proposed rule for critical habitat designation by October 1, 2002, and a final rule by October 1, 2003. A subsequent agreement resulted in extending the date for the publication. The proposed rule was printed in the Federal Register November 29, 2002 and the final critical habitat designation (70 FR 56212) was published September 26, 2005.

This BA was prepared in accordance with the following guidance and direction:

- Analytical Process (AP) for Development of Biological Assessments for Consultation on Federal Actions Affecting Fish Proposed or Listed Under the Endangered Species Act Within the Northwest Forest Plan Area (Interagency Guidelines, November 2004),
- Endangered Species Act of 1973 (as amended),

  50 CFR § 402.12 (Interagency Cooperation, Biological Assessments),
- Endangered Species Consultation Handbook (USFWS and NMFS, March 1998),
- Streamlined Consultation Procedures for Section 7 of the Endangered Species Act (FS, NMFS, BLM, & USFWS, July 1999), and

- Magnuson-Stevens Fishery Conservation and Management Act (§ 305(b)) and its implementing regulations (50CFR § 600).

NOAA Fisheries has worked with the U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), and the Forest Service (FS) to revise the methods for making determinations of effect for land management activities impacting ESA-listed salmonid species in the Northwest Forest Plan geographical area. This new approach was used to assess the effects of the proposed action. In this regard, the elements of the proposed action were analyzed for potential effects on the Upper Willamette Spring Chinook Salmon and Columbia River Bull Trout due to changes in the habitat pathways of water quality, habitat access, habitat elements, channel conditions and dynamics, flow/hydrology, and watershed conditions. In applying the revised analysis approach, the agencies consider eight factors, derived largely from the joint NOAA Fisheries and Fish and Wildlife Service ESA Section 7 Consultation Handbook, when evaluating the effects of an action on habitat indicators and subsequently the effects on ESA-listed fish. These factors are proximity, probability, magnitude (severity and intensity), nature, distribution, frequency, duration, and timing, where applicable.

This analysis considered the potential direct and indirect effect of the project's elements on each habitat indicator and then utilized the relevant factors to determine if there was an effect and whether it was measurable, insignificant, discountable, or beneficial. A summary for each habitat indicator was developed to ascertain whether effects from various elements combine to create negative effects on any of the indicators. These effects, and those of interrelated or interdependent actions to the proposed action, were considered to reach an overall effect determination for this project. The effects of other concurrent Federal actions are disclosed to provide information to assist the Services in their jeopardy and destruction/adverse modification of critical habitat determinations.

II. DESCRIPTION OF THE PROPOSED ACTION

A. Purpose and Need

The need for action in the project area was established from analysis of stand conditions of the Bridge Thin planning that has occurred over several years and was completed in 2007. Even-aged management as well as wildfires with fire suppression over the last several decades, has created stands that lack the structural and species diversity that would otherwise have developed. Stand data shows that the maximum stand density index (SDI) levels are predominantly above 50%, levels at which the limit of tree vigor is reached and overall stand health and tree vigor begin to decline. The purpose of this project is to apply silvicultural and fuels treatments to these stands to maintain or improve tree growth and vigor; to reduce the mortality that occurs in high-density stands when resources important to tree survival become limiting; to improve stand conditions in terms of species composition, density, and structure over the long term; to return the role of fire as a natural disturbance process in the ecosystem; and to improve defensible space within the wildland-urban interface in stands ranging from 80 to approximately 120 years of age. Stand treatments will occur in stands that have resulted from previous even-aged management in addition to fire regenerated stands where management has been limited to selective harvest.

Included in the purpose of the proposed action is to implement the Record of Decision (ROD) for the Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA, 1994). This document, which is better known as the Northwest Forest Plan (NWFP), established the standards and guidelines for activities on Federal Land.

The Willamette National Forest Land and Resource Management Plan, as amended by the NWFP, includes resource management goals to maintain or enhance forest conditions at the stand and landscape level: high quality water resources; aquatic habitat for fish, and terrestrial habitat diversity for wildlife and plants; scenic quality; and to provide timber products. The Forest Service is directed to meet these goals when planning projects at the site-specific level. Therefore, actions taken to meet the purpose and need shall be guided by the following objectives:

- Restore structural diversity in stem exclusion stands to enhance wildlife habitat;
- Accelerate late-successional conditions for stands within riparian reserves;
- Restore “open oak savannah” stands where they were historically present;
- Restore degraded roads infrastructure;
- Protect and maintain beneficial uses in the watershed for communities in the wildland-urban interface;
- Reduce hazardous fuels and improve the role of fire as a natural disturbance process in the ecosystem.

The following Figures in Appendix A illustrate project area:

- Figure A-1. Project Location
- Figure A-2. McKenzie River/Elk Creek Sub-watershed
- Figure A-3. ESA Fish Distribution

B. Project Elements

This project has been separated into six project elements which are described in detail below:

1) **Timber Felling,**
2) **Timber Yarding,**
3) **Timber and Rock Hauling,**
4) **Road, Rock Pit and Landing Work,** (including stream culvert replacement, road construction, reconstruction and maintenance, landing construction, and road decommissioning and closure),
5) **Fuels Treatment**

1) Timber Felling

The Bridge Thin Project proposes to commercially thin and selectively harvest approximately 2,502 acres within the Northwest Forest Plan Adaptive Management Area land allocation, yielding about 35.5 million board feet of timber products. Thinning treatments in managed stands up to 80 years of age (approximately 2,096 acres) and fire regenerated stands up to 120 years (approximately 406 acres) would occur during FY2008-2012. Oak savanna restoration on approximately 51 acres would remove encroaching trees to restore a more open condition for this unique habitat. Thinning for elk habitat enhancement would occur on approximately 237 acres, and non-commercial fire hazard reduction would occur on approximately 178 acres.

After intensive stream reconnaissance of the action area, a thinning strategy to meet project objectives was developed (Table 1), which includes no-harvest and no-fuel-treatment buffers to protect water quality and habitat conditions. In previously unmanaged and fire regenerated stands ranging from 95 to 120 years old, there will be a 300 foot no-harvest buffer (2 site potential tree heights) on all fish-bearing streams (including bull trout and spring Chinook bearing streams), with a sixty foot no-treatment buffer in units selected for fire hazard reduction only (no commercial harvest). In unmanaged stands selected for thinning, there will be a 150 foot no-harvest buffer on perennial non-fish bearing streams and a 30 foot no-harvest buffer on intermittent streams. In unmanaged stands selected for oak savannah restoration and elk habitat enhancement, there will be a 60 no-harvest buffer (with 50% canopy closure from 60 – 150 feet) on perennial streams and a 30 foot no-harvest buffer on intermittent streams. In stands selected for fire hazard reduction only, there will be a 30 foot no-treatment buffer on both perennial and intermittent streams. Lakes and wetlands will have 300 foot and 150 foot no-harvest buffers, respectively, in all harvest stands and a 60 foot no-treatment buffer in fire hazard reduction only stands.

In previously managed stands ranging from 32 to 80 years old, there will be a 60 foot no-harvest buffer on all perennial and fish-bearing streams (with 50% canopy closure from 60 – 300 feet on fish-bearing streams and 50% canopy closure from 60 – 150 feet on non fish-bearing streams), and a 30 foot no-harvest buffer on intermittent streams. Lakes and wetlands will have 300 foot and 60 foot no-harvest buffers, respectively. In stands selected for fire hazard reduction only, there will be a 60-foot no-treatment buffer on fish-bearing streams and a 30 foot no-treatment buffer on non fish-bearing perennial and intermittent streams (Table 1).

The site-potential tree height for the project area is 150 feet. Riparian reserves for fish-bearing streams are 300 feet on both sides and 150 feet for non fish-bearing perennial and intermittent streams. The no-harvest buffers in unmanaged stands on fish-bearing streams (300 feet) include all of the inner gorge and the entire primary and secondary shade zones. The no-harvest corridor retains all of the floodplain as defined by riparian indicator plants for streams lacking a clearly

defined inner gorge. Adjacent trees would be felled away from the no-harvest buffer. Trees felled within the no-treatment buffer for skyline corridors would be left on-site (see Timber Yarding for details). Fuel treatment units are located 150 feet from LFH are along the McKenzie River, which has an average wetted width of approximately 100-200 feet.

Timber harvest activity has the potential to affect stream temperature through modification of canopy. In thinning riparian reserves to accelerate stem diameter, prescribed distances to channels were developed in part to minimize potential temperature impact to year-round waterways, using the guidance provided in Northwest Forest Plan Temperature TMDL Implementation Strategies" (USDA Forest Service and USDI BLM, 2005). The following table summarizes riparian reserve thinning prescriptions, designed to minimize potential temperature and sediment impacts to aquatic habitat. (Equipment proximity to channels and potential to generate sediment was also a consideration in developing riparian reserve management prescriptions described below.)

Table 1. Riparian Reserve Management for Bridge Thin.

	Timber Harvest – Thinning and Group Selection (Includes activity fuel treatment)	Timber harvest - Savanna Restoration and Wildlife Habitat Enhancement (Includes activity fuel treatment)	Fire Hazard Reduction (No harvest – removal of ladder fuels and stems <7")
Previously Managed Stands (Units 1-72)	Fish-Bearing Streams (Class 1 and 2) - 60' NH, 50% canopy closure from 60'-300' Perennial, Non Fish-Bearing Streams (Class 3) - 60' NH, 50% canopy closure from 60'*-150' Intermittent, Non Fish-Bearing Streams (Class 4) - 30' NH Lakes - 300' NH Wetlands - 60' NH	Fish-Bearing Streams (Class 1 and 2) - 60' NH, 50% canopy closure from 60'-300' Perennial, Non Fish-Bearing Streams (Class 3) - 60' NH, 50% canopy closure from 60'*-150' Intermittent, Non Fish-Bearing Streams (Class 4) - 30' NH Lakes – 300' NH Wetlands – 60' -.NH	Fish-Bearing Streams (Class 1 and 2) – 60' NT Perennial and Intermittent, Non Fish-Bearing Streams (Class 3 and 4) – 30' NT Lakes - 60' NT Wetlands - 60'NT
Unmanaged Stands (Units 80-103, 841)	Fish-Bearing Streams (Class 1 and 2) - 300' NH Perennial, Non Fish-Bearing Streams (Class 3) - 150' NH Intermittent, Non Fish-Bearing Streams (Class 4) - 30' NH Lakes - 300' NH Wetlands - 150' NH	Fish-Bearing Streams (Class 1 and 2) - 300' NH Perennial, Non Fish-Bearing Streams (Class 3) – 60' NH, 50% canopy closure from 60-150' Intermittent, Non Fish-Bearing Streams (Class 4) - 30' NH Lakes – 300' NH Wetlands – 150' NH	Fish-Bearing Streams (Class 1 and 2) – 60' NT Perennial and Intermittent, Non Fish-Bearing Streams (Class 3 and 4) – 30' NT Lakes - 60' NT Wetlands - 60'NT

For all action alternatives, treatment within riparian reserves has been designed to comply with "Northwest Forest Plan Temperature TMDL Implementation Strategies" (USDA Forest Service and USDI BLM, 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 meets the expectations of several 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.

There are approximately 492 acres of riparian reserve within Bridge Thin, of which 148 acres are in the no-harvest and no-treatment buffers. The balance of 344 acres within the riparian reserve would be thinned. Table 2 summarizes general unit information, acres of riparian reserve and stream influence zone treated and the proximity of streams to listed fish habitat (LFH) / Critical Habitat (CH).

Table 2. General Unit Information and Tree Data.

Unit	Total Size	Total RR Area	RR Treated	SIZ[2] Treated Area	Proximity[3] to LFH/CH	Overland Proximity[5] to LFH/CH	Precip Zone[4]	Mean Tree Age	Quadratic Mean Diameter	Mean Tree Height
	Acres	Acres	Acres	Acres	Feet	Feet	DRZ, TSZ, or DSZ	Years	Inches	Feet
1	14	5	4	4	No Connection	2,090	DRZ	57	11	92
2	140	62	48	48	No Connection	2,400	DRZ	57	13	82
3	47	11	11	11	No Connection	600	DRZ	57	12	81
4	57	11	9	9	No Connection	4,000	TSZ	57	13	89
5	73	18	14	14	No Connection	2,500	DRZ	57	14	91
6	87	11	7	7	No Connection	1,900	DRZ	47	14	84
7*	20	3	2	2	No Connection	1,600	DRZ	57	23	106
8	60	6	5	5	No Connection	970	DRZ	57	12	67
10	37	2	1	1	No Connection	750	DRZ	57	15	75
11	37	23	17	17	7,600	5,840	TSZ	57	12	85
12	21	14	7	7	6,900	5,050	TSZ	52	14	98
13	21	5	3	3	No Connection	5,675	TSZ	70	12	85
14	27	0	0	0	No Streams	5,000	TSZ	80	13	76
15	79	20	12	12	3,600	2,400	TSZ	57	12	82
17	24	6	4	4	No Connection	4,600	TSZ	60	14	70
18	27	3	2	2	No Connection	4,400	TSZ	57	16	73
19*	20	2	1	1	No Connection	2,700	DRZ	57	18	90
20	66	1	1	1	No Connection	1,360	DRZ	59	15	91
21	12	8	5	5	900	640	DRZ	57	14	68
23	12	2	1	1	No Connection	490	DRZ	47	15	68
24	5	0	0	0	No Streams	1,300	DRZ	59	14	79
25	26	0	0	0	No Streams	4,700	TSZ	52	12	93

Unit	Total Size	Total RR Area	RR Treated	SIZ[2] Treated Area	Proximity[3] to LFH/CH	Overland Proximity[5] to LFH/CH	Precip Zone[4]	Mean Tree Age	Quadratic Mean Diameter	Mean Tree Height
	Acres	Acres	Acres	Acres	Feet	Feet	DRZ, TSZ, or DSZ	Years	Inches	Feet
26	14	0	0	0	No Streams	1,600	DRZ	45	16	105
27	5	0	0	0	No Streams	1,350	TSZ	87	23	97
28	7	2	1	1	No Connection	1,450	TSZ	34	11	71
29	47	2	1	1	No Connection	1,670	TSZ	59	14	76
30	38	0	0	0	No Streams	1,200	TSZ	59	13	83
31	19	0	0	0	No Streams	2,500	TSZ	61	13	90
32	123	10	8	8	No Connection	1,800	TSZ	61	18	107
33*	4	0	0	0	No Streams	3,000	TSZ	61	**	**
34	5	0	0	0	No Streams	1,800	TSZ	61	18	110
35	54	0	0	0	No Streams	740	TSZ	52	16	83
36	36	10	8	8	2,800	1,300	TSZ	42	12	75
37	43	3	3	3	No Connection	2,250	TSZ	36	10	67
38	27	0	0	0	No Streams	5,200	TSZ	36	18	112
39	20	0	0	0	No Streams	6,250	TSZ	45	12	65
40	27	13	11	11	6,200	5,600	TSZ	34	15	92
41*	7	0	0	0	No Streams	6,200	TSZ	45	**	**
42	32	0	0	0	No Streams	8,200	TSZ	49	18	105
43	44	18	11	11	10,800	8,650	TSZ	32	14	87
44	45	4	2	2	9,800	6,500	TSZ	36	13	88
45	38	12	9	9	11,000	7,700	TSZ	45	14	89
46	41	1	1	1	No Connection	8,800	TSZ	33	14	72
47	32	6	3	3	13,800	10,500	TSZ	30	12	76
48	17	1	1	1	No Connection	11,300	TSZ	32	12	69
49	7	4	3	3	No Connection	4,100	DRZ	117	14	90
50*[1]	6	5	4	4	6,500	4,200	DRZ	117	19	80
51	20	10	8	8	5,700	4,000	TSZ	36	12	84
52	11	0	0	0	No Streams	6,850	TSZ	30	12	76
53	3	0	0	0	No Streams	6,500	TSZ	35	16	106
54	10	0	0	0	No Streams	4,850	TSZ	40	13	85
55	25	2	1	1	7,700	5,850	TSZ	45	14	65
56	43	7	5	5	10,400	6,700	TSZ	65	19	120
57	15	1	1	1	No Connection	8,600	TSZ	74	24	139
58	16	0	0	0	No Streams	7,500	TSZ	41	14	67
59	22	0	0	0	No Streams	6,900	TSZ	85	15	97
60	24	8	8	8	No Connection	8,850	TSZ	41	15	69
61	16	4	4	4	No Connection	8,500	TSZ	33	13	84
62	19	0	0	0	No Streams	9,500	TSZ	52	18	94
63	29	0	0	0	No Streams	12,200	TSZ	32	13	70
64	42	9	8	8	16,000	11,300	TSZ	53	12	62
65	10	0	0	0	No Streams	12,400	TSZ	34	12	71
66	11	7	6	6	15,200	11,400	TSZ	53	18	76
67	22	2	2	2	No Connection	7,200	TSZ	48	18	100
68	41	6	6	6	No Connection	5,500	TSZ	42	16	85

Unit	Total Size	Total RR Area	RR Treated	SIZ[2] Treated Area	Proximity[3] to LFH/CH	Overland Proximity[5] to LFH/CH	Precip Zone[4]	Mean Tree Age	Quadratic Mean Diameter	Mean Tree Height
	Acres	Acres	Acres	Acres	Feet	Feet	DRZ, TSZ, or DSZ	Years	Inches	Feet
69	33	3	3	3	4,000	3,000	TSZ	45	14	103
70	3	0	0	0	No Streams	6,900	TSZ	48	16	102
71*	3	0	0	0	No Streams	1,250	TSZ	32	**	**
72	28	5	4	4	6,900	5,000	TSZ	32	15	83
80	10	0	0	0	No Streams	1,500	TSZ	101	18	104
81	14	0	0	0	No Streams	2,600	TSZ	101	21	96
82	35	9	0	0	No Connection	2,400	TSZ	101	21	112
83	17	6	0	0	No Connection	700	TSZ	101	18	75
84	32	13	8	8	No Connection	900	TSZ	100	23	129
85	12	1	0	0	No Connection	670	TSZ	127	15	89
86*	7	4	3	3	No Connection	1,200	TSZ	87	15	**
87*[1]	2	1	0	0	No Connection	1,200	TSZ	21	**	**
88	36	13	8	8	No Connection	250	TSZ	101	21	104
89*[1]	6	1	0	0	No Connection	1,650	TSZ	87	43	143
91	38	3	0	0	No Connection	1,050	TSZ	87	19	102
95*[1]	27	12	9	9	1,280	Adjacent	DRZ	120	20	88
96*[1]	10	7	4	4	1,280	850	DRZ	120	17	65
97*[1]	5	1	0	0	No Connection	100	DRZ	95	12	70
98*[1]	4	1	1	1	No Connection	30	DRZ	95	12	61
99*[1]	13	5	3	3	2,900	1,650	DRZ	115	18	79
100*[1]	42	15	10	10	1,600	500	TSZ	92	16	100
101*[1]	12	2	1	1	No Connection	1,050	TSZ	92	18	88
102*[1]	33	15	13	13	No Connection	Adjacent	DRZ	92	22	150
103*[1]	26	11	11	11	No Connection	Adjacent	DRZ	92	20	98
841	26	4	0	0	No Connection	250	TSZ	100	23	129
TOTAL	2502	492	344	344						

* No harvest; ** No stand data; 1 Fuel treatment only (remove ladder fuels/stems <7" dbh)

2= SIZ - Stream Influence Zone, this is 1 SPT height distance from the stream

3 = Proximity is the downstream distance through connecting stream channels to listed fish distribution or CH.

4 = Dominant rain zone (DRZ), transient snow zone (TSZ), dominant snow zone (DSZ)

5 = Proximity is the overground distance to LFH/CH from the closest point of the unit.

The project will apply several different thinning prescriptions within units. These are defined as Heavy (40-55% canopy closure), Moderate (50-65% canopy closure), Wildlife (30-50% canopy closure), Oak (20-45% canopy closure), Riparian Reserve (40-55% canopy closure) and Non-commercial Fuels Thin (no change to canopy closure due to removal of ladder fuels and brush <7" dbh) (Table 3).

Table 3. Summary of project thinning and fuels treatment prescriptions.

Prescription	Target % SDImax for trees >= 7" dbh	Post Harvest % CC for trees >= 7" dbh	Residual SDI range based on DF SDImax of 595 for trees >= 7" dbh
Moderate CT (MT)	35-45	50-65	208-268
Riparian Thin(RT)	31-52 (large spread due to canopy closure requirements)	50-55 in ground based or cable units 40-50 in helicopter units to facilitate safe yarding operations	190-305 (large spread due to canopy closure requirements)
Heavy CT (HT)	17-34	40-55	101-207
Wildlife Thin (WT)	13-17	30-50	77-101
Oak Thin (OT)	17-24	20-45	101-143
Non-commericial Fuels Thin (FT)	No significant change due to removal of ladder fuels and brush less than 7" dbh		

Units with <200 TPA >= 7" dbh were assigned the Moderate CT Rx.

Units with >=200 TPA >= 7" dbh were prescribed Heavy CT.

Wildlife Thin units are those units with an emphasis of creating elk habitat.
Riparian Thin is a subset of the original unit (HT, OT, WT) with requirements for canopy closure Rx and are tracked independently in this analysis.

Oak Thin units are those units with an emphasis on restoring Oak Savanna habitat.

Fuels Thin units are units where no commercial thin would occur where fuels reduction in the Wildland Urban Interface is planned.

Table 4 summarizes pre and post treatment stand conditions in each unit and within the stream influence zone.

Table 4. Unit Harvest Treatment Information.

Unit	Canopy Closure				Trees Per Acre				Relative Density				Basal Area			
	Unit		SIZ		Unit		SIZ		Unit		SIZ		Unit		SIZ	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	86	53	86	53	392	106	392	106	78	18	78	18	260	56	260	56
2	74	40	74	50	252	171	252	171	62	24	62	24	219	84	219	84
3	73	50	73	50	268	207	268	207	64	27	64	27	224	92	224	94
4	63	40	63	50	184	144	184	144	49	24	49	24	177	89	177	89
5	71	40	71	50	202	109	202	109	59	25	59	25	220	94	220	94
6	76	41	76	50	213	138	213	138	60	22	60	22	222	83	222	83
7*	52	52	52	52	68	68	68	68	41	41	41	41	200	200	200	200
8	69	43	69	50	223	179	223	179	51	26	51	26	179	90	179	90
10	55	41	55	50	138	140	138	140	44	30	44	30	173	120	173	120
11	68	50	68	50	206	157	206	157	48	29	48	29	168	102	168	102
12	70	56	70	56	181	156	181	156	53	36	53	36	200	136	200	136
13	81	45	81	50	260	194	260	210	58	24	58	27	200	86	200	96
14	79	43	No Streams	No Streams	274	171	No Streams	No Streams	70	29	No Streams	No Streams	250	113	No Streams	No Streams
15	74	40	74	50	278	176	278	215	67	26	67	35	236	91	236	123
17	59	40	59	50	171	181	171	214	47	27	47	36	173	99	173	133
18	61	41	61	50	137	89	137	117	47	28	47	36	188	115	188	147
19*	14	14	14	14	22	22	22	22	9	9	9	9	40	40	40	40

Unit	Canopy Closure				Trees Per Acre				Relative Density				Basal Area			
	Unit		SIZ		Unit		SIZ		Unit		SIZ		Unit		SIZ	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
20	64	50	64	50	170	269	170	269	55	37	55	37	213	144	213	144
21	61	53	61	53	157	152	157	152	43	35	43	35	160	129	160	129
23	71	58	71	58	189	169	189	169	58	40	58	40	224	158	224	158
24	64	52	No Streams	No Streams	319	161	No Streams	No Streams	44	35	No Streams	No Streams	166	130	No Streams	No Streams
25	80	40	No Streams	No Streams	296	227	No Streams	No Streams	69	22	No Streams	No Streams	240	76	No Streams	No Streams
26	65	53	No Streams	No Streams	161	115	No Streams	No Streams	55	34	No Streams	No Streams	220	131	No Streams	No Streams
27	48	40	No Streams	No Streams	63	295	No Streams	No Streams	39	27	No Streams	No Streams	187	131	No Streams	No Streams
28	92	40	92	50	591	120	591	120	115	23	115	23	380	77	380	77
29	65	42	65	50	195	130	195	130	56	29	56	29	203	108	203	108
30	69	43	No Streams	No Streams	296	137	No Streams	No Streams	72	28	No Streams	No Streams	253	94	No Streams	No Streams
31	60	40	No Streams	No Streams	208	114	No Streams	No Streams	51	28	No Streams	No Streams	180	99	No Streams	No Streams
32	63	51	63	51	133	103	133	103	57	41	57	41	243	176	243	176
33*	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams
34	64	50	No Streams	No Streams	133	89	No Streams	No Streams	60	40	No Streams	No Streams	260	176	No Streams	No Streams
35	68	40	No Streams	No Streams	247	116	No Streams	No Streams	61	27	No Streams	No Streams	216	96	No Streams	No Streams
36	74	40	74	50	324	135	324	135	69	26	69	26	236	89	236	89
37	73	40	73	50	331	172	331	172	60	24	60	24	195	77	195	77
38	61	40	No Streams	No Streams	115	116	No Streams	No Streams	47	25	No Streams	No Streams	198	107	No Streams	No Streams
39	72	40	No Streams	No Streams	277	115	No Streams	No Streams	65	26	No Streams	No Streams	232	91	No Streams	No Streams
40	75	31	75	51	197	90	197	90	64	17	64	17	250	66	250	66
41*	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams
42	48	30	No Streams	No Streams	69	62	No Streams	No Streams	30	16	No Streams	No Streams	127	69	No Streams	No Streams
43	76	30	76	51	245	111	245	111	72	18	72	18	270	68	270	68
44	76	31	76	51	287	76	287	76	70	19	70	19	250	66	250	66
45	66	30	66	50	194	105	194	105	54	18	54	18	202	68	202	68
46	57	31	57	50	115	137	115	137	32	15	32	15	120	54	120	54
47	81	43	81	50	334	474	334	474	73	24	73	24	250	83	250	83
48	77	52	77	52	288	223	288	223	68	33	68	33	240	111	240	111
49	71	47	71	50	219	307	219	307	64	27	64	27	240	99	240	99
50*[1]	48	48	48	48	94	94	94	94	42	42	42	42	180	180	180	180
51	90	44	90	50	339	385	339	385	80	20	80	20	280	71	280	71
52	73	40	No Streams	No Streams	243	513	No Streams	No Streams	57	22	No Streams	No Streams	198	78	No Streams	No Streams
53	52	40	No Streams	No Streams	96	65	No Streams	No Streams	35	23	No Streams	No Streams	140	95	No Streams	No Streams

Unit	Canopy Closure				Trees Per Acre				Relative Density				Basal Area			
	Unit		SIZ		Unit		SIZ		Unit		SIZ		Unit		SIZ	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
54	80	45	No Streams	No Streams	290	572	No Streams	No Streams	71	24	No Streams	No Streams	253	83	No Streams	No Streams
55	77	40	77	50	266	94	266	94	78	27	78	27	294	103	294	103
56	72	40	72	50	176	205	176	205	78	31	78	31	335	133	335	133
57	67	40	67	50	102	123	102	123	66	31	66	31	325	152	325	152
58	65	52	No Streams	No Streams	168	118	No Streams	No Streams	50	34	No Streams	No Streams	191	130	No Streams	No Streams
59	76	40	No Streams	No Streams	263	537	No Streams	No Streams	86	31	No Streams	No Streams	338	120	No Streams	No Streams
60	62	50	62	50	147	140	147	140	48	35	48	35	190	138	190	138
61	78	40	78	50	248	271	248	271	66	22	66	22	240	81	240	81
62	56	50	No Streams	No Streams	106	107	No Streams	No Streams	46	38	No Streams	No Streams	196	162	No Streams	No Streams
63	78	41	No Streams	No Streams	259	274	No Streams	No Streams	66	23	No Streams	No Streams	240	84	No Streams	No Streams
64	74	56	74	56	287	200	287	200	65	39	65	39	227	135	227	135
65	81	55	No Streams	No Streams	299	268	No Streams	No Streams	65	31	No Streams	No Streams	220	106	No Streams	No Streams
66	63	50	63	50	138	109	138	109	57	39	57	39	242	167	242	167
67	66	51	66	51	111	223	111	223	47	31	47	31	198	132	198	132
68	51	32	51	50	91	251	91	251	30	15	30	15	120	59	120	59
69	71	41	71	50	233	90	233	90	67	25	67	25	253	95	253	95
70	49	43	No Streams	No Streams	97	211	No Streams	No Streams	33	27	No Streams	No Streams	133	109	No Streams	No Streams
71*	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams	**	**	No Streams	No Streams
72	48	40	48	48	97	77	97	77	32	25	32	25	124	97	124	97
80	68	20	No Streams	No Streams	182	35	No Streams	No Streams	76	15	No Streams	No Streams	320	62	No Streams	No Streams
81	66	49	No Streams	No Streams	114	72	No Streams	No Streams	61	34	No Streams	No Streams	280	149	No Streams	No Streams
82	56	40	56	50	109	63	109	63	56	38	56	38	256	180	256	180
83	62	40	62	50	132	561	132	561	54	31	54	31	227	138	227	138
84	54	26	54	50	92	34	92	34	55	22	55	22	260	108	260	108
85	46	42	46	46	67	58	67	58	21	18	21	18	80	67	80	67
86*	6	6	6	6	8	8	8	8	3	3	3	3	10	10	10	10
87*[1]	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
88	61	40	61	51	116	54	116	54	63	35	63	35	290	169	290	169
89*[1]	36	36	36	50	20	20	20	20	31	31	31	31	200	200	200	200
91	46	41	46	50	71	59	71	59	32	26	32	26	140	112	140	112
95*[1]	53	53	53	53	67	265	67	265	32	32	32	32	145	145	145	145
96*[1]	55	55	55	55	93	421	93	421	34	34	34	34	140	140	140	140
97*[1]	59	59	59	59	149	391	149	391	34	34	34	34	120	120	120	120
98*[1]	89	89	89	89	330	532	330	532	79	79	79	79	280	280	280	280
99*[1]	83	83	83	83	133	380	133	380	56	56	56	56	240	240	240	240
100*[1]	62	62	62	62	149	168	149	168	54	54	54	54	220	220	220	220
101*[1]	54	54	54	54	114	114	114	114	47	47	47	47	200	200	200	200
102*[1]	50	50	50	50	92	107	92	107	53	53	53	53	250	250	250	250

Unit	Canopy Closure				Trees Per Acre				Relative Density				Basal Area			
	Unit		SIZ		Unit		SIZ		Unit		SIZ		Unit		SIZ	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
103*[1]	42	42	42	42	84	84	84	84	42	42	42	42	187	187	187	187
841	54	40	54	50	92	59	92	59	55	36	55	36	260	175	260	175

* No harvest; ** No stand data; [1] Fuel treatment only (remove ladder fuels/stems <7" dbh)

2) Timber Yarding

Yarding systems for this project include ground-based, skyline and helicopter methods. Harvesting methods will be based on the topography of the land and the correlation to the existing road system and in some cases more then one harvesting method may be used per unit. Units with portions less than 30% in slope and stable soils are suitable for ground-based harvest. Ground-based machinery may be used to harvest logs from existing roads where the equipment can reach the logs without having to leave the road system. Table 5 shows acres of harvest method per unit and skyline corridor information. Figures A-4 and A-5 in Appendix A show logging systems for all units.

Table 5. Yarding and Skyline Corridor Information

Unit	Acres by Yarding System[2]			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)
1	0	0	13				
2	103	14	9	0	N/A	2	No Connection
3	47	0	0				
4	18	0	37				
5	52	0	17				
6	21	46	16	0	N/A	0	N/A
7*	0	0	0				
8	59	0	0				
10	36	0	0				
11	0	31	0	10	7,600	10	tributary to perennial stream
12	0	14	0	11	6,900	3	tributary to perennial stream
13	0	0	19				
14	0	0	27				
15	0	0	71				
17	0	0	22				
18	0	0	26				
19*	0	0	0				
20	66	0	0				
21	10	0	0				
23	11	0	0				
24	5	0	0				
25	0	26	0	0	N/A	0	N/A
26	11	0	3				
27	0	5	0	0	N/A	0	N/A
28	4	2	0	0	N/A	0	N/A

Unit	Acres by Yarding System[2]			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)
29	6	0	40				
30	9	0	29				
31	0	1	18	0	N/A	0	N/A
32	0	121	0	0	N/A	0	N/A
33*	0	0	0				
34	0	5	0	0	N/A	0	N/A
35	6	48	0	0	N/A	0	N/A
36	0	34	0	0	N/A	6	2,800
37	0	43	0	0	N/A	0	N/A
38	0	27	0	0	N/A	0	N/A
39	2	20	0	0	N/A	0	N/A
40	20	5	0	9	6,200	0	N/A
41*	0	0	0				
42	0	32	0	0	N/A	0	N/A
43	33	4	0	0	N/A	0	N/A
44	43	0	0				
45	15	20	0	10	11,000	4	tributary to perennial stream
N/A 46	5	36	0	0	N/A	0	N/A
47	0	29	0	7	13,800	0	N/A
48	17	0	0				
49	6	0	0				
50*[1]	0	0	0				
51	0	18	0	2	5,600	6	tributary to perennial stream
52	0	11	0	0	N/A	0	N/A
53	0	3	0	0	N/A	0	N/A
54	10	0	0				
55	0	24	0	0	N/A	0	N/A
56	0	0	41				
57	0	0	15				
58	0	16	0	0	N/A	0	N/A
59	0	22	0	0	N/A	0	N/A
60	10	14	0	0	N/A	0	N/A
61	16	0	0				
62	19	0	0				
63	0	14	15	0	N/A	0	N/A
64	6	35	0	0	N/A	0	N/A
65	0	10	0	0	N/A	0	N/A
66	9	1	0	0	N/A	0	N/A
67	22	0	0				
68	10	31	0	0	N/A	0	N/A
69	15	18	0	0	N/A	0	N/A
70	0	3	0	0	N/A	0	N/A
71*	0	0	0				
72	8	19	0	0	N/A	0	N/A
80	0	10	0	0	N/A	0	N/A
81	0	14	0	0	N/A	0	N/A
82	0	26	0	6	No	0	N/A

Unit	Acres by Yarding System[2]			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)
					Connection		
83	0	11	0	0	N/A	0	N/A
84	0	20	7	0	N/A	3	No Connection
85	0	0	11				
86*	0	0	0				
87*[1]	0	0	0				
88	0	8	23	0	N/A	4	No Connection
89*[1]	0	0	0				
91	17	18	0	2	No Connection	0	N/A
95*[1]	0	0	0				
96*[1]	0	0	0				
97*[1]	0	0	0				
98*[1]	0	0	0				
99*[1]	0	0	0				
100*[1]	0	0	0				
101*[1]	0	0	0				
102*[1]	0	0	0				
103*[1]	0	0	0				
841	0	22	0	0	N/A	0	N/A
TOTAL	747	931	459	57		38	

* No harvest; ** No stand data; [1] Fuel treatment only (remove ladder fuels/stems <7" dbh)

[2] Acres by yarding system excludes acres not treated due to riparian buffers. Therefore, these acres will vary from Total Acres in Table 2.

Note: Shaded rows indicate units with skyline yarding.

Ground-Based Yarding

Approximately 747 acres will be harvested via ground-based methods – 35 percent of the harvest area. Designated skid trails would be required in all ground-based yarding units. Skid trails would be located outside drainages, seeps, springs and/or concave landforms to avoid accumulation and transport of overland flow of sediment. Existing skid trails that are outside drainages, seeps and springs that meet the needs of the yarding system would be used wherever possible. Minimization of new riparian reserve disturbance will occur with designation of skid trails. Restrictions in equipment proximity to channels are described in Table 13.

Skyline Yarding

Skyline yarding would occur on terrain with sufficient slope to allow at least one end of the log to be suspended above the ground. As a result, these methods would be focused on those areas adjacent to streams, positioned on midslope terrain areas, or on higher slopes possessing adequate access to existing roads. These conditions occur on slopes ranging from 30 to 70 percent within the action area. Skyline yarding would occur on approximately 931 acres - 44 percent of the harvest area. Cut logs would be hauled by cable upslope, and downslope, to landing locations attached to the existing road system. A minimum of one end of the tree would be suspended above the ground, and full suspension would be utilized wherever topography permitted. Yarding corridors would be spaced at least 100 feet apart to reduce additive effects. Full suspension will be required over all perennial waterways. Where full suspension is not possible over intermittent streams, yarding over dry channels only will be required. Skyline yarding

equipment would not be permitted within the no-harvest corridors adjacent to all streams. Approximately 57 skyline corridors are proposed across perennial streams and 38 across intermittent streams, all of which are more then 0.5 mile away from LFH (Table 5).

No seasonal restrictions would apply to skyline cable yarding operations, however, skyline cable yarding systems will operate only when landing conditions are relatively dry. Operations will be suspended if rainfall or precipitation results in pooling of water in landings. See Table 13 for more project mitigations, best management practices and design criteria.

Helicopter Yarding

Helicopter yarding would be utilized on approximately 459 acres – 21 percent of the harvest area. Areas planned for helicopter yarding include all of the harvested acres at risk of soil disturbance due to the slope of the ground. Helicopter yarding will also be used where access to system roads is limited. Helicopter operations would not occur in some units between March 1 to July 15 to protect spotted owls during their breeding season. Helicopter yarding would provide full suspension. There is no other seasonal or conditional restriction on helicopter yarding.

Riparian Reserve Harvest Methods

A total of 344 acres within riparian reserves will be treated outside of the designated no-harvest and no-fuels-treatment buffers. Approximately 282 acres will be treated with harvest methods (not fire hazard reduction). A significant portion of riparian reserve thinning (46%) is accomplished with ground-based harvest. Ground-based yarding equipment (and fuels reduction equipment) would not be permitted within 120 feet of the stream channel of fish-bearing and perennial non fish-bearing (Class 1, 2, and 3) streams. Ground-based equipment would not be permitted within 50 feet of the stream channel in intermittent, non fish-bearing (Class IV) streams. In the remainder of the riparian reserve, ground-based equipment is permitted, but would be restricted to existing skid trails from previous entries. Alternative low disturbance ground-based equipment, such as shovel yarding, is also permitted in the remainder of the riparian reserve. About 36 percent of riparian reserve thinning is accomplished by skyline suspension, with a minimum of partial suspension. Full suspension is required over perennial channels. Where full suspension is not possible over intermittent channels, partial suspension over dry channels is required. Corridors over stream channels are necessary for thinning operations in some units (Table 5). Mitigations to maintain the benefits of woody material in channel and streambank stability will require trees fallen in no-harvest buffers for a corridor to be left in-stream (Table 13) and full suspension of yarded material. Approximately 18 percent of riparian reserve thinning will be accomplished by helicopter with full suspension.

3) Timber and Rock Hauling

Approximately 36 miles of road are proposed for timber and rock haul (Figures A-6, A-7). Two miles of haul road is asphalt paved and selected for wet weather haul. Approximately 27 miles are aggregate surface road, 21.5 miles of which is selected for wet weather haul. About 4 miles are native surface road restricted from wet weather haul. Table 6 summarizes the haul route information and proximity to LFH.

The primary route for timber hauling from federal land on the west side of the project area is FS Road 1900-408 – Langasher Road. A 0.6-mile section of this road will not be hauled on. Instead, haul from adjacent units will be directed east and west of the non-haul section. FS Road 1900-408 is the only aggregate surface road in the west side of the project area selected for wet weather haul. In this area, there are three stream crossings over LFH - two paved bridges over the McKenzie River and one paved bridge over the South Fork McKenzie River. There is only one

other stream crossing in the west side haul route that has surface connection to LFH, approximately 1,400 feet downstream. It is an intermittent, non fish-bearing stream located in the South Fork McKenzie/Cougar Creek 6th Field subwatershed (See Action Area Description and Table 12 for details). In the east side of the project area, the two main roads used for timber hauling are FS Roads 2633 and 1501, both aggregate surfaced roads. There are no stream crossings in this area over LFH. All wet weather haul routes have aggregate surface and will receive road upgrades such as the addition of surface aggregate and additional cross drain culverts before use. Winter haul will be immediately stopped if the timber sale administrator finds sign of road surface deformation leading to sediment eroding into live streams. See Table 13 for project mitigation, BMPs and design criteria related to timber hauling.

The Mill Creek rock pit is located in Unit 41 on FS Road 2633-720. Approximately 1,000 loads (approximately 15,000 cubic yards) of rock will be hauled out of this location – about 75% down FS Road 2633 and 25% up FS Road 2366 and down FS Road 1501 – to various locations throughout the project area selected for road reconstruction and maintenance.

Table 6. Aggregate and Native-surface Haul Route Information

Haul Route by road #	Season of Use[1]	Miles of Haul	Road Surface (A,N)	# of Loads	Number of Crossings Over:				Nearest Distance (ft) from Crossing To LFH by Type:		Road Length Within 100' of LFH/CH[2]
					LFH		Other Peren.	Other Inter.	Peren.	Inter.	
					Bridge	Culvert					
1500-100	DS	0.2	A	168	0	0	0	0			0
1500-101	DS	0.5	A	135	0	0	0	0			0
1500-104	DS	3.0	A	864	0	0	1	1	No Connection	No Connection	0
1500-105	DS	0.5	A	864	0	0	0	0			0
1501	YR	3.6	A	2,658	0	0	2	2	13,400	(1) 4200; (1) No Connection	0
1501-060	DS	0.1	N	2	0	0	0	0			0
1501-075	DS	0.1	A	2	0	0	0	0			0
1501-198	DS	0.4	A	208	0	0	0	0			0
1501-202	DS	0.4	A	77	0	0	0	0			0
1900-386	DS	0.1	N	0	0	0	0	0			0
1900-387	DS	0.4	N	22	0	0	0	0			0
1900-393	DS	0.2	N	0	0	0	0	1		No Connection	0
1900-394	DS	0.2	N	212	0	0	0	2		No Connection	0
1900-396	DS	0.1	N	86	0	0	0	0			0
1900-398	DS	0.1	N	0	0	0	0	0			0
1900-401	YR/DS[3]	2.8	A	946	0	0	2	4	(2) No Connection	(1) No Connection; (3) 9,000	0
1900-402	DS	0.5	N	688	0	0	0	1		No Connection	0
1900- 408 West	YR	4.1	A	2,119	0	0	1	2	No Connection	(1) No Connection; (1) 1,400	0
1900- 408 East	YR	2.6	A	925	0	0	0	0			0
2633	YR	5.5	A	5,845	0	0	4	2	(1) 7,400; (1) 8,000; (1) 13,900; (1) 13,600	(1) 13,900; (1) 17,000	0
2633-620	DS	0.1	N	14	0	0	0	0			0

Haul Route by road #	Season of Use[1]	Miles of Haul	Road Surface (A,N)	# of Loads	Number of Crossings Over:				Nearest Distance (ft) from Crossing To LFH by Type:		Road Length Within 100' of LFH/CH[2]
					LFH		Other Peren.	Other Inter.	Peren.	Inter.	
					Bridge	Culvert					
2633-700	YR	1.0	A	1,844	0	0	0	2		(1) 6,800; (1) No Connection	0
2633-701	DS	1.0	A	784	0	0	0	1		No Connection	0
2633-702	DS	1.0	A	784	0	0	0	1		10,200	0
2633-714	YR	0.4	N	218	0	0	0	1		7,000	0
2633-715	DS	0.1	N	17	0	0	0	0			0
2633-720	DS	2.1	A	691	0	0	7	0	(2) 9,700; (2) 8,800; (1) 9,800; (1) 10,700; (1) 11,300		0
2633-722	DS	0.2	N	123	0	0	0	0			0
2633-723	DS	0.6	A	326	0	0	1	0	10,900		0
2633-725	DS	0.4	A	86	0	0	0	0			0
2633-740	DS	1.1	A	158	0	0	0	0			0
2633-745	DS	0.2	N	207	0	0	1	0	11,700		0
2633-760	DS	0.5	N	127	0	0	0	1		15,000	0
2633-763	DS	0.1	N	2	0	0	0	2		15,200	0
2633-765	DS	0.3	N	73	0	0	0	2		(1) 15,800; (1) 16,000	0
2633-768	DS	0.2	N	51	0	0	0	3		(2) 15,700; (1) 16,000	0
2633-770	DS	0.1	N	89	0	0	0	0			0
2633-784	DS	0.0	A	0	0	0	0	0			0
2633-789	DS	0.8	N	150	0	0	0	0			0
TOTAL		35.7		13,900	0	0	19	28			0

[1] Season of use: dry season only, year-round

[2] Road length within 100' of LFH is a measure of "drawbottom" roads used by haul route, does not include distance at c crossings, which is already accounted for in the previous columns.

[3] See haul route map in Appendix A for seasonal split

[4] Based on 4,000 BF per load

4) Road, Rock Pit and Landing Work

This project element consists of five sub-elements: 1) stream culvert replacement, 2) road construction, reconstruction, decommissioning and closure, 3) road maintenance, 4) landing construction and (5) rock pit development.

1) *Stream Culvert Replacement:*

Eight perennial stream culverts and 18 intermittent stream culverts – 26 total – are proposed for replacement or installation (Table 7). Four intermittent stream culverts are within 0.5 miles of LFH, but have no surface connection to LFH. The closest stream crossing – an intermittent stream – to LFH with surface connection is 1.0 mile. Three culverts are upstream of Tokatee Golf Course and are tributary to a series of ponds and wetlands. All perennial stream crossings are greater than one mile from LFH. In order to reduce the amount of sediment entering the live streams, culverts would be replaced during the ODFW in-stream work period for the watershed (July 15 through October 15), the dry season, and a de-watering plan would be implemented on all perennial streams scheduled for culvert replacement. Erosion control measures such as spreading straw, seeding, hay bales, silt fences or other means deemed effective for individual sites would be used when there is potential for off-site delivery of sediment to the streams (Table 13). Culvert sizing and design will accommodate Q100 flow.

Table 7. Stream Culvert Installation, Replacement or Decommissioning

Road Number	New Culvert Diameter	Streamflow	Install/ Replace/ Decommission	Height of Fill to be Removed	Distance to LFH/CH
	Inches	Class	I/R/D	Feet	Feet
1900- 401	24	I	R	5	2,640*
	36	I	R	6	3,168*
	24	I	R	5	6,864*
	24	I	R	5	3,168*
	24	I	R	5	3,696*
	24	I	R	5	5,280
1900- 393	24	I	I	5	1,584*
	24	I	I	5	2,112*
1900- 384	60	I	R	10	2,640*
2633	24	P	R	5	6,864
	24	I	R	5	6,864
2633- 620	24	I	I	5	6,336**
	24	I	I	5	6,336**
	36	P	I	6	5,808**
2633- 720	60	P	R	8	8,448
	36	P	R	6	8,448
	24	I	R	15	8,448
	24	I	R	5	9,504
	36	P	R	6	10,560
	24	P	R	15	11,088
	24	P	R	5	12,672
	24	P	R	5	12,144
2633- 760	24	I	R	5	14,784
	24	I	R	5	15,840
2633- 765	24	I	I	5	15,840
	24	I	R	5	16,368
2633- 723	NA	P	D	5	10,560
2633- 763	NA	I	D	5	14,256
2633- 764	NA	I	D	5	14,784

* culvert replacement in channels with no surface connection to the McKenzie River;

**culvert replacements upstream of Tokatee Golf Course and are tributary to a series of golf course ponds

LFH = Listed Fish Habitat/Critical Habitat (McKenzie River, South Fork McKenzie River).

(2) *Road Construction, Reconstruction, Decommissioning and Closure:*

Approximately 4.8 miles of semi-permanent spur road construction would occur within the action area (Table 8). Road construction will occur from existing system roads located on stable flat ground. Spur road construction would occur outside of riparian reserves where logging systems permit, with exception to one new spur road built over two existing intermittent streams in Unit 2 (Figure A-8). Intermittent streams through Unit 2 provide no surface connection to LFH. Temporary culverts will be installed and will be removed if activities halt for the wet season. All spur roads will be stabilized with erosion control measures as necessary for the wet season (i.e. waterbars, etc.) to minimize accumulation of runoff and transport of sediment. Semi-permanent roads (and temporary culverts) will be fully decommissioned after the project is complete. Proper drainage will be installed and maintained throughout the operating season. No other road construction will occur.

Approximately 31 miles of permanent road reconstruction will occur within the action area. Reconstruction activities may include cutting roadside brush and/or trees, grubbing tree and brush roots, constructing or reconstructing ditches, replacing or installing culverts, raising road grade by utilizing borrow materials, constructing rolling dips or waterbars, shifting road alignment, placement of aggregate surfacing, constructing or reconstructing turnouts or turnarounds. Approximately 8.3 miles of reconstruction occur within 0.5 miles of LFH (Table 10). These roads have 5 stream crossings within 0.5 mile of LFH – 4 with no surface connection and one within 1,400 feet of surface connection to LFH. The existing road and culvert at this stream crossing is in good condition and little reconstruction is needed.

Approximately 0.3 miles of existing permanent road will be decommissioned (Figure A-9) and 0.5 will be closed. Decommissioning includes obliteration and elimination of existing road, including necessary cleanup work, and in this case removing three stream crossing structures and restoring channel topography. All culverts would be removed, fills would be pulled back, and the road would be sub-soiled. (See Figures A-9, A-10a and A-10b for maps of proposed decommissioning and closure). Road closure will convert the road into a storage condition by restricting access and restoring hydrologic stability.

Table 8. New Road Construction/ Reconstruction and Road Decommissioning

Surface-Type	Miles of New Road Construction			Miles of Road Reconstruction	Miles of Pre-existing Road Decommissioned	Miles of Pre-existing Road Closed
	Permanent[1]	Semi-permanent[2]	Temporary[3]			
Natural	0	4.8	0.0	4.2	0.3	0.5
Aggregate	0	0.0	0.0	26.8	0.0	0.0
Paved	0	0.0	0.0	0.0	0.0	0.0
Total Miles	0	4.8	0.0	31.0	0.3	0.5

[1] Permanent – road will remain available for use after the sale ends

[2] Semi-permanent – road will be decommissioned at the end of the sale

[3] Temporary – road will be built and decommissioned within the same dry season

Construction – builds new road; Reconstruction – improves existing unusable road to new road standards

(3) *Road Maintenance*

Approximately 2.0 miles of road maintenance will occur within the action area (Table 9). Road maintenance activities may include cutting hardwood trees along roads, felling hazard trees for the life of the road, clearing and grubbing, surface blading, replacing drainage structures, reshaping ditches, and placement of aggregate surfacing. Approximately 0.2 miles of maintenance will occur within 0.5 miles of LFH, but no stream crossings exist (Table 10).

Table 9. Road Maintenance/Renovation

Road number	Surface Type	Reconstruction Miles	Maintenance Miles	Number of Stream Crossings (perennial and intermittent)	Distance to LFH/CH from Nearest Crossing (feet)
1500-100	A		0.2	0	
1500-101	A	0.5		0	
1500-104	A	3.0		2	(2) No Connection
1500-105	A	0.5		0	
1501	A	3.6		2	(2) 13,400
1501-060	N	0.1		0	
1501-075	A		0.1	0	
1501-198	A	0.3		0	
1501-202	A	0.4		0	
1900-386	N		0.1	0	
1900-387	N	0.4		0	
1900-393	N	0.2		0	
1900-394	N		0.2	0	
1900-396	N	0.1		0	
1900-398	N		0.1	0	
1900-401	A	2.8		6	(3) No Connection; (3) 9,000
1900-402	N	0.5		1	No Connection
1900-408	A/N	4.1		3	(2) No Connection; (3) 1,400
2633	A	5.5		6	(1) 7,400; (1) 8,000; (1) 13,600; (2) 13,900; (1) 17,000
2633-620	N		0.1	0	
2633-700	A	1.0		2	(1) No Connection; (1) 6,800
2633-701	A	1.0		1	No Connection
2633-702	A	1.0		1	10,200
2633-714	N	0.4		1	7,000
2633-715	N	0.1		0	
2633-720	A	2.1		7	(2) 9,700; (2) 8,800; (1) 9,800; (1) 10,700; (1) 11,300
2633-722	N	0.2		0	
2633-723	A	0.6		1	10,900
2633-725	A	0.4		0	
2633-740	A		1.1	0	
2633-745	N	0.2		1	11,700
2633-760	N	0.5		1	15,000
2633-763	N	0.1		2	(2) 15,200
2633-765	N	0.3		2	(1) 15,800; (1) 16,000
2633-768	N	0.2		3	(2) 15,700; (1) 16,000
2633-770	N		0.1	0	
2633-784	A		0.0	0	
2633-789	N	0.8		0	
	TOTAL	31.0	2.0	41	

Table 10. Road Reconstruction and Maintenance within 0.5 Miles of LFH

Road Number	Surface Type	Within 0.5 Mile of LFH			Distance to LFH/CH from Stream Crossing (feet)
		Miles of Reconstruction	Miles of Maintenance	Number of Stream Crossings (perennial and intermittent)	
1500-100	A	0.0	0.2	0	
1500-101	A	0.3	0.0	0	
1500-104	A	1.5	0.0	2	(2) No Connection
1500-105	A	0.2	0.0	0	
1501	A	1.1	0.0	0	
1501-060	N	0.1	0.0	0	
1900-393	N	0.1	0.0	0	
1900-401	A	0.6	0.0	1	No Connection
1900-408	A	4.1	0.0	2	(1) No Connection; (1) 1,400
2633	A	0.2	0.0	0	
Total		8.3	0.2	5	

4) *Landing Construction*

There are 7 new helicopter landings and no new skyline landings proposed for this project. All new landing construction will occur outside of riparian reserves. Landings are no closer than 600 feet from LFH and have no hydrological connection to stream channels (see Figures A-4 and A-5 in Appendix A for landing locations). Typical landing locations occur on the existing road system and will require minor maintenance and rebuilding to become functional.

5) *Rock Pit Development*

Rock Pit development will take place in the existing Mill Creek rock pit located on FS Road 2633-720. It is currently 4 acres and there will be 0.5 acres of new development. Approximately 15,000 cubic yards of material will be extracted to use for road reconstruction and maintenance activities. No timber will be removed for new development. The nearest perennial streams are over 1,000 feet away. Mill Creek rock pit is located 1.6 miles from LFH.

5) Fuels Treatment

This project element consists of three sub-elements: 1) Post-Commercial-Thinning Fuels Treatment, (2) Fire Hazard Reduction (No Commercial Timber Harvest) and (3) Natural Fuels Underburn:

(1) *Post Commercial Thinning Fuels Treatment (Units 1-6, 8-18, 20-32, 34-40, 42-49, 51-70, 72-85, 88, 91, 841)*

Post commercial thinning fuels will be reduced by several treatment prescriptions. Where possible, the project will maximize the use of a processor or similar equipment to concentrate fuels within units. Additional machine/grapple piling and burning will occur on approximately 480 to 622 acres within thinning units. Hand piling will occur on approximately 312 to 792 acres, and mulching with a machine may occur on up to 124 acres (Table 11). All equipment is restricted 120 feet from perennial streams and 50 feet from intermittent streams. There will be a 60-foot no-treatment buffer on fish-bearing streams and a 30-foot buffer on non fish-bearing streams (Table 1). Pile burning will likely occur in the winter, in rainy or high humidity conditions. Mulching will occur from Spring to Fall.

Prescribed underburns will occur on approximately 879 acres and may occur on up to 1,514 acres, depending on tree size within each unit. Fire line will be constructed around the unit boundary. No-treatment buffers (Table 1) will be in place for underburns. However, fire line will not be constructed within the riparian reserve, so fire will be allowed to back down into the buffer. Burning will occur in spring-like conditions with high moisture content in the larger fuels >3". Water resources will be used to prevent burning outside of the unit boundary. Water used for treatment will be drafted from various water sources outside of Listed Fish Habitat (see Figure A-11 for potential sites). Water is drafted out of the stream channel by a pump and into a fire engine that has a holding capacity of 1,000 gallons. Water is then transported, used on the work site, or dumped into folding tanks at the work site location. At all drafting locations, 90% of stream flow will be maintained to reduce risk to aquatic species and water quality.

(2) Fire Hazard Reduction (No Commercial Timber Harvest) (Units 50, 86, 87, 89, 95-103)

Fire hazard reduction treatment consists of removing trees and stems <7" dbh through mechanical means. These small stems will be grapple piled and burned and/or mulched to reduce fuels. This treatment may occur on up to 142 acres. All restrictions, no-treatment buffers, and design criteria listed above in *Post Commercial Thinning Fuels Treatment* will apply. Exceptions to fuels treatment within the unit boundaries will occur in Units 95, 97, 98, 102 and 103 where paved roads parallel the McKenzie River (Figure A-14). Instead of treating down to the 60 foot no-treatment buffer, fuels treatment will stop at the road, leaving larger buffers approximately 100 feet in width.

(3) *Natural Fuels Underburn (Unit 100)*

Natural Fuels underburn may occur on up to 42 acres in Unit 100. Fire line would be constructed around the unit boundary. The underburn would exclude commercial thinning, and not exceed 20% fire mortality. No-treatment buffers will be in place and no fire line would be constructed within riparian reserves, so fire may back down into buffers. Water resources will be used to prevent burning outside of the unit boundary. Burning will occur in spring-like conditions with high moisture content. Water used for treatment will be drafted from nearby water sources outside of Listed Fish Habitat (Figure A-11) and 90% of stream flow will be maintained.

1 **Table 11. Fuels Treatment Prescriptions.**

UNIT	ACRES	FUELS TREATMENT
1	14	HP
2	140	GP/HP
3	47	GP/HP
4	57	HP
5	73	UB*/GP/HP
6	87	UB*/GP/HP
7*	20	NT
8	60	GP/HP
10	37	UB
11	37	GP/HP
12	21	GP/HP
13	21	HP
14	27	HP
15	79	HP
17	24	HP
18	27	UB
19*	20	NT
20	66	UB
21	12	GP/HP
23	12	GP/HP
24	5	GP/HP
25	26	GPHP
26	14	UB
27	5	UB
28	7	GP/HP
29	47	UB*/GP/HP
30	38	GP/HP
31	19	UB*/HP
32	123	UB
33*	4	NT
34	5	UB

2

UNIT	ACRES	FUELS TREATMENT
35	54	UB
36	36	UB*/HP
37	43	UB*/HP
38	27	UB
39	20	UB*/GP/HP
40	27	UB
41*	7	NT
42	32	UB
43	44	UB*/GP/HP
44	45	UB*/GP/HP
45	38	UB*/GP/HP
46	41	UB*/GP/HP
47	32	HP
48	17	GP/HP
49	7	GP
50*	6	FT/GP or Mulch
51	20	HP
52	11	UB*/HP
53	3	UB
54	10	GP/HP
55	25	UB*/HP
56	43	UB
57	15	UB
58	16	UB*/HP
59	22	UB
60	24	UB
61	16	UB*/GP/HP
62	19	UB
63	29	HP
64	42	GP/HP
65	10	HP

UNIT	ACRES	FUELS TREATMENT
66	11	UB
67	22	UB
68	41	UB
69	33	UB*/GP/HP
70	3	UB
71*	3	NT
72	28	UB
80	10	UB
81	14	UB
82	35	UB
83	17	UB
84	32	UB
85	12	UB
86*	7	UB
87*	2	UB
88	36	UB
89*	6	FT/ HP
91	38	UB
95*	27	FT/GP or Mulch
96*	10	FT/GP or Mulch
97*	5	FT/GP or Mulch
98*	4	FT/GP or Mulch
99*	13	FT/GP or Mulch
100*	42	Natural Fuels UB or FT
101*	12	FT/GP or Mulch
102*	33	FT/GP or Mulch
103*	26	FT/GP or Mulch
841	26	UB
TOTAL	2502	

* = no commercial harvest

UB=underburn

UB*=possible underburn trees<15"

NT = No Treatment

GP= grapple pile through unit <30%slope

HP= hand piling within unit and/or along roads ~100 ft.

FT= no commercial harvest, remove trees <7" dbh

Wildlife gaps in harvest will be UB

All non-heli, UB units will aim to concentrate fuels to reduce them across the entire unit

C. Action Area Description

The action area is defined for ESA purposes as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402).

The action area is shown in Figure A-12. The McKenzie River/Elk Creek HUC6 sub-watershed contains the majority of the action area, with some exceptions. One haul route crosses over into the South Fork McKenzie River/Cougar Creek 6th Field HUC; a portion of Unit 54 and one haul route crosses over into the McKenzie Bridge 6th Field HUC; and one haul route crosses over into the Lower Blue River 6th Field HUC. Table 12 summarizes acres of harvest, miles of haul route and relation to LFH outside of McKenzie River/Elk Creek 6th Field HUC. Effects of these actions will be analyzed in the sediment indicator Effects Analysis.

Table 12. Actions Outside of McKenzie River/Elk Creek 6th Field HUC.

Acres of Harvest	Miles of Haul	Haul Road Surface Type (A,N,P)	Wet Weather Haul (Y/N)	Stream Crossings	Stream Type (Peren./Inter.)	Stream Crossings Over LFH	Distance to LFH from Stream Crossing
McKenzie Bridge HUC6							
3.4				0		0	
0	1.3	A	Y	2	Inter.		No Connection
South Fork McKenzie River/Cougar Creek HUC6							
0	0.2	A	Y	1	Peren.	0	1,400'
0	0.7	P	Y	1	Peren.	1	Adjacent
Lower Blue River HUC6							
0	0.7	A	N	1	Inter.	0	No Connection
0	0.1	P	Y	0		0	
0	0.6	A	Y	0		0	
0	0.1	A	N	0		0	

D. Project Mitigation, Best Management Practices and Design Criteria

Table 13 describes the mitigation measures that would be applied in the implementation of the Bridge Thin Project. These measures will be incorporated into individual unit prescriptions to mitigate potential undesirable effects.

Table 13. Project Mitigation, BMPs, and Design Criteria

1.	Any project activity such as culvert replacement that must occur within fish-bearing and other perennial streams would comply with Oregon Department of Fish and Wildlife (ODFW) seasonal restrictions on in-stream work activities. Best Management Practices (BMP's), including placement of sediment barriers, provision of flow bypass, and other applicable measures, will be included in project design as necessary to control off-site movement of sediment.
2.	Native surfaced roads would be restricted for hauling during the winter rainy season between October 15 and May 31. The objectives are to maintain water quality and fish habitat.
3.	Construction and or maintenance of roads would not be done when soils are saturated or run-off occurs, to minimize erosion and sedimentation. A stable fill will be constructed across all streams.
4.	All haul roads would be maintained in stable condition. Winter hauling may be allowable when the road surface is either covered with a relatively continuous snow pack or when void of snow when run-off from the road is unlikely. Watering the road surface would be used if roads become excessively dusty during the summer.
5.	Ground-based yarding systems would operate only when soils are relatively dry following the rainy season in the spring through the summer, or during the winter months when there is a continuous snow pack of at least eighteen inches deep or when soils are frozen to a depth of six inches or greater. Operations would be suspended if rainfall or precipitation results in pooling of water in skid trails or landings.
6.	Designated skid trails would be required in all ground-based yarding units. Skid trails would be located outside drainages, seeps, springs and/or concave landforms, which could accumulate and transport overland flow and sediment. Existing skid trails that are outside drainages, seeps and springs that meet the needs of the yarding system should be used wherever possible.
7.	Ground-based equipment would be limited to slopes less than 30 percent for harvester/forwarder and conventional ground skidding operations. Short, isolated pitches up to 40 percent on otherwise suitable slopes may be approved after consultation with soil/watershed specialist determines that sediment transport to streams would not occur as a result. Adverse skidding conditions would be avoided through skid trail layout and use of alternative yarding systems.
8.	Ground-based yarding equipment would not be permitted within 120 feet of the stream channel of Class 1, 2, and 3 (fish bearing and perennial non fish bearing streams) streams. Ground-based equipment would not be permitted within 50 feet of the stream channel in Class IV (seasonal, non-fish bearing) streams. In the remainder of the riparian reserve, ground-based equipment is permitted, but would be restricted to existing skid trails from previous entries. Alternative low disturbance ground-based equipment such as shovel yarding is also permitted in the remainder of the riparian reserve.
9.	Regardless of unit harvest prescription, portions of harvest units that lie within riparian reserves would be managed to meet riparian objectives. Prescriptions elements designed to accomplish this are detailed in Table 4.
10.	Full suspension would be required when yarding over perennial stream channels. Where full suspension is not obtainable over intermittent streams, partial suspension would be required and yarding would be limited to when the stream is dry.
11.	Where cable yarding requires corridors through a riparian reserve, corridors would be laid out to result in the least number of trees cut. Trees located within no-harvest buffers that must be cut to facilitate yarding corridors would be felled into the channel and left on site.
12.	All skid trails and landings would be water-barred to provide adequate drainage. Water bars location should occur where local terrain facilities effective drainage of the skid trail or landing. In general, water bars should be constructed every 100 feet on slopes less than 15 percent, and every 50 feet on slopes greater than 15 percent. Water bars should be keyed-in to the cut bank and have a clear outlet on the down hill side. Where available, slash should be placed on skid trails and landings.
13.	Skid trails in thinning units with ground-based yarding would be scarified to a depth of 3-6 inches. Skid trails in regeneration treatments and all landings would be sub-soiled to a depth of 18-22 inches.
14.	All areas of exposed soil, such as landings, skid trails, decommissioned roads, and cut and fill slopes associated with road construction or maintenance would be seeded with non-invasive cereal grains such as winter wheat, and native perennial species.
15.	Temporary roads would be decommissioned after completion of logging operations. Decommissioning of roads may include: berming the entrance, removal of culverts, out-sloping the road surface, pulling back displaced material onto the road way, installation of water bars, removal of placed rock, and re-vegetation of the road prism.
16.	In units containing stream channels, all existing large woody debris would be retained within riparian reserves to maintain aquatic objectives.
17.	Water sources used by project operations will be reconstructed or maintained as necessary to protect stream bank stability, riparian vegetation, and water quality.

III. STATUS OF LISTED SPECIES/CRITICAL HABITAT (Bull Trout Only)

A. ESA Status

Bull Trout –

On June 13, 1997, the US Fish and Wildlife Service published in the Federal Register (62 FR 32268) a proposed rule to list the Klamath River population segment of bull trout as an endangered species, and the Columbia River population segment of bull trout as a threatened species. On June 10, 1998, a final rule was published in the Federal Register (63 FR 31647) determining the Klamath River and Columbia River population segments of bull trout to have Threatened status under the Act. At the time of listing, the Service, made the finding that critical habitat was not determinable for these populations because their habitat needs were not sufficiently well known (63 FR 31647). For a further summary of previous Federal actions, see 64 FR 58916.

On January 26, 2001, the Alliance for the Wild Rockies, Inc. and Friends of the Wild Swan, Inc. filed a lawsuit in the U.S. District Court of Oregon challenging the Service's failure to designate critical habitat for bull trout. A settlement agreement was reached on January 14, 2002, which stipulated that the Service would make critical habitat determinations for the five population segments of bull trout (Civil Case No: CV 01-127-JO). For the Klamath River and Columbia River populations, the Service agreed to submit for publication in the Federal Register a proposed rule for critical habitat designation by October 1, 2002, and a final rule by October 1, 2003. A subsequent agreement resulted in extending the date for the publication. The proposed rule was printed in the Federal Register November 29, 2002 and the final critical habitat designation (70 FR 56212) was published September 26, 2005.

Fish distribution of this DPS within the action area and within the McKenzie River watershed is shown in Figure A-3. Critical Habitat designation is shown in Figure A-4. Critical habitat is exempted from designation on Federal lands covered by the NW Forest Plan (Federal Register – Final Rule 6 October 2004). The land ownership along the McKenzie River through the action area is very fragmented, so, for the purposes of this assessment, the entire reach of the McKenzie River and the South Fork McKenzie River that flow through the action area was analyzed as if it were critical habitat. This conservative approach to effects analysis may slightly exaggerate the actual effects to the fragmented, designated critical habitat reaches.

The Matrix Indicators discussed below are described at the 6th field sub-watershed level (McKenzie River/Elk Creek sub-watershed), with the exception of the indicators for population characteristics, which are more appropriately discussed at the 5th Field Watershed level (McKenzie River and South Fork McKenzie River).

B. Population Size and Distribution

Bull Trout –

Bull trout do not spawn in this 6th field sub-watershed. The McKenzie River in this location would provide rearing habitat for subadult and adult bull trout. Bull trout in this river segment are part of the Mainstem fluvial sub-population, and any bull trout that were entrained at Trail Bridge Dam (Trail Bridge adfluvial sub-population) or Cougar Dam (Army Corps of Engineers dam on South Fork McKenzie River – South Fork adfluvial sub-population).

In calendar year 2007, seventy-seven (77) bull trout redds were tallied in Mainstem population spawning sites (note: these spawning sites are in different 5th and 6th field HUCs) (Table 14, Figure A-13). With two fish per redd it is estimated that the population that uses this 6th field sub-watershed is 154 adult bull trout. This is a conservative estimate since some bull trout may spawn biannually, and it is likely that bull trout from the South Fork population and the Trail Bridge population are also found in this 6th field.

Table 14. Bull trout redd counts from surveys of the mainstem McKenzie population spawning tributaries conducted by ODFW and Forest Service, 1989-2007.

	Anderson Creek	Olallie Creek	McKenzie below Trail Bridge	Total Mainstem McKenzie
1989	7	-	-	7
1990	9	-	-	9
1991	8	-	-	8
1992	13	-	-	13
1993	15	-	-	15
1994	30	3	-	33
1995	73	10	-	83
1996	82	7	-	89
1997	85	9	-	94
1998	79	7	-	86
1999	77	6	-	83
2000	83	9	-	92
2001	72	6	-	78
2002	60	10	-	70
2003	56	17	0	73
2004	49	12	1	62
2005	47	12	2	61
2006	59	8	1	68
2007	58	15	4	77

Ratliff and Howell (1992) described the mainstem McKenzie bull trout population as “at moderate risk of extinction.” Buchanan and others (1997) upgraded the status of this population to “of special concern” This change was due to 1) recent changes in angling restrictions, 2) increased redd counts, 3) large numbers of migrating fry out of Anderson Creek, and 4) increased numbers of staging adults counted in the main stem McKenzie River.

Since Buchanan upgraded the status of bull trout in the mainstem McKenzie River in 1997, bull trout redd counts decreased from a peak count of 94 in 1997 to a low of 61 in 2005. In the last two year, however, there has been an upward trend (Table 14, Figure A-13). This fluctuation may be a reflection of normal cyclic changes in abundance, but may also reflect other influences on the population. The decrease in redds may reflect a negative effect of the February 1996 flood event on incubating bull trout and young juvenile bull trout, and a depressed rate of recruitment of reproductive age bull trout in the early 2000’s (bull trout become sexually mature at about age 6 and the flood may have impacted several age classes of juvenile bull trout). Another influence upon bull trout abundance is angling harvest. While bull trout are protected with “no angling for bull trout” and catch-and-release regulations, bull trout have been found to

be vulnerable to angling, particularly to the use of bait, and fluctuations in abundance may reflect hooking mortality and/or poaching. Still another influence is the removal of bull trout fry from the McKenzie population. Between 1997 and 2007, nearly 15,000 bull trout fry have been removed from Anderson Creek, the primary natal creek for the mainstem McKenzie population, for reintroduction into the Middle Fork Willamette drainage. While rearing habitat continues to appear to be fully seeded in Anderson Creek, the contribution of removed bull trout to overall mainstem McKenzie River production is unknown. Migratory bull trout fry, entering mainstem McKenzie River as rearing habitat, are believed to suffer a high rate of mortality. The rate of mortality among out-migrant fry and early life history in a large river has not been studied and the survival rate among out-migrants can only be speculated upon at this time. Described later in the description of baseline conditions, several habitat factors are functioning at risk. The likelihood fluctuations in bull trout abundance occurred due to changes in habitat conditions is unlikely. Habitat critical to bull trout has been maintained or improved since monitoring of populations began in the early 1990's. In the absence of negative changes to habitat quality, the population size is expected to reflect maintained or positive improvements to habitat conditions (passage improvements, road decommissioning, in-stream improvements, and Northwest Forest Plan riparian protections in forest management activities).

Baseline Condition: Adults in this population are less than 500 but greater than 50. This indicator is *FUNCTIONING AT RISK.*

C. Growth and Survival

Bull Trout –

Bull trout do not spawn in the mainstem McKenzie River in this 6th field sub-watershed. This portion of the river is not suitable since the stream temperatures are not in the preferred range for spawning, incubation, or early rearing. The only known suitable spawning areas for bull trout in the mainstem subpopulation are two spring fed streams (Olallie and Anderson Creeks) which are approximately 14 miles upstream of the Bridge Thin project area.

The best information available for analysis is redd survey results in Anderson and Olallie Creek. The recent numbers in Olallie Creek, relative to the 1990's, show an increase. However, Anderson Creek continues to show lower redd tallies. Anderson Creek had 58 redds in 2007 as compared to a high count of 85 redds in 1997. The total mainstem subpopulation has seen a general decrease from 94 redds in 1997 to 77 in 2007, but has shown an upward trend in the last two years (Table 14, Figure A-13).

Baseline Condition: The steady reduction in the number of redds for the Mainstem population is troubling and of concern, but it does not appear to be based on habitat factors or water quality. Due to this reduction in redd numbers in Anderson Creek this indicator is considered *FUNCTIONING AT RISK*.

D. Life History Diversity and Isolation

Bull Trout –

The McKenzie River bull trout sub-population is a fluvial life history form, but the meta-population exhibits an adfluvial form in the South Fork McKenzie River above Cougar Dam and McKenzie River above Trail Bridge Dam. Both adfluvial forms are adaptations (since the early 1960's) to fragmentation of habitat by impassable dams.

Fluvial bull trout use the McKenzie River as foraging, adult rearing, and migratory habitat. The only known spawning habitat that the Mainstem population successfully utilizes, are Anderson and Olallie creeks which are tributaries to the upper McKenzie River.

Baseline Condition: The Mainstem population is fluvial, and the Trail Bridge and South Fork populations have been forced into a fluvial/adfluvial life history. They appear to be rearing well in the reservoirs, but unsafe downstream entrainment at dams is a concern.

Within this 6th field sub-watershed there are no human caused barriers to bull trout. However the bull trout that utilize this 6th field come from the Mainstem, South Fork, and Trail Bridge populations, and those populations are disconnected from spawning areas due to dams without upstream passage and safe downstream passage. Therefore this indicator is *FUNCTIONING AT RISK*.

E. Persistence and Genetic Integrity

Bull Trout –

At the 5th field watershed level, and the 6th field sub-watershed level there are no connectivity barriers for bull trout. Barriers that do exist (Trail Bridge and Cougar Dams) occur in different 5th field watersheds.

Within the McKenzie River/Elk Creek 6th field sub-watershed no brook trout have been reported by anglers. The only area where brook trout / bull trout hybridization has been documented is in the Trail Bridge sub-population.

Genetic variation within the mainstem McKenzie River bull trout sub-population is of great concern. Effective population size of greater than 500 adults has been recommended for the recovery of evolutionary potential (Franklin and Frankham 1998; Lynch and Lande 1998). The adult bull trout population in the entire McKenzie River watershed is estimated as less than 300.

Baseline Condition: There are no indications of hybridization for the bull trout that utilize the McKenzie River/Elk Creek 6th field sub-watershed. However, due to the existence of Trail Bridge and Cougar Dams (in different 5th field watersheds) and the small effective population size in the McKenzie River watershed, this indicator is considered *FUNCTIONING AT RISK*.

IV. DESCRIPTION OF ENVIRONMENTAL BASELINE

A. General Information

The project area for Bridge Thin Project consists of two tributary drainages (Elk/Cone Creek and Mill Creek) of the McKenzie River, the main stem McKenzie River, as well as glaciated side slopes on the north and south side of the McKenzie River, near Blue River, Oregon (USGS River mile 54 extending upstream to USGS River mile 66, near the confluence of West Fork Horse Creek). The project lies within the McKenzie River/Elk Creek 6th Field Hydrologic Unit (HUC 170900040502; Figure A-2).

The action area is defined for ESA purposes as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402).

The action area is shown in Figure A-12. The McKenzie River/Elk Creek 6th Field HUC sub-watershed contains the majority of the action area, with some exceptions. One haul route crosses over into the South Fork McKenzie River/Cougar Creek 6th Field HUC; a portion of Unit 54 and one haul route crosses over into the McKenzie Bridge 6th Field HUC; and one haul route crosses over into the Lower Blue River 6th Field HUC. Table 15 summarizes acres of harvest, miles of haul route and relation to LFH outside of McKenzie River/Elk Creek 6th Field HUC. Effects of these actions will be analyzed in the sediment indicator Effects Analysis.

Table 15. Actions Outside of McKenzie River/Elk Creek 6th Field HUC.

Acres of Harvest	Miles of Haul	Haul Road Surface Type (A,N,P)	Wet Weather Haul (Y/N)	Stream Crossings	Stream Type (Peren./Inter.)	Stream Crossings Over LFH	Distance to LFH from Stream Crossing
McKenzie Bridge HUC6							
3.4				0		0	
0	1.3	A	Y	2	Inter.		No Connection
South Fork McKenzie River/Cougar Creek HUC6							
0	0.2	A	Y	1	Peren.	0	1,400'
0	0.7	P	Y	1	Peren.	1	
Lower Blue River HUC6							
0	0.7	A	N	1	Inter.	0	No Connection
0	0.1	P	Y	0		0	
0	0.6	A	Y	0		0	
0	0.1	A	N	0		0	

The McKenzie River/Elk Creek 6th Field HUC combined with the Quartz Creek 6th Field HUC make up the McKenzie River/Quartz Creek 5th Field HUC. The McKenzie River flows through the center of the McKenzie River/Elk Creek 6th Field HUC from NE to SW. Quartz Creek is tributary to the mainstem McKenzie River and that portion of the 5th field watershed is downstream of the project area. Therefore, the baseline assessment focuses on the McKenzie River/Elk Creek 6th field HUC since project activities will not effect the Quartz Creek drainage. The 6th field is approximately 20,674 acres – 32 square miles (Table 16).

Table 16. Watershed Information.

Watershed Data Element	Units of Measure	McKenzie River/ Elk Creek 6th Field HUC	McKenzie River/ Quartz Creek 5th Field HUC
Total Size	Acres	20,674	47,764
	Square Miles	32.3	74.6
Non-federal Management	% of Watershed	41.1%	48.7%
Federal Management	% of Watershed	58.9%	51.3%

Elevations exceeding 4,400 feet are located to the north and south of the McKenzie River. McKenzie River elevation ranges from 990 to 1,260 feet within the 6th field watershed. Precipitation averages about 69 inches per year at the 1,200 foot elevation. Approximately 59% of the 20,674 acre analysis area (12,177 acres) is federally managed (Table 1), the remainder is largely privately owned.

The McKenzie River/ Elk Creek sub-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), and 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 Rvier 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 have is 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.

The existing road system is routing soil to stream channels at a higher than natural rate, the road system is in need of repair, upgrading, closures and decommissioning where necessary to reduce fine sediment delivery rate.

B. Land Ownership/Allocation

Table 17 summarizes the Northwest Forest Plan Land Use Allocations at the 6th and 5th Field scales. About 66 percent of federal land is within the Adaptive Management Land Allocation - designed to develop and test new management approaches. About 33 percent is within Late Successional Reserve. All of the units in Bridge Thin lie completely within Adaptive Management Areas. There are no project elements that occur within LSR.

Table 17. Land Use Allocation (NW Forest Plan).

Federal NW Forest Plan Land Use Allocation	% of the Federally Managed Lands	
	McKenzieRiver/ Elk Creek 6th Field HUC	McKenzie River/ Quartz Creek 5th Field HUC
Matrix	0.3	22.4
Administratively Withdrawn	0.5	1.4
Congressional Reserve	0	0
Late Successional Reserve	33.0	35.0
Adaptive Management Area	66.2	41.2

C. Historical Management

Most of the project area is located within previously managed timber stands, thinning or regeneration cuts of 32-80 year old plantations. Approximately 50% of federally managed land in the McKenzie River/Elk Creek sub-watershed has been subject to timber management or road construction since 1930's. The remainder of privately owned and managed land is largely of a young age (industrial timberlands managed on an approximate 40 year rotation) and/or developed as private or rural residential property. Table 18 summarizes historic management by activity on federal land per decade since the 1940s.

Table 18. Historic Management on Federal Land.

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
2000-2010	0	21	15	224

The Riparian Reserve on the north side of the McKenzie River through the action area has a paved highway (Oregon State Highway 126) and a paved local road (McKenzie River Drive), but there are some small pockets of mature/old growth forest. The south side, in general, has a more mature forest or has been previously harvested in the early to mid 1900's. The Elk Creek/Cone Creek system (a tributary system to the McKenzie River within the 6th field sub-watershed) has had relatively little disturbance and is part of a Late Successional Reserve. The community of Blue River, Oregon also lies within this 6th field sub-watershed.

Development along the terraces and flood plains of the McKenzie River, especially early road construction and road maintenance activities, has resulted in an increased rate of bank erosion and the introduction of sediment into the river system. Volumetrically, it is unlikely that this amount of sediment has had a serious, long-term negative impact on channel processes (Quartz Creek and Minor Tributaries Watershed Analysis 1998).

D. Environmental Baseline Condition

This section provides a description of the environmental baseline for the McKenzie River/Elk Creek 6th field sub-watershed, considered the action area* (see explanation in Section II-C).

Table 19 provides a summary of the current habitat and watershed conditions, as compared to the biological requirements of the listed species from the AP table entitled: *FWS/NOAA Fisheries Table Of Population And Habitat Indicators For Use In The Northwest Forest Plan Area*.

Most of the larger fish bearing streams in the watershed have been surveyed in the past decade. Data collected from these stream surveys, water quality monitoring, queries of the GIS database, and watershed analyses were compared to the default AP values resulting in a determination of the appropriate condition category of Properly Functioning, At Risk, or Not Properly Functioning. This analysis was conducted at the 6th field watershed scale. Two ESA listed species and habitat are assessed below, both present downstream of the project area. A separate determination of condition between species will be made only when there is a difference (between species) within an indicator.

Table 19. Summary of baseline conditions at the action area scale.

Indicator	Environmental Baseline Condition Category		
	McKenzie River/Elk Creek HUC6		
	PF	FAR	NPF
Temperature	X		
Suspended Sediment/Turbidity		X	
Chemicals/Nutrients	X		
Physical Barriers	X		
Substrate Embeddedness		X	
Large Woody Material	X		
Pool Frequency and Quality			X
Large Pools			X
Off-channel Habitat		X	
Refugia			X
Width:Depth Ratio			X
Streambank Condition		X	
Floodplain Connectivity			X
Change in Peak/Base Flows			X
Drainage Network Increase			X
Road Density & Location			X
Disturbance History			X
Riparian Reserves			X
Disturbance Regime			X

PF = Properly Functioning, FAR = Functioning At Risk, and NPF = Not Properly Functioning

Temperature:

In September 1999, a project was implemented to collect stream temperatures in the McKenzie River using Forward Looking Infrared (FLIR) technology (Torgersen, et. al.). This project documented temperatures at the confluence of the mainstem McKenzie and South Fork McKenzie River as 10.5 degrees Celsius and 11.3 degrees Celsius, respectively.

The following table provides maximum 7-day averages for tributaries in the McKenzie River/Elk Creek 6th field sub-watershed. Data collected by Forest Service in 2005.

Table 20. Seven-day average maximum temperature (degrees C) data collected by the Forest Service in 2005.

Stream Name	Geographic Description of Sensor Location	7-Day Average Maximum in Degrees Celsius	Date of Maximum Temperature
Cone Creek	Above private land	16.6	September 10
Mill Creek	Above private land	14.2	September 10
Mill Creek	Below private land	20.0	September 10
Unnamed McKenzie Trib	Mid-slope location near Thor's Hammer. No surface connection to McKenzie River in the summer.	17.4	July 23
Quartz Creek	Above private land	15.5	September 10

Information was reviewed for the USGS gauge that is located immediately adjacent to Bruckart Boat Ramp. The USGS name for this gage location is:

- McKenzie River above South Fork near Rainbow, Oregon.
- USGS ID: 14159110

Table 21. Data from USGS Gage near Bruckart Boat Ramp in 2005.

Date of 7-Day Average Maximum	Temperature in Degrees Celsius
July 20	13.7
August 8, 9, 10, and 11	13.5
September 1	12.2
September 30[a]	9.8

[a] The 7-day avg max for the month of September was on the 1st. The September 30 7-day avg max is provided to show the decreasing trend in temperature during the month of September.

Tributaries that have a surface connection to the mainstem McKenzie River in this 6th field sub-watershed are warm. However, the mainstem remains relatively cold due to the influence of ground water from the upper watershed.

Bull trout use this 6th field to rear as subadults and adults, and as a migratory corridor to upstream spawning areas. The USGS gage shows that the 7-day average maximum in the mainstem did not exceed 15 degrees Celsius.

This is not an area of "high concentration" for chinook spawning (personal communication with Mark Wade of ODFW). The Oregon Department of Fish and Wildlife has conducted aerial redd surveys along the McKenzie River. They found that the highest concentrations occurred from Trail Bridge dam downstream to the McKenzie River Trailhead. From the trailhead down to the confluence with Horse Creek spawning concentrations were considered "light." And finally, from Horse Creek downstream to Finn Rock Bridge (this reach encompasses almost the entire 6th field discussed here) spawning was "moderate." Spawning begins around mid-August and continues thru October with a peak in early October. During that time period temperatures were below 14 degrees Celsius (57 degrees Fahrenheit) providing suitable spawning conditions.

Baseline Condition: Given the temperatures recorded and the life history phases using this 6th field sub-watershed, this indicator is *PROPERLY FUNCTIONING*.

Suspended Sediment – Intergravel DO/Turbidity:

No intergravel DO information is available, however turbidity information is available from the USGS gage near Bruckart Boat Ramp. During the winter of calendar year 2005 there was a high water event that peaked on December 30 and 31. A second event occurred in 2006 on January 10 and 11. The following table displays peak turbidity measurements during the high water at two gages on the McKenzie River that are 14.9 miles apart. The gage near Vida, OR is an indicator of the influence of private land management, especially in Quartz Creek. During the high water events field investigations showed a stark difference in turbidity upstream and downstream of Quartz Creek. The gage above the South Fork near Rainbow, OR has private land influence, but since the land base upstream of this gage is predominantly National Forest System it is a reasonable indicator of conditions upstream.

Table 22. Turbidity measurements from USGS gages on the McKenzie River

Location of Gage	Date	Turbidity in FNU[a]	Discharge in cfs
McKenzie River above South Fork Near Rainbow, OR (River Mile 62.3)	12/30/2005	139.0	18,662
	12/31/2005	139.0	18,706
	01/10/2006	139.0	18,313
	01/11/2006	139.0	18,313
	02/01/2006	4.2	6,727
McKenzie River near Vida, OR (River Mile 47.4)	12/30/2005	332.0	21,769
	12/31/2005	236.0	21,809
	01/10/2006	169.0	20,745
	01/11/2006	332.0	21,373
	02/01/2006	329.0	12,204

[a] An FNU is a Formazin Nephelometric Unit. It is a measure of turbidity commonly used in Europe and is similar to Nephelometric Turbidity Unit (NTU). The difference is based on the wavelength used to make the measurement. NTUs are measured with a white light, while FNUs are measured with an infrared light. Due to the fact that suspended particles scatter light of different wavelengths with varying efficiency, FNU data often are not directly comparable to NTU data.

These turbidity events were relatively high for the McKenzie River hydrologic regime. The readings at the two gages show high turbidity that occurred during a storm, but the high turbidity on February 1 was from a slide on private land in the Quartz Creek watershed downstream of National Forest System lands. This information is only used for comparison to turbidity conditions on the same day at the upstream gage that is a reasonable indicator for conditions in the McKenzie River/Elk Creek 6th field sub-watershed.

Baseline Condition: Relative to measurements downstream of National Forest System lands, turbidity in the McKenzie River/Elk Creek 6th field sub-watershed is considered "moderate." On the high water event on 12/30/2005 the upper gage was 193 FNUs lower than the lower gage that is approximately 9 river miles downstream of National Forest System lands. The FNU graphs show that the high water events caused a spike in turbidity, but they also show that during the spawning and incubation season in the McKenzie River/Elk Creek 6th field turbidity conditions were low to moderate. This indicator is *FUNCTIONING AT RISK*.

Chemical Contamination/Nutrients:

The McKenzie River is not listed as 303d for chemicals. There are no agricultural, industrial, or other sources of chemical contamination. It is likely that hydrocarbons on Highway 126 get washed into the river during rain events. This 6th field does however have a number of private residences, and mixed ownerships. It is unknown if, or at what level, chemicals from private

residences, the town of Blue River, and private timberlands are entering the McKenzie River in this 6th field sub-watershed.

Baseline Condition: Since there is no indication of chemical contamination in this 6th field, this indicator is *PROPERLY FUNCTIONING*.

Physical Barriers:

There are no physical barriers to either upstream or downstream migration in the 6th field sub-watershed. Major streams entering the mainstem McKenzie River in this sub-watershed either have bridges or culverts that do not prevent passage.

Baseline Condition: Given the absence of human caused barriers to bull trout and spring Chinook salmon in this 6th field sub-watershed, this indicator is *PROPERLY FUNCTIONING*.

Substrate Character and Embeddedness:

Development along the terraces and flood plains of the McKenzie River, especially early road construction and road maintenance activities, has locally resulted in increased bank erosion and the introduction of sediment into the river system. Volumetrically, it is unlikely that this amount of sediment has had a serious, long-term negative impact on channel processes (Quartz Creek and Minor Tributaries Watershed Analysis 1998).
The two major river systems that enter into the McKenzie River/Elk Creek 6th field sub-watershed are Blue River and South Fork McKenzie River. They are each independent 5th field watersheds, and both have Army Corps of Engineers flood control dams (Blue River dam at about river mile 1.5; and Cougar Dam at about river 4.5). Each of these dams traps tens of thousands of cubic yards of sediment.

Baseline Condition: The specific measurement has not been taken throughout the mainstem river in this 6th field sub-watershed. Visually it appears that cobble and gravel dominate the channel in this 6th field, and bedload material is well sorted. This indicator is *FUNCTIONING AT RISK*.

Large Woody Material:

In this 6th field watershed, two inventories have been conducted to count wood in the McKenzie River. One was done in 1997 to evaluate large wood associated with the "Mile Post 44 Logjam" and the other was done in 1999 (Bennett) that covered areas in the 6th field not evaluated by the 1997 effort.

The 1997 (Clearwater Biostudies) evaluation looked at wood in the river from the confluence with the South Fork McKenzie River upstream to Belknap Bridge (upstream of Dearborn Island). This evaluation reach is approximately 4 river miles in length. The following table provides counts of woody material in the reach.

Table 23. Woody Material in the area of the MP 44 Logjam

Location	Pieces of large woody material (>10' long, 12" diameter)	Key Pieces of large woody material (>30' long, 20" diameter)
Associated With Mile Post 44 Logjam	151[a]	66
River Meander Near Mile Post 44 Logjam	57	24
Remainder of Study Reach	26	14
Total	234[a]	104

[a] Count of woody material associated with the Mile Post 44 jam was a significant underestimate due to an abundance of pieces deep within the jam which could not be enumerated.

Twenty-six pieces of woody material in the jam area were measured to be over 100' long and six were more than 150' long. The largest piece of woody material in the study area was 182' long with bark and root wad still attached. Since the time of the study in 1997, at least 5 more pieces had entered the MP 44 Log Jam area. However, during the high water events of December 2005 and January 2006 dynamic changes took place at the log jam. Woody material was transported downstream and much of it can be found at the heads of islands in this 6th field. Large trees with partial crowns and with root wads attached were also deposited in the log jam area. Channel shifts took place and gravels and cobbles were mobilized, transported, and deposited into new areas. This specific segment of the McKenzie River where the log jam occurs is the most dynamic and complex of the "upper river" (upstream of Vida, OR).

An updated inventory has not been accomplished since the changes, the jam area and the 6th field remains rich with woody material. The deposits at the heads of islands will provide for long-term maintenance of off channel habitats, and provide cover during future high water events. The log jam area remains a complex network of rearing, spawning and migratory channels for spring Chinook salmon.

In addition to the wood counted in the Mile Post 44 Logjam study (Clearwater Biostudies 1997), the following wood was counted in 1999 by a contractor (Bennett) in areas of the 6th field that were not covered in the 1997 inventory.

Table 24. Woody material inventory conducted by Bennett (1999)

Size of Woody Material	Pieces
Small (25' x 12")	59
Medium (50' x 24")	10
Large (50' x 36")	0

Baseline Condition: Given the amount of woody material inventoried, this indicator is *PROPERLY FUNCTIONING*.

Pool Frequency and Quality; and Large Pools:

The McKenzie River varies in width in the 6th field sub-watershed. It ranges from 100 to 200 feet throughout the sub-watershed. In the "South Fork to Finn Rock" reach there are approximately 2.5 large pools per mile in a segment where the river is over 65 feet wide.

The following table is from Minear (1994) and shows changes in large pools in two reaches of her study. Minear looked at changes between 1938 and 1991 using aerial photos. A large pool was defined as a pool with a minimum depth of 2 meters and an area of at least 40 square meters.

Table 25. Changes in Large Pools

Reach	1938 Number of Pools	1991 Number of Pools	Percent Change
Rainbow to South Fork Junction	22	6	-73%
South Fork to Finn Rock	21	13	-38%

The McKenzie River/Elk Creek 6th field sub-watershed has had private land development, the town of Blue River is partially in the 6th field, and Highway 126 or McKenzie River Drive are adjacent to the river almost along the entire length in this 6th field. The presence of these paved

roads prevents full riparian development on the north side of the river, and constrains the river. These conditions are not conducive to the promotion of large pools in a river channel.

Baseline Condition: There have been dynamic changes to the river since the 1991 aerial photograph series (e.g. the 1996 floods, and smaller events). However, a similar exercise to inventory pools with aerial photos has not taken place, nor has a ground inventory of pools. Given the reductions in large pool habitat found by Minear (1994), the low number of large pools that are found in the 6th field, and the chronic effect of paved roads adjacent to the river throughout much of the 6th field sub-watershed, this indicator is *NOT PROPERLY FUNCTIONING*.

Off Channel Habitat:

The following table displays the changes in side channel numbers and length found by Minear (1994) using aerial photos in the 6th field sub-watershed.

Table 26. Changes in side channel numbers and length found by Minear (1994) using aerial photos

Reach	Number of Side Channels 1945/49	Number of Side Channels 1986	Side Channel Length (m) 1945/49	Side Channel Length (m) 1986
Rainbow to South Fork Junction	21	7	6,027	973
South Fork to Finn Rock	7	9	5,957	3,077

The Mile Post 44 Log Jam is located at the lower end of the "Rainbow to South Fork Junction" reach and has undergone dynamic changes since the 1986 photo time series, as has the "South Fork to Finn Rock" reach. The large woody material deposits at the heads of islands will provide for long-term maintenance of off channel habitats, and provide cover during future high water events. The log jam area remains a complex network of rearing, spawning and migratory channels for spring Chinook salmon.

Baseline Condition: Channel complexity is high in this section of the "upper river" (i.e. upstream of Vida, OR). This can be attributed to geomorphic conditions and geographic location. The lower boundary of this 6th field sub-watershed is near the lower terminus of Pleistocene glacial advance (Upper McKenzie River Watershed Analysis 1995). Downstream of this 6th field the McKenzie River channel is influenced by the Western Cascade geology and naturally becomes more constrained relative to the glacial-valley segment of the McKenzie River/Elk Creek 6th field sub-watershed. The reach of river from the South Fork to Finn Rock is geomorphically set up to have high channel complexity. However, due to the presence of Highway 126 and McKenzie River Drive the channel is constrained on the north side and inhibits lateral scour. This indicator is *FUNCTIONING AT RISK*.

Refugia:

The McKenzie River has habitats capable of supporting strong and significant populations. However, many human activities take place in the upper watershed and that is especially true in the McKenzie River/Elk Creek 6th field sub-watershed. The presence of Highway 126 and McKenzie River Drive (both paved roads) adjacent to the river, mixed ownership, numerous private residences within the river valley and some directly adjacent to the river, and recreational boating.

Baseline Condition: This 6th field does not function as a "refugia" and is therefore *NOT PROPERLY FUNCTIONING*.

Width to Depth Ratio:

Width to depth ratios have not been physically collected in the main stem McKenzie River. The following is an estimate of bankfull width (using a range finder), and a visual estimate of bankfull depth. The McKenzie River/Elk Creek 6th field sub-watershed is in a segment of the McKenzie River where two large flood control dams impact the sediment and flow regime.

Table 27. Estimated width to depth ratio at Bruckart boat launch

Site description	Bankfull width	Bankfull depth	Bankfull width/depth
Current Bruckart boat launch site	160	7	22

Baseline Condition: An estimate of the bankfull width to depth ratio is greater than both criteria in the matrix of indicators (20 for bull trout; 12 for spring Chinook salmon). This indicator is *NOT PROPERLY FUNCTIONING*.

Streambank Conditions:

Streambank conditions in the 6th field in general are good. However, some of the banks along the McKenzie River in the 6th field have been reinforced with rip-rap (eg. at the head of Dearborn Island). Development along the terraces and flood plains of the McKenzie River, especially early road construction and road maintenance activities, has locally resulted in increased bank erosion and the introduction of sediment into the river system. Volumetrically, it is unlikely that this amount of sediment has had a serious, long-term negative impact on channel processes (Quartz Creek and Minor Tributaries Watershed Analysis 1998).

Baseline Condition: Streambank conditions in the 6th field in general are good. However, due to the presence of paved roads that have required rip-rap in places, and the presence of some private residences along the river that have placed rip-rap along the bank, this indicator is *FUNCTIONING AT RISK*.

Floodplain Connectivity:

Floodplain connectivity is a concern in this 6th field sub-watershed due to the presence of flood control dams (Cougar and Blue River) in tributary 5th field watersheds. These dams do not allow peak flows to inundate the floodplains in a similar spatial and temporal frequency as compared to historic conditions. In addition there are areas of rip-rap along the river bank that do not allow lateral scour to occur.

Baseline Condition: Given the presence of flood control dams in tributary 5th field watersheds and changes to natural bank conditions, this indicator is *NOT PROPERLY FUNCTIONING*.

Changes in Peak/Base Flows:

Upstream of the McKenzie River/Elk Creek 6th field sub-watershed the flow regime is not impacted by flood control dams, so the hydrologic regime that flows into this 6th field is "natural" for the most part. However, there are two tributary 5th field watersheds (South Fork and Blue River) that enter this 6th field that have significantly affected the hydrograph as compared to historic conditions.

Baseline Condition: Due to the presence of two flood control dams, the peak and base flows in this 6th field sub-watershed are not characteristic of historic conditions. Therefore, this Indicator is *NOT PROPERLY FUNCTIONING.*

Increases in Drainage Network:

There is significant mixed ownership in this 6th field. There is a State highway (Hwy 126), municipal roads (the town of Blue River), private timber company roads, other private land holder roads, and Forest Service roads.

Many roads in the 6th field are paved roads administered by the State of Oregon or the Forest Service and are in good shape. However, Highway 126 and McKenzie River Drive have a significant impact on the river due to their location.

Baseline Condition: This indicator is *NOT PROPERLY FUNCTIONING*.

Road Density and Location:

There is significant mixed ownership in this 6th field. There is a State highway (Hwy 126), there are municipal roads (town of Blue River), private timber company roads, other private land holder roads, and Forest Service roads. Many roads in the 6th field are paved roads administered by the State of Oregon or the Forest Service and are in good shape. However, Highway 126 and McKenzie River Drive have a significant impact on the river due to their location.

The following table displays existing road densities for all roads in the 5th Field and 6th Field watersheds.

Table 28. Existing Road Densities

Location	Density All Roads
McKenzie River/ Quartz Creek 5th Field Watershed	3.7
McKenzie River/ Elk Creek 6th Field Watershed	4.0

Baseline Condition: The density ratio of 3.7 is considered Not Properly Functioning for bull trout and for Chinook salmon. Private timber lands in Quartz Creek do not have the rigorous requirements of the Northwest Forest Plan, and harvest activities are substantial. When taking into account the watershed impacts caused by private timber harvest, this indicator is considered *NOT PROPERLY FUNCTIONING* at the 5th field watershed level.

Disturbance History:

This 5th field watershed (McKenzie River/Quartz Creek - 1709000405) has a history of significant human caused disturbance.

Timber harvest by private companies has been extensive in the past and continues to the present. The Forest Service has acquired lands along the river terraces that was clear cut using ground based yarding methods. These lands were cut 50 to 60 years ago and many of the old roads are in disrepair. The Forest Service has also extensively managed portions of the river terraces in the past (Mill Creek area). Those stands are currently 30 to 50 years old and densely stocked. In the Quartz Creek portion of the 5th field watershed extensive clear cutting continues by a private timber company.

Oregon State Highway 126 and other roads have had negative impacts on the watershed by constraining the river, permanently removing riparian areas, and providing an avenue for chemical spills.

Baseline Condition: Given the human caused disturbance that has occurred in the past, and continues in the present, this indicator is *NOT PROPERLY FUNCTIONING*.

Riparian Reserves:

There are approximately 4,561 acres of Riparian Reserve on National Forest System lands in the 5th field watershed. Development along the terraces and flood plains of the McKenzie River, especially early road construction and road maintenance activities, has locally resulted in increased bank erosion and the introduction of sediment into the river system. Volumetrically, it is unlikely that this amount of sediment has had a serious, long-term negative impact on channel processes (Quartz Creek and Minor Tributaries Watershed Analysis 1998).

Many of the Riparian Reserves in the 5th field either have had some form of timber harvest, or there is a residence, or a road (paved or gravel). The Riparian Reserve on the north side of the river is a paved highway, but there are some small pockets of mature/old growth forest. The south side, in general, has a more mature forest. The Elk Creek/Cone Creek system has had relatively little disturbance and is part of a Late Successional Reserve.

Baseline Condition: Due to the presence of Highway 126, McKenzie River Drive, and the amount of residential development along the river in the McKenzie River/Elk Creek 6th field sub-watershed, and the substantial amount of timber harvest in the Quartz Creek 6th field sub-watershed, this indicator is *NOT PROPERLY FUNCTIONING*.

Disturbance Regime:

There has been significant human disturbance in this 5th field in the form of road building, timber harvest, private land development, and flood control dams in tributary 5th field watersheds that significantly impact the disturbance regime of the McKenzie River/Elk Creek 6th field sub-watershed.

Baseline Condition: The extent of human induced disturbance, and interruption of disturbance (i.e. flood control dams) have created conditions in the 5th field watershed that are *NOT PROPERLY FUNCTIONING*.

Integration of Species and Habitat Conditions (Bull Trout Only):

Bull trout use this 6th field as a foraging area for sub-adults and adults. Adult bull trout also use this 6th field as a migratory corridor upstream to the spawning tributaries of Olallie and Anderson Creeks.

Despite the high amount of human influence in the McKenzie River/Elk Creek 6th field sub-watershed, the river still provides good water temperatures and complex habitat for bull trout. This section of the McKenzie River contains the most complex habitat in the upper river due to the presence of the Mile Post 44 logjam. However, it can only be considered to be functioning at risk due to the human impacts.

Flood control dams have significantly altered the disturbance regime; river banks and terraces have had significant development; and Highway 126 and McKenzie River Drive directly impact the river throughout much of the 6th field. These are chronic cumulative effects that will continue to impact the river into the foreseeable future.

Baseline Condition: This indicator is *FUNCTIONING AT RISK*.

E. Bull Trout Critical Habitat – Environmental Baseline Condition, Critical Habitat PCEs

Critical Habitat has been designated for Columbia River bull trout in the Willamette River basin (Final Rule September 26, 2005). This designation includes some river segments within the McKenzie River / Elk Creek 6th field sub-watershed (HUC). The USFWS has determined there are 8 primary constituent elements (PCEs) essential for the conservation of bull trout. These are sites and habitat components that support one or more life stages, including:

1. Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72° F (0 to 22° C) but are found more frequently in temperatures ranging from 36 to 59° F (2 to 15° C). These temperature ranges may vary depending on bull trout life history stage and form, geography, elevation, diurnal and season variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude any bull trout are specifically excluded from designation;
2. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.
3. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. Should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.
4. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation;
5. Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source;
6. Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows;
7. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish;
8. Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.

The Critical Habitat designation protects PCEs necessary to support the life history functions which were the basis of the designation. Because not all life history functions require all the PCEs, not all habitat will contain all the PCEs.

Each of the areas designated in the final rule have been determined to contain sufficient PCEs to provide for one or more of the life history functions of bull trout. In some cases, the PCEs

exist as a result of ongoing federal actions. As a result, ongoing federal actions at the time of Critical Habitat designation are included in the baseline in any consultation conducted subsequent to the designation.

Water Temperature Baseline Condition

The indicator condition for water temperature is Properly Functioning. For additional information see the discussion above.

The segment of the McKenzie River where the Bridge Thin project is located is used by bull trout for adult and sub-adult rearing. Buchanan and others (1997) found that adult bull trout required temperatures of 4 to 20^{o} C, but that densities were highest at 12^{o} C or less. The following table provides temperature collected during the calendar year of 2005 at the USGS gage near Bruckart boat launch which is located within this 6th field HUC.

Table 29. Monthly Mean Temperature Calendar Year 2005 at McKenzie River above South Fork near Rainbow, Oregon. USGS ID: 14159110.

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
5.18	5.30	6.45	6.98	8.44	9.44	11.10	11.07	9.38	8.10	6.31	*

*Data incomplete and unavailable.

Temperatures are less than 12^{o} C throughout the year in this segment of the McKenzie River. Therefore, the baseline condition for this PCE is *PROPERLY FUNCTIONING*.

Complex Stream Channel Baseline Condition

The habitat indicators that are associated with this PCE were a mix of existing condition. Large wood was Properly Functioning, pools were Not Properly Functioning, and off channel habitat was Functioning at Risk.

Given the human impacts in this segment of the McKenzie River (Highway 126, McKenzie Bridge Drive, private land development and associated rip rap along the river) this PCE is *FUNCTIONING AT RISK*.

Substrate Baseline Condition

Development along the terraces and flood plains of the McKenzie River, especially early road construction and road maintenance activities, has locally resulted in increased bank erosion and the introduction of sediment into the river system. Volumetrically, it is unlikely that this amount of sediment has had a serious, long-term negative impact on channel processes (Quartz Creek and Minor Tributaries Watershed Analysis 1998).

The specific measurement has not been taken throughout the mainstem river in this 6th field sub-watershed. Visually it appears that cobble and gravel dominate the channel in this 6th field, and bedload material is well sorted. This PCE is considered *FUNCTIONING AT RISK*.

Hydrograph Baseline Condition

Upstream of the McKenzie River/Elk Creek 6th field sub-watershed the flow regime is not impacted by flood control dams, so the hydrologic regime that flows into this 6th field is “natural” for the most part. However, there are two tributary 5th field watersheds (South Fork and Blue River) that enter this 6th field that have significantly affected the hydrograph as compared to historic conditions.

Due to the presence of two flood control dams, the peak and base flows in this 6th field sub-watershed are not characteristic of historic conditions. Therefore, this Indicator is *NOT PROPERLY FUNCTIONING*.

Seeps, Springs, and Groundwater Sources Baseline Condition

Ground water sources are dominant in the upper McKenzie River 5th field HUC (upstream of this segment of the river). The geology of this 6th field (Western Cascades Province) do not have an abundance of cold water springs. This area has deep glacial deposits within the river corridor and this strongly influences hyporheic flow in the 6th field. The characteristics of tributary streams in this area during the summer are that they have perennial flow in the steep canyon areas and go subsurface when they reach the glacial deposits. This keeps characteristically warm Western Cascades water temperatures from reaching the mainstem river. This PCE is *PROPERLY FUNCTIONING*.

Migratory Corridors Baseline Condition

There are no physical barriers to either upstream or downstream migration in the 6th field sub-watershed. Major streams entering the mainstem McKenzie River in this sub-watershed either have bridges or culverts that do not prevent passage.

Given the absence of human caused barriers to bull trout in this 6th field sub-watershed, this indicator is *PROPERLY FUNCTIONING*.

Food Base Baseline Condition

The only information available for macroinvertebrates in this segment of the McKenzie River is from a sample collected in 1999 in Cone Creek (a tributary in this 6th field). A benthic invertebrate assessment was conducted by Aquatic Biology Associates, Inc. A summary score of 81.5 was determined which is considered "High biotic/habitat integrity." There is no indication that the fish prey base is limiting for adult and subadult bull trout in this 6th field HUC. Therefore, this PCE is considered to be *PROPERLY FUNCTIONING*.

Permanent Water Quality and Quantity Baseline Condition

Ground water influences in the McKenzie River provide for relatively high base flows during the summer. Cougar Dam has recently been retrofitted with a temperature control tower that provides temperatures that better emulate historic conditions below the dam. The Army Corps of Engineers has estimated that the tower influences temperature conditions as far downstream as Vida, Oregon. There are no indications of adverse water quality conditions in this 6th field HUC. Therefore, this PCE is considered to be *PROPERLY FUNCTIONING*.

F. Spring Chinook Salmon Critical Habitat - Environmental Baseline Condition, Critical Habitat PCEs

Critical Habitat has been designated for Upper Willamette River Chinook salmon. This designation for Chinook salmon includes the reach of the McKenzie River flowing though the Action Areas. NMFS has determined that there are six primary constituent elements (PCEs) essential for the conservation of Chinook salmon. These are sites and habitat components that support one or more life stages, including:

1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
2) Freshwater rearing sites with:

(i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;

(ii) Water quality and forage supporting juvenile development; and

(iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;

4) Estuarine areas free of obstruction and excessive predation with:

(i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and

(iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

5) Nearshore marine areas free of obstruction and excessive predation with:

(i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Only PCEs 1-3 are found within the 6th field subwatersheds. The baseline condition of these PCEs is described below:

Freshwater Spawning Sites: Baseline Condition

The McKenzie River in the project area provides favorable spawning sites for spring Chinook salmon. The Oregon Department of Fish and Wildlife has conducted aerial redd surveys along the McKenzie River. They found that the highest concentrations occurred from Trail Bridge dam downstream to the McKenzie River Trailhead. From the trailhead down to the confluence with Horse Creek spawning concentrations were considered “light.” And finally, from Horse Creek downstream to Finn Rock bridge spawning was “moderate.

Stream temperatures in this segment of the McKenzie River are favorable for all life history stages of spring Chinook salmon (see discussion of this indicator and Table 29 in the bull trout PCE discussion above). This PCE for spring Chinook is *PROPERLY FUNCTIONING*.

Freshwater Rearing Sites: Baseline Condition

Downstream of Belknap Springs as the river makes its bend westward, it becomes less constrained as it flows through a glacial valley. More physical features in the channel (i.e. islands) can be found with an associated increase in channel complexity and log jams. This reach provides abundant rearing habitat for juvenile spring Chinook salmon.

Minear (1994) found a significant reduction in the number of pools between Horse Creek and Finn Rock (near Quartz Creek) by comparing changes in aerial photos thru a number or time series. Adjacent to this segment of river are McKenzie River Drive and Oregon State Highway 126. In some sections these paved roads are directly adjacent to the McKenzie River and this has impacted important source areas of large wood. This segment of the river still provides important rearing areas due to the number of side channels.

The Mile Post 44 Log Jam is located in the McKenzie River/Elk Creek 6th field sub-watershed. The log jam area is a complex network of rearing, spawning and migratory channels for spring Chinook salmon. The large woody material deposits at the heads of islands in this 6th field sub-watershed will provide for long-term maintenance of off channel habitats, and provide cover during future high water events.

Stream temperatures in this segment of the McKenzie River are favorable for all life history stages of spring Chinook salmon (see discussion of this indicator and Table 29 in the bull trout PCE discussion above). This PCE for spring Chinook is *PROPERLY FUNCTIONING*.

Freshwater Migration Corridors: Baseline Condition

Within the project area there are no barriers to spring Chinook migration. The McKenzie River in the project area provides suitable stream temperatures for both adult and juvenile migration. Stream flows in Western Cascades are flashy and have low base flows in the late summer and early fall (spawning season). However, the spring fed streams from the High Cascades provide a relatively high discharge in the summer and buffers the effects of the Western Cascades low base flows. This PCE is *PROPERLY FUNCTIONING*.

V. EFFECTS OF THE PROPOSED ACTION

A. Introduction

The effects to baseline habitat indicators were assessed for each of the project elements: 1) Timber Felling 2) Timber Yarding, 3) Timber and Rock Haul, 4) Road, Rock Pit and Landing Work, 5) Fuel Treatment

The potential effects (negative, positive, or neutral) that the implementation of each project element may have on each indicator or group of indicators was assessed, where applicable, using the AP factors as defined below:

Proximity ~ The geographic relationship between the project element or action and the species/designated critical habitat.

Probability ~ The likelihood that the species or habitat will be exposed to the biotic or abiotic effects of the project element or action to the indicator.

Magnitude ~ The severity and intensity of the effect.

Distribution ~ The geographic area in which the disturbance would occur (may be several small effects or one large effect).

Frequency ~ How often the effect would occur.

Duration ~ How long the effect would last. Potential categories include (a) short-term event whose effects subside immediately (pulse effect); (b) sustained, long-term effect, or chronic effect whose effects persist (press effect); and (c) permanent event that sets a new threshold for a species' environment (threshold effect).

Timing ~ When the effect would occur in relation to the species' life-history patterns.

Nature ~ Effects of the action on elements of a species' life cycle, population size or variability, or distribution; or on the primary constituent elements of critical habitat, including direct and indirect effects.

As the AP directs, the Proximity, Probability, and Magnitude factors are to be considered first. If either of the following conclusions is made, no further analysis of the PE for that indicator is needed:

1) There is no probability or there is a discountable (extremely unlikely to occur) probability of the impact occurring; and/or

2) The magnitude of the effect is insignificant (not able to be meaningfully measured, detected, or evaluated) or non-existent.

The combined effects to each of the indicators were also assessed for the project as a whole (Indicator summary).

B. Project Effects to Habitat Indicators

Temperature	Baseline Condition	
	Action Area	HUC6
	PF	PF

1) Timber Falling

a) Proximity: In previously unmanaged units, no trees >7"dbh will be cut within 300 feet of fish-bearing streams or LFH, within 60 feet of perennial, non fish-bearing streams, and within 30 feet of intermittent, non fish-bearing streams. In previously managed units, no trees >7"dbh will be cut within 60 feet of all perennial streams or LFH, and within 30 feet of intermittent, non fish-bearing streams.

b) Probability: The effect that this project will have on stream shade was estimated using the model described in the "Northwest Forest Plan Temperature TMDL Implementation Strategies" (USDA and USDI 2005). This model provides the process for calculating the width of the riparian area adjacent to perennial stream channels that provides stream shade for the period of greatest solar loading (between 1000 and 1400 hours), known as the primary shade zone. It also provides the process for calculating the width of the riparian area that provides shade in the morning and afternoon (0600-1000 hours; 1400-1800 hours), considered to be the secondary shade zone. In over-dense riparian stands, optimum shade can be provided by the primary shade zone alone, and the secondary shade zone may contribute little to no shade since trees in the primary shade zone are already blocking the sun's solar radiation (USDA and USDI 2005).

The TMDL Implementation document suggests that thinning in Riparian Reserves could be considered as long as they meet the following conditions:

1. Vegetation density is high and will benefit from thinning.
2. Vegetation thinning will not occur in the primary shade zone. Vegetation thinning in the secondary shade zone will not result in less than 50% canopy closure post harvest.
3. NWFP Standards and Guidelines and BMPs still apply.
4. The width of the primary shade zone will be set using the values below, unless a shade model is used for site specific analysis.

Table 30. Minimum Width of Primary Shade Zone (in feet) based on Slope and Tree Height (USDA and USDI 2005).

TREE HEIGHT	HILL SLOPE		
	<30	30 TO 60	>60
< 20 feet	12	14	15
20 to 60 feet	28	33	55
>60 to 100 feet	50	55	60

Depending on slope, the width of the primary shade zone for units in the Bridge Thin action area ranges from 50 feet to 60 feet (Table 30). Thinning will not occur within the primary shade zone

of any perennial stream. Thinning in the remainder of the riparian reserve of any perennial stream (two site-potential tree heights on fish-bearing streams and one site-potential tree height on all non-fish bearing, perennial streams), will not result in less than 50% canopy closure post harvest. This will include those portions of the riparian reserve that are providing secondary shade. Therefore, thinning prescriptions in riparian reserves for Bridge Thin meet all four conditions recommended by the TMDL Implementation document. Based on field observation and compliance with the aforementioned conditions, the probability of timber falling effecting stream temperature is **discountable**.

Element Summary: The Project Design Criteria were developed to protect stream temperature and ensure that sufficient shade will remain for the streams in the Bridge Thin action area. Thinning prescriptions in riparian reserves meet all four conditions recommended by the TMDL Implementation document. Therefore, the probability of timber felling affecting stream temperature is **discountable**.

2) Timber Yarding

a) Proximity: Approximately 57 skyline corridors are proposed over 8 perennial streams in the action area. Only three of these streams flow into the McKenzie River (LFH/CH). Skyline corridor widths are about 10 feet (thinned tree spacing in riparian reserve stands will be about 20 feet). The nearest distance to LFH from a corridor is over 1.0 mile.

b) Probability: Typically, corridor widths are 10 feet wide and eliminate very little actual effective shade. Minor reduction in stem density immediately adjacent to channels from the corridor is expected with construction of 57 corridors across perennial streams. The net area of corridor opening in the primary shade zone adjacent to perennial channels would be 1.6 acres – 0.06% of the 2,531 riparian reserve acres on federal land in the 6th Field. Skyline corridors would be spaced at least 100 feet apart to reduce additive effects. Skyline yarding equipment would not be permitted within 120 feet of all perennial stream channels. Trees felled for corridors would be left on site. Mitigations requiring full suspension over channels and retention of immediate LWD to the channel is expected to protect understory vegetation close to the channel and retain some shade provided by downed wood. Any effect that does occur would be of short duration as the young stands would be expected to re-close openings in 3 to 5 years, based on rates of new growth. Due to the relatively small area of stream adjacent opening, the probability of increasing stream temperature any amount is considered **discountable.**

Element Summary: Due to project design criteria and relatively small area of stream adjacent opening, timber yarding has **discountable** probability of having a negative effect on the stream temperature indicator.

3) Timber and Rock Haul

a) Proximity: Timber and rock haul routes are proposed adjacent to LFH.

b) Probability: Timber and rock haul have no casual mechanism to affect stream shade therefore there is no probability to affect stream temperature.

Element Summary: Because there is no probability to affect stream temperature timber and rock haul will have a **neutral** affect to the stream temperature indicator.

4) Road, Rock Pit and Landing Work

a) Proximity: A variety of road construction, reconstruction, maintenance, closure and decommissioning, culvert replacements and rock pit development will occur within the action area. No new road construction will occur within riparian reserves except one semi-permanent spur road that crosses two intermittent streams with no surface connection to LFH (Unit 2; Figure A-8). None of these components will occur adjacent to LFH, but road maintenance and reconstruction will occur adjacent to some perennial streams hydrologically connected to LFH.

b) Probability: Proposed road maintenance and reconstruction on approximately 34 miles of existing road may require removal of small understory vegetation – brushing – within riparian reserves. Brushing alongside roads has no causal mechanism to effect water temperature because it does not remove shade canopy. In addition, no stream shade will be lost due to road closure and decommissioning. Because road maintenance, reconstruction, decommissioning and closure will not effect stream shade and the new semi-permanent road is over streams that have no connection to LFH, the potential for increasing stream temperature is **discountable**.

Element Summary: No shade canopy over streams hydrologically connected to LFH will be removed by brushing and other road work. Therefore, effects are characterized as **discountable** to the stream temperature indicator.

5) Fuels Treatment

a) Proximity: Proposed fuel treatment will not occur within the no-treatment buffers, which are located outside of the primary shade zone (60 feet) on all perennial streams. All equipment is restricted 120 feet from perennial streams and 50 feet from intermittent streams. Fire treatment units with the closest proximity to LFH are Units 95, 97, 98, 102 and 103, which are adjacent to the McKenzie River. Two paved roads, McKenzie River Drive and King Road, pass through these units and parallel the McKenzie River (Figure A-14). These roads are approximately 100 feet away from the river. No fuels treatment will occur on the river side of the paved roads. Therefore, the 60 foot no-treatment buffers will be exceeded in these units.

b) Probability: Removal of trees <7”dbh for fuels treatment will not result in change to the overstory canopy and therefore will have no causal mechanism to effect stream temperature.

In units treated with an underburn (up to 1,656 acres) or natural fuels underburn (up to 42 acres) no ignition will occur inside the no-treatment buffers, but fireline will not be constructed within the riparian reserves. Therefore, fire may back down into the primary shade zone. Burning will occur in spring-like conditions with high moisture content in the larger fuels >3", so the likelihood of fire removing shade canopy is very low. If trees begin to torch, firefighters will use water to reduce the fire intensity and to keep fire in the ground fuels. The only units adjacent to LFH (Units 95, 97, 98, 102 and 103) will have the two paved roads to serve as substantial fire line, with no treatment in-between the road and the McKenzie River.

Most of the streams within units do not have surface connection with the McKenzie River (LFH). There are five tributaries with surface connection to LFH that have fire treatment units in the uplands. In all tributaries, there is substantial length of stream channel that have no management activities associated with this project and are heavily forested to facilitate cooling effects before reaching LFH. In addition, all tributaries flow through the wide, porous, glacial

terrace in the McKenzie River valley and have high hyporheic interaction. These channel lengths from the lowest treatment unit to the McKenzie River (LFH) are as follows:

- *Mill Creek* = 6,250 feet
- *Unnamed Tributary through Tokatee Golf Course* = 5,600 feet
- *Tributary out of Unit 100* = 1,650 feet
- *Tributary out of Unit 95* = 1,280 feet
- *Tributary from West Side of Project Area* = 3,800 feet with small unit (21) in-between; 6,900 feet from upland units

Based on monitoring of past underburning on the District, it is anticipated that underburning will not remove any overstory shade trees. Risk of underburn leading to torching of trees is very low due to high fuel moisture conditions and availability of water at time of burning. In addition, the channel length downstream of units that is forested, unmanaged, and having hyporheic interaction is substantial to promote cooling. Therefore, the probability that prescribed fire will affect stream temperature is **discountable**.

Element Summary: Because fire will be allowed to back down into the primary shade zone, so that construction of fireline in riparian reserves can be avoided, there may be potential to affect shade canopy. Implementation in high moisture conditions and use of water to keep fire in the ground fuels will reduce the potential. Based on monitoring of past of underburning on the District, it is anticipated that underburning will not remove any overstory shade trees. Risk of underburn leading to torching of trees is very low due to high fuel moisture conditions and availability of water at time of burning. In addition, the channel length downstream of units that is forested, unmanaged, and having hyporheic interaction is substantial to promote cooling before reaching the McKenzie River. Therefore, the probability of affecting stream temperature through fuels treatment is **discountable**.

Indicator Summary:

The Project Design Criteria and TMDL Sufficiency Criteria were developed to protect stream temperature and ensure that sufficient shade will remain for perennial streams in the Bridge Thin action area. Stream shade may be slightly affected at the site scale initially with construction of yarding corridors and with implementation of fuels treatment. However, given the shade protection buffers, the spatial separation of the individual project activities from one another and LFH, the low stream flows in the perennial streams potentially affected and hydrologic disconnection between these streams and LFH, any negative effects to stream temperature would be **discountable**.

	Baseline Condition	
Suspended Sediment/Turbidity	Action Area	HUC6
	FAR	FAR
Substrate Embeddedness	Action Area	HUC6
	FAR	FAR

To evaluate the effects of the proposed action on sediment delivery, an annual sediment budget was prepared by Dave Kretzing, McKenzie River District Hydrologist. Quantitative rates of sediment delivery were calculated for surface erosion associated with existing road related sediment delivery and sedimentation delivery associated with culvert removal, road reconstruction, road decommissioning and increased road use for timber haul (Table 32).

Timber felling and yarding sediment effects were analyzed qualitatively based on findings by Rashin et. al. (2006). Rashin's research examined the effectiveness of equipment setbacks, stream buffers, falling and yarding practices, and harvest timing in reducing transport of sediment to small order streams. The study includes sites in western Washington, with west Cascades geomorphic conditions similar to those found in the Bridge Thin project area.

Roadway erosion was evaluated using a modeling tool to complete the analysis. Roads within the sub-watersheds were placed into 4 categories for analysis: Paved, Lower Slope, Mid Slope, and Ridge top, and mileages of each category were estimated based on map review. The Road WEPP module of the FSWEPP model was used to estimate sediment yields for each category of road. Several runs for each category were completed to account for differing levels of use and maintenance condition. The results were used to analyze existing condition, sediment yield while sale operations are in progress, and post sale conditions. Sediment yield was estimated for all roads in the project area, regardless of land ownership.

Table 32 summarizes the results of analytical procedures for the proposed action. Sources are displayed for National Forest System lands only. Volumes described are displaced or mobilized fine sediments from road use, and these values provide an estimate of overall soil disturbance, which is only partially correlated to soil delivery to stream channels.

Table 32. Sediment Yield Summary from Road Use for Bridge Thin Proposed Action

Sediment Source	No Action	Proposed Action	Proposed Action (Post-implementation)
NF Road Origin Sedimentation	247 cubic yards/year	273 cubic yards/year	229 cubic yards/year
Actual Increase from No Action	NA	+26 cubic yards/year	-18 cubic yards/year
% Change from No Action	NA	+ 10.5%	-7.3%

In the proposed action, sediment yields of road origin increase during project implementation, at a rate of approximately 26 cubic yards per year. Road reconstruction, semi-permanent road construction, timber harvest and timber haul is estimated to span about 3 years for various timber sales associated with Bridge Thin project. Sediment yield from roadway erosion is expected to decrease compared to the no action alternative once all project elements are complete (reflecting road condition improvement associated with maintenance/improvement and a lower level of use).

In addition to the annual sediment yield, culvert replacements will result in the greatest source of short-term sediment delivery, described below (Road Reconstruction project element), estimated at a one-time impulse of about 14.5 cubic yards (about 0.5 cubic yards per culvert – 26 replacements and 3 removals from decommissioning). It is important to note that the proposed culvert replacements/removals will result in stabilization of approximately 3,625 cubic yards of existing at-risk fill material. Modeled increase in sediment yield is expressed as a percent increase/decrease from the no action alternative for the proposed action in Table 32.

Effects of the Action by project element:

1) Timber Falling

a) Proximity: Within the primary shade zone, trees will be felled toward channels and left in place to construct yarding corridors (units described in Table 33). Otherwise trees will be fallen away from channels, toward yarding equipment and landing sites. Six of 38 corridors over intermittent waterways are closer than 1 mile in proximity to LFH (one stream in Unit 36 is 2,800 feet to LFH) otherwise corridors over all waterways, perennial and intermittent, are greater than 1 mile away.

Table 33. 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		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		6	2,800
40	20	5	0	9	6,200	0	
45	15	20	0	10	11,000	4	tributary to perennial stream
47	0	29	0	7	13,800	0	
51	0	18	0	2**	5,600	6**	tributary to perennial stream
82	0	26	0	6*	No Connection	0	
84	0	20	7	0		3*	No Connection
88	0	8	23	0		4*	No Connection
91	17	18	0	2*	No Connection	0	
841	0	22	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.

b) Probability: Due to small tree diameters and lack of movement once a corridor tree is felled into the channel to create a yarding corridor, the likelihood of sediment mobilization to LFH is low. Minimum stream buffer width of 30 feet on intermittent streams, equipment setback requirements, and directional falling requirements carry low likelihood providing sedimentation to stream channels (Rashin et. al 2006). Distance of timber harvest activity to LFH and in several cases, absence of surface connection between harvest activity and LFH further reduces risk of fine sediment transport to LFH. In addition, the area of effect of openings adjacent to channels for corridors is only 1.6 acres - 0.06% of the 2,531 riparian reserve acres on federal land in the 6th Field sub-watershed. Considering absence of movement of corridor fallen trees, the small area of effect, and the distant proximity to LFH, the probability of sediment transport to LFH from timber felling is **discountable**.

Element Summary: At the site level, there may be some transport of sediment when trees are felled near streams for skyline corridors. However, considering the absence of movement of corridor fallen trees, the small area of effect, and the distant proximity to LFH, the level of sediment transport to LFH from timber felling is immeasurable and therefore **discountable**.

2) Timber Yarding

a) Proximity: The proximity of each unit to LFH is described in Table 2. Most of the streams within units do not have surface connection with the McKenzie River (LFH). There are three tributaries with surface connection to LFH that have harvest units in the uplands. These channel lengths from the closest unit to the McKenzie River (LFH) are as follows:

- *Mill Creek:* Unit 49 = 6,200 feet; Unit 36 = 2,800 feet
- *Unnamed Tributary through Tokatee Golf Course*: Unit 51 = 5,700 feet
- *Tributary from Southwest Side of Project Area:* Unit 21= 900 feet; Unit 15 = 3,600 feet; Unit 12 = 6,900

b) Probability: Mitigation measures restrict the proximity that ground-based equipment can approach perennial channels (120 feet). Use of existing skid trails and designation of new trails is expected to minimize ground disturbance by ground-based equipment. Rashin's research indicated a high degree of effectiveness in reducing transport of sediment to small order streams when 10 meter equipment setbacks and 10 meter stream buffers are incorporated into Best Management Practices. Actual equipment setbacks included as mitigation in the Bridge project range from 15 meters (50 feet) for non-fish bearing intermittent streams, to 36 meters (120 feet) for fish bearing and perennial streams. This represents a setback width this is at a minimum 50% greater than those found effective at reducing sediment yield found by the Rashin research. Best Management Practices in addition to those recommended by Rashin are described in Table 13 (elements 5-14) and have been found effective at reducing sedimentation resulting from timber harvest activity. Due to the limited extent of stream adjacent area subject to ground-based harvest, and mitigation measures to minimize potential ground disturbance, the likelihood of soil mobilization and alteration of listed species habitat is very low. Skyline yarding presents some increased potential, but due to small tree diameter and at least partial suspension, the likelihood of soil mobilization with skyline yarding is low. Helicopter yarding also presents a low risk of soil disturbance.

The presence of ground-based equipment presents minor increased risk of mobilization of sediment at the site-scale. Mitigations minimize potential negative effects with restrictions on equipment type and proximity to channels. Full suspension requirements while yarding over perennial channels will minimize potential mobilization of sediment. Where yarding occurs over intermittent channels and full suspension is not possible, mitigations will require yarding over dry channels only, including yarding over trees fallen into the channel to create a corridor.

The three tributary drainages (with harvest units) to the McKenzie River (LFH) all pass through a wide, porous glacial terrace before entering the McKenzie River. These lower reaches serve as depositional reaches, not transport reaches, and therefore provide opportunity for sediment to settle out before reaching the McKenzie River.

At the site scale there may be some sediment transport to streams. However, due to mitigation measures, hydrologic disconnection and distant proximity to LFH, stream channel length and complexity below units, and presence of a glacial terrace to facilitate sediment deposition, the probability of transporting sediment to LFH is near zero and therefore **discountable**.

Element Summary: At the site-scale, in the upland units, there may be a slight, short-term negative effect. However, due to the hydrologic disconnection and distant proximity to LFH, stream channel length and complexity below units, and presence of a glacial terrace to facilitate

sediment deposition, the probability of transporting sediment to LFH is immeasureable. Therefore, timber yarding will have a **discountable** effect on the sediment indicators.

3) Timber and Rock Hauling

a) Proximity: Timber haul with closest proximity to LFH occurs largely along Hwy 126 (paved), Road 1900 near the South Fork McKenzie River (paved) and Road 1900-408 (aggregate surface, 1,400 feet to LFH, Table 6). Timber haul within 0.5 mile of LFH in the South Fork McKenzie sub-watershed consists of 925 truck loads crossing Pond Creek on Rd 1900-408 (east) to lower South Fork McKenzie River. Paved approaches and a paved crossing of the South Fork McKenzie River itself occurs on lower South Fork McKenzie River and over LFH. This road is paved for about 0.5 miles on one side of the bridge and for miles on the other. The same 925 loads would cross the South Fork McKenzie at this point (river mile 2.3).

Approximately 2,119 loads would cross Quartz Creek Bridge on Rd 1900-408, heading west (Table 6), immediately adjacent to LFH. This bridge is paved for at least 500' on one side, and paved to Hwy 126 on the other, with a paved crossing.

b) Probability: Road origin sediment yield is distributed across the landscape and is dependant upon road surface type, location and intensity of road use. The total volume mobilized due to timber haul (approximately 26 cubic yards per year of haul) will not all reach stream channels. A significant portion will be stabilized in vegetation (through ditch relief culverts) or into channels with no surface connection to the McKenzie River. The volume of sediment mobilized into stream channels with direct surface connection to the McKenzie River is dependant upon ditch length, adjacent vegetation and road surface area immediately tributary at each stream crossing. Aggregate surface haul routes with close proximity to LFH are on Rd 1900-408 (east) Pond Creek crossing 1,400 feet upstream of LFH. Ditch length and potential road surface contribution to Pond Creek total 100 feet of road. This small surface area is estimated to yield about .008 cubic yards of mobilized fine sediment per year, delivered to perennial Pond Creek downstream of the crossing. The low volume of fine sediment delivered at this crossing is not expected to arrive in LFH/CH in measurable quantity or present risk to LFH/CH (due to small volume, distance and channel storage). The Road 1900-408 (west) crossing of McKenzie River has paved approaches on both sides of the river. The north approach is entirely paved with connection to Hwy 126. The south approach is 500 feet of pavement, sloping away from the river before turning to aggregate. Well vegetated ditch lines act to stabilize sediments adjacent to aggregate surfaces. Observation of this area during haul from Quartz Creek drainage (Rosboro Lumber Co; including wet weather haul) yields fines to vegetated surfaces between the road and river, with no apparent overland flow or sedimentation to LFH. Aerially delivered dust to surrounding vegetation adjacent to Pond Creek and Quartz Creek bridge is probable with timber haul, but at levels discountable (due to watering mitigations; Table 13, measure 4). The overall probability of sediment reaching LFH is low.

c) Magnitude: The quantity of fine sediment delivered will be of small volume (a fraction of the estimated 26 cubic yards mobilized over 36 miles of haul route), delivered consistently during the haul period. A small increase in sediment yield associated with timber hauling and road work is anticipated, with net sediment yield a slight increase over background levels. Volumes of fine sediment delivered to LFH is believed not measurable at tributary junctions to LFH. There is a short-term negative influence presented by project haul activity (compared to no activity), but at an **insignificant** level. Project mitigations, including watering of road surfaces during dry periods of haul, are expected to reduce sedimentation.

Element Summary: A short-term negative effect is expected to occur with timber haul activity. The magnitude of effect, however, will be a slight increase over background levels, transmitted during the season of haul. The severity of effect is expected to be **insignificant** and is not expected to exceed listed species ability to utilize habitat or to cause avoidance of areas of local effect.

4a) Road Reconstruction, Culvert Replacement, Rock Pit Development and Road Decommissioning

a) Proximity: 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, the distance of culvert replacements at stream crossings with surface connection to LFH is no closer than 1 mile (Table 7). Similarly, the Mill Creek Rock Pit has no connection to nearest surface water (Mill Creek is over 1,000 feet away), and the pit is located 1.6 miles from LFH. A well vegetated buffer exists between potential overland routes and the rock pit.

b) Probability: It is not possible to do this work without some sediment displacement. A number of culverts will be replaced that are currently in poor repair or inadequately sized to pass Q100 flows. Replacement will require in-stream work in perennial crossings. 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. 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 minor increase in sources of suspended sediment. Decommissioning of road surfaces and culvert removal will similarly be required to meet seasonal restrictions, limiting the transmission of fine sediment. Accurate estimates are not predictable, but depending on weather behavior and other variable factors, sediment yields should fall between 0.1 and 1.0 cubic yards per installation based on professional experience. Because some culverts to be replaced are in poor condition or undersized for Q100 flows, their current condition presents an elevated risk of failure.

Engineering personnel estimated average fill volume of 125 cubic yards. This material is at risk of entering the streams and potentially generating debris torrents if the existing culvert fails. Concurrent with culvert replacement will be resurfacing of the same haul routes, and an expected reduced rate of fine sediment transmission into waterways

c) Magnitude: Local disturbance and sediment delivery resulting from culvert replacements in the action area totals about 14.5 cubic yards – approximately 0.5 cubic yards per culvert (26 replacements and 3 removals for decommissioning). Pathways for increased sediment yield are advantageous on many tributaries to the McKenzie River and present negligible risk of affecting listed species habitat (few channels with surface connection to the McKenzie River). Those channels with direct connection to the McKenzie River (Mill Creek and a few unnamed tributaries) have limited potential to transmit sediment to listed species habitat due to: distance removed from LFH greater than 1 mile for surface connected channels; low gradient glacial terrace adjacent to the McKenzie River in the action area; channel complexity and storage capacity; and additional areas of sediment deposition such as golf course ponds and wetlands

within the glacial terrace. Table 7 describes road crossing/culvert proximity and connectivity to LFH.

Mitigation methods to minimize mobilization and trap fines may be expected to reduce a portion of this amount. Beyond the short-term, a reduction in the rate of crossing failure is also likely following culvert replacements and can be expected to result in a further reduction in sediment yield. A fraction of the concentrations described above would be expected to be actually suspended, and are not expected to negatively effect listed species, or to incrementally increase background levels to a significant level to cause negative effects. Spring Chinook salmon in the vicinity of the McKenzie River/Elk Creek sub-watershed are known to use the area as spawning and rearing habitat, and bull trout as foraging habitat. Under conditions of a fall/winter first storm, both species are expected to exhibit avoidance behavior in response to turbid tributary conditions, and temporarily vacate turbid water (66-88 mg/l) (Newcombe and MacDonald 2001). Effects to spring Chinook spawning habitat located downstream of confluences, is also considered insignificant, due to the small volume of potential increase in the short-term.

The volume of fine sediment mobilized due to culvert replacement may be expected to have a slight negative effect on this indicator, but the quantity is considered **insignificant**. A longer term stabilization of stream crossings in the sub-watershed is expected to contribute to reduced rates of road generated sediment and mobilization of sediment for the life of the replacement culverts (~ 50 years). This reduction is expected to occur at an insignificant level (approximately 18 cubic yards/year).

Potential sediment flushes typically occur during the first fall/winter significant storm (> bankfull event or 1.5 year recurrence interval) and potential increases in road related reconstruction sediment yield would be expected at this point in time. Storm duration is usually several days long. Individual timber sales are expected to occur over a 3 year period, with associated road work in the vicinity of units occurring prior to thinning activity.

Element Summary: A short-term negative effect to this indicator, but **insignificant** in quantity of sediment mobilized during the seasons of culvert replacements and road reconstruction. Localized increases in turbidity during and following the season of culvert replacement, is believed to remain within the habitat needs of listed species.

4b) Semi-Permanent Road Construction

a) Proximity: Implementation of Bridge Thin project would require construction of 4.8 miles of semi-permanent road. Upon completion of sale activities, semi-permanent roads would be decommissioned and re-vegetated. With the exception of two stream crossings in Unit 2, no semi-permanent roads are located within riparian reserves (Figure A-8). Two intermittent channels are crossed by Unit 2 semi-permanent road. No surface connection to the McKenzie River is present in these crossings. During most flows, the tributaries crossed in Unit 2 go subsurface as they reach the McKenzie River glacial terrace, with no surface connection to the McKenzie River. At high flows, they flow into a series of ponds and wetlands at the base of the slope.

b) Probability: All semi-permanent roads to be constructed are situated on stable terrain and, with the exception of Unit 2, are outside of riparian reserves. These conditions make transport of sediment from disturbed soils unlikely and of low risk, and consequently no measurable amount of sediment is expected to reach stream channels as a result of road construction activity. Probability of negative effects is low. The intensity and severity of this activity are reduced with

seasonal (dry season) restrictions on semi-permanent road construction and road decommissioning activities. Erosion control features at the two stream crossings and culvert removal points will be necessary. With mitigation measures in place, the probability of effect is **discountable**.

Element Summary: The low probability of mobilized sediment from semi-permanent road construction results in a **discountable** level of negative effect.

5) Fuels Treatment

Proximity: Fire prescriptions are just outside the primary shade zone of perennial and intermittent waterways tributary to LFH, to well upland - 0.2 mile or greater (individual unit proximity to LFH is described in Table 2). Oak savannah fire treatment Units 84, 85, and 86 have no surface connection to the McKenzie River (located 1,200 feet from the river or further). Fuel treatment buffers on channels are 60 feet from perennial and fish-bearing channels; 30 feet from intermittent channels.

Probability: Fire treatment prescriptions are focused on burning during periods of low risk, when spring-like conditions are present, and potential to carry into the crown and damage to duff layers is low. No units are prescribed for regeneration harvest and broadcast burn will not be used. Due to the immediate proximity of rural properties, a cautious use of fire in fuels treatment is prescribed. Burning activity will occur during spring-like conditions when soil and duff moistures are high enough to avoid loss of duff and mobilization of soil (desired burn intensity is low to conserve soil resources). Minimal fire backing into riparian reserves is expected in fire treatment stands due to site conditions (unit aspects and moist season burning). Fire line will not be dug within riparian reserves. With no construction of fire line in riparian reserves and low risk burning, the probability of effects will be **discountable.**

Element Summary: A **discountable** negative effect upon sedimentation/substrate embeddedness from fire treatments is expected.

Indicator Summary:

A very small portion of project generated fine sediment will reach the McKenzie River due to absence of surface hydrological connection across stable glacial terraces, floodplain landforms and soils. Several project elements have short-term negative effects upon the indicator of sedimentation to aquatic habitat. Cumulatively, these project elements do not add significant quantities of sediment beyond the “no-action” level of sediment yield (existing background levels) to place listed species or their habitat at risk. Short-term and localized increases in the rate of sedimentation delivered throughout project activities are considered an **insignificant** quantity that will not harm bull trout, spring Chinook, or their habitat.

Chemicals/Nutrients	Baseline Condition	
	Action Area	HUC6
	PF	PF

1) Timber Felling, 2) Timber Yarding, 3) Timber and Rock Hauling, 4) Road, Rock Pit and Landing Work, 5) Fuels Treatment

a) Proximity: A variety of project elements could occur between 30 and 300 feet from live streams with some hauling occurring directly over LFH and some road maintenance and reconstruction occurring upstream of LFH.

b) Probability: Although each of the project elements utilize petroleum based fuel, standard protection measures have been shown effective at reducing the probability of water contamination. Long-term monitoring of accidental spillage and contamination rates during similar projects implemented on the Willamette N.F. indicate that these types of events occur very infrequently. Therefore, the probability of a chemical contamination is **discountable**.

Risk of transmission of ignition fuels (gel fuels used to ignite slash piles) to waterways is discountable due to the long distance slash piles are located from channels. Increased nutrient supply to channels is greatest in underburn units (up to 1,514 acres) in which fire is allowed to back down into no-treatment buffers. Increased quantities of nitrate and phosphate may be available to the channel. However the small area of effect, location of burn beyond the riparian reserve, and rare occurrence of natural fire with fire suppression, reduce potential increases in nutrients to aquatic habitat to less than available within the historic fire regime. With precautionary measures in place to keep fire intensity and severity low near stream channels, the probability of affecting nutrient concentration is **discountable**.

Indicator Summary

Potential contaminants used with project implementation are not likely to enter the stream network. Risk of transmission of ignition fuels to stream channels is discountable. Potential increases in nutrients due to fire backing down into the no-treatment buffers will not be more than what was available within the historic fire regime. Therefore, there may be a slight negative but **discountable** effect on the indicator.

Physical Barriers	Baseline Condition	
	Action Area	HUC6
	PF	PF

Indicator Summary:

All elements have no causal mechanism to affect this indicator; they will have a **neutral** effect.

Large Woody Material	Baseline Condition	
	Action Area	HUC6
	PF	PF
Pool Frequency and Quality	Baseline Condition	
	Action Area	HUC6
	NPF	NPF
Large Pools	Baseline Condition	
	Action Area	HUC6
	NPF	NPF
Off-Channel Habitat	Baseline Condition	
	Action Area	HUC6
	FAR	FAR
Refugia	Baseline Condition	
	Action Area	HUC6
	NPF	NPF
Ave. Wetted Width/Max. Depth Ratio (in scour pools)	Baseline Condition	
	Action Area	HUC6
	NPF	NPF
Streambank Condition	Baseline Condition	
	Action Area	HUC6
	FAR	FAR
Floodplain Connectivity	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

The indicators listed above are grouped in the effects analysis because they are interrelated and effects realized by the stream indicators are primarily affected by changes to the large woody material indicator. Therefore, the effects analysis will focus on the project effect on the delivery potential and supply of large woody material.

a) Proximity: A variety of project elements occur between 30 and 300 feet from perennial streams with some hauling occurring directly over LFH and some road maintenance and reconstruction occurring upstream of LFH, with some potential to affect habitat conditions. There are no harvest units adjacent to LFH. Timber harvest Unit 23, the closest of the project units to the McKenzie River, is an overland distance of 490 feet (Table 2). All trees will be retained within the Stream Influence Zone along LFH.

1) Timber Felling

b) Probability: Timber falling has the greatest potential to influence aquatic habitat condition and influence the indicators described above, due to the removal of woody material mass and reduction of recruitment potential. As described in the riparian reserve indicator section, there is

a very small likelihood of diminished in-stream wood supply from acres of riparian reserve thinned (Table 2), in part due to the small diameter of stem currently present, tree height, and the small area of thinning within the 100 foot zone adjacent to tributary channels. Removal of wood mass would influence future wood supply (immediately adjacent to tributary channels, generally within 100 feet) for a period estimated at 40 years. Debris torrents and material migrating to the McKenzie River channel are not a prevalent habitat forming processes in this 6th field sub-watershed. Rather, contribution to mainstem McKenzie River habitats is stream adjacent recruitment. There are no commercial thinning activities adjacent in the proposed action adjacent to the McKenzie River. The probability riparian reserve thinning would negatively affect habitat building, sediment storage capacity or floodplain processes in LFH is very low. An accelerated rate of stem development and tree height in even-aged stands is expected to contribute a greater diversity of significant sized LWD (>24 inch DBH), but the small overall area of treatment in riparian reserves is not expected to contribute significantly to future in-stream wood quantity in LFH for the same reason.

As described in Table 2, approximately 344 acres of riparian reserve (out of 492 acres) within project units would have thinning or fuels treatment activity. No harvest buffers (Table 1) will maintain trees immediately adjacent to channels for short, mid, and long term recruitment. However, thinning in the remainder of the riparian reserve could cause short term reductions in wood delivery to stream channels within proposed timber harvest units. These effects on tributary streams to LFH (the McKenzie River) are not expected to be negative for the following reasons:

- Many of the streams do not have surface connection to the McKenzie River. This is due to the porous and permeable nature of the glacial fill in the McKenzie River valley. Valley fills have been drilled to 146 feet in the Blue River area, and 175 feet in the McKenzie Bridge area (Williamson 1961 as cited in the Upper McKenzie Watershed Analysis 1995).

- Only 344 acres of riparian reserve out of 2,531 acres (13.6%) of riparian reserve on federal land in the 6th field sub-watershed would have thinning or fuels treatment activity, and this activity will not remove any trees from the streamside direct recruitment zones.

- There are 3 streams where timber harvest would occur in riparian reserves that do have a surface connection, but there is significant stream length on each of these tributaries that would not have any timber harvest (on federal lands). These areas of “no harvest” would provide a range of conditions to the riparian reserve system in this 6th field:
    - Mill Creek has approximately 5.1 miles of stream length (on federal land) that will not have any timber harvest within riparian reserves (Figure A-5).
    - An unnamed tributary that flows through the golf course has approximately 2.5 miles of stream length (on federal land) that will not have any timber harvest within riparian reserves (Figure A-5).
    - An unnamed tributary on the south side of the McKenzie River and the eastern portion of the project area has approximately 2.0 miles of stream length (on federal land) that will not have any timber harvest within riparian reserves (Figure A-4).
- The mechanism for woody material to reach LFH in this 6th field is not due to debris flows that transport wood. Woody material in this 6th field comes from two sources: bank-side sources along the McKenzie River, and fluvial transport from sources further upstream in the river system (e.g. Deer Creek, and Horse Creek). Trees that fall into tributary

streams in this 6th field tend to stay where they fell, or if transported downstream for any distance will settle on the glacial terrace before reaching LFH (the McKenzie River).

c) Magnitude: Due to the relatively small portion of 6th field sub-watershed riparian reserve (on federal land) thinned -13.6% -, the minimal probability to influence current in-stream wood density with significant wood, and the amount of stream length that will have no timber harvest, the magnitude of project effect as a primary habitat forming component is **insignificant**. There is a slight negative effect on immediately available supply to tributary streams as described earlier, but this is not expected to translate into a negative effect on habitat indicators in LFH. A slight positive effect is expected in the future as the recruitment supply attains the desired diameters exceeding 24 inches (>40 years), and those trees function to store sediments and contribute to habitat formation. That level of benefit is expected at the site scale and is seen to benefit native species such as cutthroat trout and brook lamprey using tributary channels for some portion of their life history.

Element(s) Summary: Project design is intended to contribute large tree diameters to stream adjacent stands that have been previously managed. There is a current under-abundance of trees measuring greater than 24 inches in diameter in the sub-watershed that reflects past management effects upon riparian reserve composition. Acceleration of even-aged riparian reserve at this point in time is not expected to influence currently available significant wood, nor the immediate volume of in-stream wood.

Riparian thinning is not expected to result in negative effects to LFH given the following rationale: many of the tributary streams do not have a surface connection due to the porous and permeable nature of the glacial valley fills; only 13.6% of the riparian reserve on federal land within the 6th field sub-watershed have thinning or fuels treatment activities; there are approximately 9.6 miles of stream channel in the 6th field sub-watershed that will not have any thinning activity; and down woody material in tributary channels are highly unlikely to reach LFH. For these reasons, the slight negative effects due to riparian thinning on listed species habitat are expected to be of **insignificant** magnitude**.**

2) Timber Yarding and 3) Timber and Rock Hauling

There is no causal mechanism for these elements to affect the above indicators.

4) Road, Rock Pit and Landing Work, 5) Fuels Treatment

b) Probability: Other project elements have causal mechanisms limited by landscape processes to affect these indicators. Road reconstruction, culvert replacement, rock pit development and fuels treatment may have a slight negative effect of **insignificant** magnitude to these indicators as influenced by the Sediment indicator and described in the Sediment/Substrate Embeddedness effects discussion (for example, pool quality as affected by increased sediment supply would occur at a discountable level – i.e., the level of pool filling from increased fine sediment would be negligible).

Indicator Summary:

The slight **negative** effects to habitat indicators from removal of woody material are **insignificant** in magnitude. The probability of affecting the habitat indicators from road reconstruction, culvert replacement, rock pit development and fuels treatment is considered **discountable**. Other project elements will have a **neutral** effect on these indicators.

Change in Peak/Base Flows	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

1) Timber Falling, 2) Timber Yarding:

a) Proximity: Timber felling and yarding will occur up to 60 feet from perennial channels, but over 0.5 mile from LFH.

b) Probability: Effects of proposed harvest activities could be expected to be greatest immediately after implementation. Timber removal in the Bridge Thin Project is anticipated to be completed by 2012.The probability of affecting peak and base flow throughout the watershed with these project elements is low.

c) Magnitude: Timber felling changes the rate of evapotranspiration, increasing soil water and overall water yield. A short term (5-10 years) increase in discharge during the wet and the dry periods would occur from two mechanisms for the thinned stands. Increased snow accumulation (wet period) would create small increases in peak flows (Jones and Grant 1996), and reduced canopy (dry periods) would reduce transpiration rates which would account for small increases in summer flows.

Land Resource Management Plan (LRMP or Forest Plan) direction recommends midpoint levels of recovered forest condition (closed canopy conditions of stands generally greater than 15 years old). Midpoint values are determined by site conditions and beneficial uses. In the proposed action, post implementation recovery levels drop from 88.31% to 88.26% when compared to the No Action alternative (Table 34). All planning sub-watersheds continue to exceed recommended Midpoint values in the LRMP. Movement of the ARP (% recovered) value toward the midpoint indicates a slightly negative effect, but of **insignificant** magnitude.

Table 34. Recovery Levels (ARP) Immediately after Project Implementation in the McKenzie River/Elk Creek Sub-watershed.

	ARP Value
Forest Plan MidPoint Standard	80%
No Action	88.31%
Proposed Action	88.26%

*ARP values are constantly recovering as previously harvested stands of trees grow and regain their hydrologic function. The values reported are the expected condition at a point in time 3 years from present, when projects will be in the midst of completion.

Element Summary: There is insignificant probability and magnitude of affecting the above indicators - ARP levels are well above midpoint values. There will be a slightly negative but **insignificant** effect to flow regimes from timber felling and yarding in the Bridge Thin Project area.

3) Timber and Rock Hauling

a) Proximity: Drafting of water for dust abatement will occur in six potential established drafting sites (outside of LFH) shown in Figure A-11. Four of the sites are located at Blue River Reservoir, and two sites are located in upper Mill Creek – 9,400 feet and 13,800 feet from LFH.

b) Probability: Drafting of water from Blue River Reservoir will have no effect on peak/base flows. Drafting from upper Mill Creek may occur during base flows, but will maintain 90% of the stream flow at all times. Mill Creek's flow near the confluence with the McKenzie River was 9.8 cfs on June 24, 1993. The mean monthly flow for the McKenzie just above Mill Creek in June is 2,510 cfs (USGS, 2004-2006). At that time of year – about the same time drafting would occur for dust abatement – Mill Creek has approximately 0.4% flow contribution to the McKenzie River. The probability of drafting having an effect on peak/base flows in the McKenzie River is considered **discountable**.

Element Summary: Because drafting will occur from a regulated reservoir and from a tributary with minimal flow contribution to LFH, and will maintain 90% of flow in the channel, the probability of affecting peak/base flows in the McKenzie River is **discountable**.

4) Road, Rock Pit and Landing Work

a) Proximity: Landing work will occur as close as 700 feet from LFH and road work will occur as close as 200 feet from LFH. Approximately 4.8 miles of semi-permanent road will be constructed in the action area.

b) Probability: No semi-permanent roads will enter riparian reserves, except for one road that crosses two intermittent streams with no surface connection to LFH (Unit 2; Figure A-8). These crossings will require surfacing or drainage features. The semi-permanent roads will exist for the season of timber harvest, then will be obliterated upon completion of harvest activity (may exceed 1 year). Compacted soil at landings and roads may increase water yield due to reduced soil storage potential.

c) Magnitude: Approximately 30 acres of new landing work will be affected in the action area. This element will only affect 0.1% of the sub-watershed. This will result in a near zero magnitude of effect, far below any detectible level. Road work such as ditch cleaning, ditch relief culverts and decommissioning will help increase infiltration and would not have a negative effect. The negative effect of road and landing work on the indicator will be **insignificant**.

Decommissioning 0.3 miles of road and removing three stream crossings in the sub-watershed may be expected to contribute to improvement of the flow regime, as well as ripping of historic skid roads. This would result in a slightly positive effect, but at an **insignificant** level.

Element Summary: An increase in road surface through semi-permanent road construction is expected to lead to a greater efficiency in the drainage network for a short-term, but at an insignificant level. A longer term improvement through reduction in road surface (0.3 miles) is expected to be insignificant as well. The slight negative effect from this project element is **insignificant** in magnitude and presents no risk to listed species or habitat.

5) Fuels Treatment

a) Proximity: Underburning will occur up to 30 feet from perennial streams and up to 60 feet from LFH. Underburning adjacent to LFH, however, will be buffered by paved roads (see discussion below.)

Drafting of water for fuels treatment will occur in six potential established drafting sites (outside of LFH) shown in Figure A-11. Four of the sites are located at Blue River Reservoir, and two sites are located in upper Mill Creek – 9,400 feet and 13,800 feet from LFH.

b) Probability: Underburning can cause creation of hydrophobic soils, where soil structure is damaged, water storage potential is reduced, and yield increased. The amount of acres proposed for underburning is approximately 7.3% of available acreage in the McKenzie River/Elk Creek HUC6 watershed. Based on past experience and monitoring of underburn projects, we estimate that the actual acreage that burned hot enough to adversely affect infiltration and result in runoff will be less than 1% (Shank and Kretzing, pers. com.). This barely exceeds enough disturbance to predict a change in over-ground water flow. Because acreage being burned is within thinned stands, the intensity of the fire will be minor and not all soil conditions will lose their ability to withhold water. Since APR levels would be well above midpoint, the probability of underburning having an effect on peak/base flows is **discountable**.

Drafting for fuels treatment will occur during spring-like conditions, when flows are well above base flow. Drafting water from Blue River Reservoir will have no effect on peak/base flows. Drafting from upper Mill Creek will maintain 90% of the stream flow at all times. Mill Creek's flow near the confluence with the McKenzie River was 9.8 cfs on June 24, 1993. The mean annual flow for the McKenzie in June is 2,510 cfs. At that time of year Mill Creek has approximately 0.4% flow contribution to the McKenzie River. Due to the miniscule contribution of Mill Creek, the probability of drafting having an effect on peak/base flows in the McKenzie River is considered **discountable**.

Element Summary: The small amount of acreage being treated with low intensity fire barely exceeds enough disturbance to predict a change in over-ground water flow. The ARP levels will stay well above the midpoint value. Maintaining 90% flow when drafting from Mill Creek will not measurably effect peak/base flows in the McKenzie River. Therefore, the effect on the indicator is considered **discountable**.

Indicator Summary:

Post implementation recovery levels (ARP) drop from 88.31% to 88.26% when compared to the No Action alternative, and are well above the midpoint value (80%). An increase in road surface through semi-permanent road construction (4.8 miles) is expected to lead to a greater efficiency in the drainage network for a short-term, but at an insignificant level. A longer term improvement through reduction in road surface (0.3 miles) is expected to be insignificant as well. The small amount of acreage being treated with low intensity fire, and even smaller area that will burn hot enough to affect soil infiltration, is not enough to measurably affect over-ground water flow. In addition, drafting for dust abatement and fuels treatment will not measurable affect peak/base flows in the McKenzie. Cumulatively, there may be a slight negative but **insignificant** effect on peak/base flows.

Drainage Network Increase	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

1) Timber Felling, 2) Timber Yarding, 3) Timber and Rock Hauling and 5) Fuels Treatment

These project elements do not have any causal mechanism to affect these indicators, therefore it is concluded that their implementation would result in a **neutral** effect.

4) Road, Rock Pit and Landing Work

a) Proximity: Approximately 35 miles of road reconstruction and maintenance and 4.8 miles of semi-permanent road construction will occur upland of LFH. New roads and landings will not be constructed within riparian reserves, except one semi-permanent road over two intermittent streams crossings. There is no surface connection from these streams to LFH. Numerous ditch relief culverts will be installed and 26 culverts will be replaced in the action area along the haul route (Table 7).

b) Probability: This work may result in a slight change in the drainage network.

c) Magnitude: Culvert replacements and new installs, combined with road-blading (restoring road crown) and aggregate surfacing may be expected to have an **insignificant** positive effect on the drainage network, as replacements are expected to decrease the probability of road failure and new placements and road treatments are expected to improve dispersal of road concentrated flow onto the forest floor.

New semi-permanent road construction will result in a short-term increase in road density and drainage network, so there will be an **insignificant** negative effect to this indicator for short duration (1-3 years).

Road decommissioning of 0.3 miles of existing road will have a long-term, positive effect to this indicator.

Element Summary: Cumulatively, the effects to drainage network will be result in a **insignificant** change in the condition of this indicator, due to the small level of effect in the sub-watershed.

Indicator Summary:

Timber felling and yarding, timber and rock hauling, and fuels treatment have no causal mechanisms to affect the drainage network indicator. Road reconstruction and maintenance is expected to slightly improve the drainage network by decreasing the probability of road failure improving the dispersal of road concentrated flow onto the forest floor. This positive effect, however, is insignificant when compared to the overall drainage network of the sub-watershed. There is very small potential to favorably influence drainage network through decommissioning of 0.3 miles of existing road. Cumulatively, the project elements will have an **insignificant** affect on the indicators.

C. Project Effects to Watershed Condition Indicators (WCI)

Per AP direction, the watershed condition indicators would not be evaluated using the eight factors or by project element. Instead, this BA would provide information about changes to WCI values/conditions as a result of the entire action.

ROAD DENSITY AND LOCATION	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

Effects of the Action - Indicator Summary:

This project will not construct any new permanent roads and semi-permanent roads used for yarding and log haul would be fully decommissioned after project implementation. A total of 0.3 miles of existing road will be fully decommissioned and removed permanently off of the road system. An additional 0.5 miles of road will be closed to access and hydrologically stabilized. The project will generate short term negative effects by increasing road density with semi-permanent roads, however this project will provide long term positive effects by decreasing road network and reducing the probability of road failure that would have an effect on aquatic resources and LFH. The effects would be **insignificant** due to the relative size of the McKenzie River/Elk Creek 6th Field sub-watershed.

DISTURBANCE HISTORY	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

Effects of the Action - Indicator Summary:

ARP values would not be significantly altered within the McKenzie River/Elk Creek 6th Field sub-watershed (Table 34). The ARP values will stay well above midpoint following completion of the project suggesting that harvest would not affect the hydrological functioning of these drainage basins. Consequently, no direct, indirect, or cumulative changes in flow regime are anticipated, and the negative effect to listed species habitat is **discountable.**

The resultant short term and long term effects on habitat indicators due to proposed actions in watershed disturbance condition is reflected in the effect discussions. It is not expected that there would be any additional or collective negative effects due to the change in this indicator, other then those identified in the non-WCI indicator assessments. This indicator would have an **insignificant negative** effect from the project in the short-term. However, as LSR conditions improve, the sub-watershed will experience an **insignificant positive** effect.

RIPARIAN RESERVES	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

Approximately 50% of federally managed land in the Elk/McKenzie River sub-watershed has been subject to timber management or road construction since 1930's. Project objectives include restoring a greater diversity (varying age and structural stages) of potential recruitment

wood in the sub-watershed. Most of the project area is located within previously managed timber stands and consists of thinning 32-80 year old plantations (Table 18). The remainder of privately owned and managed land is largely of a young age (industrial timberlands managed on an approximate 40 year rotation) and/or developed as private or rural residential property. Only 344 acres of riparian reserve (13.6%) out of 2,531 acres of riparian reserve on federal land in the 6th field sub-watershed would have thinning or fuels treatment activity.

The desired benefit of thinning in riparian reserves is the influence on stand structure and the development of large diameter trees. The even-age character of managed stands ranging in age from 32-80 years, is expected to respond favorably to thinning in terms of growth rate. Once thinned, riparian reserve stands are expected to provide a greater degree of diversity of size in the long-term within the Elk/McKenzie River watershed as compared to non-thinning of reserves.

Plantation trees thinned in project area riparian reserves are expected to accelerate stream adjacent trees toward diameters considered better suited to provide stable in-stream large woody material. Within 40 years, stream adjacent trees thinned in this project, will begin to approach the size considered "significant" (greater than or equal to 24 inches in diameter at breast height) to function as in-stream sediment storage elements and valuable in aquatic habitat development. The future rate of wood recruitment to channels following thinning will depend largely upon natural disturbance events such as wind-throw and snow-down, flood, and fire. The current thinning proposal will be the last entry into these reserves under forest plan direction.

Portions of the riparian reserve that remain un-thinned are within 60 feet of perennial channels. That portion of the reserve will remain unmodified by the proposed action, and dependant upon natural disturbance processes for wood recruitment. The exceptions are openings created by skyline corridors in Unit 51 (over a fish-bearing channel) and Units 11, 12, 40, 45, 47, 51, 82, and 91 (non fish-bearing perennial channels) described in Table 33. Along skyline corridors some release of plantation trees would occur and be expected to accelerate tree growth. Trees yarded through skyline corridors will require full suspension over perennial waterways. Channels adjacent to skyline corridors will receive a management induced pulse of in-stream wood that will be left in place.

As this landscape rarely transports the products of disturbance, recruited material has little opportunity to migrate to listed fish habitat. Improvements in riparian stand diversity are expected to be of greatest benefit to resident fish, primarily cutthroat trout and brook lamprey.

Due to project area of riparian reserve treatment (13.6% of riparian reserve area in federally managed Elk/McKenzie sub-watershed), the influence over the long term on stand structure and future large wood recruitment will be minor on the 6th field scale. A short-term reduction in woody material recruitment supply will follow removal of thinned trees, generally within 60-100 feet proximity of perennial channels. Over the longer term, site specific benefits are expected to provide for a greater diversity of woody material available to aquatic habitat. Aquatic habitats currently characterized as simplified may be expected to improve in substrate storage and habitat complexity, improving their ability to meet aquatic life history needs at the site scale.

A short-term **negative** effect to this indicator is expected in the Elk Creek/McKenzie sub-watershed, due to a reduction in stream adjacent recruitment potential of woody material. A longer-term **positive** effect is expected as riparian stand diversity and diameters increase. Due

to the low probability recruited material will migrate, the short and long term effects are **insignificant** to listed species habitat.

Fire prescriptions range from just beyond the primary shade zone of perennial and intermittent waterways tributary to listed species habitat, to well upland; 0.2 mile or greater. Fire treatment prescriptions are focused on burning during periods of low risk, when spring-like conditions are present, and potential to carry into the crown is low. No units are prescribed for regeneration harvest and broadcast burn will not be used. Due to the immediate proximity of rural properties, a cautious use of fire in fuels treatment is prescribed. Burning activity will occur during spring-like conditions when soil and duff moistures are high. Minimal fire creeping into riparian reserves is expected in fire treatment stands due to site conditions (unit aspects and moist season burning). Fire line will not be dug within riparian reserves.

Due to the low intensity of fire used and relatively small area treated by understory burning, there is a low level of effect of fuel treatment upon this indicator. Understory burning and treatment of management-induced fuel loads are proposed. Due to the timing of fire use, a **discountable** effect upon riparian reserve stand composition is expected.

Indicator Summary: Timber falling has short-term, **insignificant negative** effects upon the indicator of riparian reserves (also see discussion on large woody material indicator), but all other project elements will have **discountable** effects. All project elements combined do not reduce significant quantities of wood recruitment supply to listed fish habitat (beyond the "no-action" condition of wood recruitment supply) to place listed species or their habitat at risk. A reduction of recruitment supply through project activities is considered **insignificant** to listed fish habitat due to landscape transport processes.

DISTURBANCE REGIME (NATURAL PROCESSES)	Baseline Condition	
	Action Area	HUC6
	NPF	NPF

Effects of the Action: Indicator Summary:

This project would have a short-term negative effect of insignificant magnitude on this indicator at the action area scale. There would be no change to the vegetation class, rather a moderate thinning of an overstocked Douglas-fir stand to a stand more likely to reach large tree seral class more quickly. In the short-term, there will be a negative effect realized to LFH by increased sediment that is insignificant at the site scale level within the McKenzie River/ Elk Creek 6th Field sub-watershed. Longer term, this project would have a positive effect, as the remaining trees mature and road condition is improved. At the larger Quartz Creek HUC5 watershed, the limited extent of this project would not result in a measurable shift in the overall condition for the basin. Hence, the project would have an **insignificant** effect, both **positive and negative** to the disturbance regime indicator.

D. Project Elements and Effects Occurring Outside the McKenzie River/Elk Creek 6th field Sub-watershed:

South Fork McKenzie/Cougar Creek 6th Field portion of 3) Timber and Rock Haul

a) Proximity*: Timber haul in proximity to spring Chinook and bull trout Critical Habitat in the South Fork McKenzie sub-watershed consists of 925 truck loads crossing an unnamed tributary to lower South Fork McKenzie River on an aggregate surface. Proximity to listed fish habitat is 1,400 feet from this crossing. Paved approaches and a paved crossing of the South Fork McKenzie River itself occurs on lower South Fork McKenzie River and over Critical Habitat. The same 925 loads would cross the South Fork McKenzie at this point (river mile 2.3).

b) Probability: Delivery of road origin fine sediment would be expected at the unnamed tributary crossing. No measurable quantity of fine sediment would be expected at the paved crossing or from paved Rd 1900. Aerially delivered dust to surrounding vegetation adjacent to the unnamed tributary is probable with timber haul in the South Fork McKenzie River sub-watershed. The probability of these project elements having a negative effect on the suspended sediment indicator is low.

c) Magnitude: The quantity of fine sediment delivered will be of small volume, delivered consistently during the haul period. Project mitigations, including watering of road surfaces during dry periods of haul, are expected to reduce dusting at the unnamed tributary crossing. The magnitude of effects will be **insignificant**.

Element Summary: A slight negative impact to the suspended sediment indicator is expected in the South Fork McKenzie sub-watershed (slight increase over background levels), due to the proximity of Rd 1900-408 to the South Fork McKenzie, but **insignificant** in terms of quantity or potential negative impact to listed species or their habitat. The magnitude of effect in the South Fork McKenzie is similar to project hauling effects elsewhere in the project area (McKenzie River/Elk Creek 6th field sub-watershed), which were also considered **insignificant**.

McKenzie Bridge 6th Field portion of 1) Timber Felling and 2) Timber Yarding

a) Proximity: A small portion of unit 54 is located in McKenzie Bridge 6th field watershed (3.5 acres). No portion of the unit is located within riparian reserve. Proximity to listed fish habitat is 0.7 mile.

b) Probability: No surface connection to the McKenzie River is available from the nearest intermittent channel, so there is minimal chance for transport of sediment generated by ground disturbance to the McKenzie River. Therefore, probability of negative effects to listed fish or LFH is **discountable.**

Element Summary: No portion of Unit 54 is within riparian reserve and the nearest stream has no surface connection to LFH. Therefore, probability of effects to listed fish and LFH is **discountable**.

E. Project Effects to Population Indicators for Bull Trout

The AP directs the assessment of population indicators when recovery plans are available for listed species. For this project, a draft recovery plan for Columbia River bull trout is currently in use. The effects to population indicators (population size and distribution, growth and survival, life history diversity and isolation, and persistence and genetic integrity) are analyzed below.

POPULATION SIZE AND DISTRIBUTION:
Implementation of Bridge Thin project is not expected to result in bull trout take. Project and cumulative effect to bull trout or their habitat is judged **insignificant**. In the absence of significant direct, indirect or cumulative impacts to water quality and habitat, bull trout population and distribution is expected to be maintained. Improving diversity and quality (diameter) in riparian plantation stands is expected to contribute to improved stand composition in the 6th field. However, minimal opportunity for significant sized large woody material migration into bull trout habitat exists in this sub-watershed (and to positively affect habitat, population and distribution).

GROWTH AND SURVIVAL:
Project related effects to habitat in the McKenzie River are either **discountable** or **insignificant**. Potential effects to bull trout foraging and migration habitat are similarly of discountable probability. The bull trout life stages present adjacent to the project area would not be negatively affected in terms of growth and survival. Bull trout utilization of McKenzie River/Elk Creek sub-watershed is expected to continue unaltered.

LIFE HISTORY DIVERSITY AND ISOLATION:
The Bridge Thin project would have **no effect** on migration avenues, water quality or habitat to place bull trout life history needs at risk.

PERSISTENCE AND GENETIC INTEGRITY:
Although the mainstem McKenzie River bull trout sub-population is at elevated risk for loss of genetic variation, there is no causal mechanism for the proposed action to affect these indicators. As no project level effect to habitat or watershed indicators could lead to the reduction of bull trout population size, there is **no effect** to bull trout genetic persistence and integrity.

F. Project Effects to Primary Constituent Elements (PCEs) of Upper Willamette River Spring Chinook Salmon Critical Habitat

Only PCEs 1-3 are found within the 6th field sub-watershed. Existing condition of these PCEs is described baseline conditions:

Freshwater Spawning Sites:
Potential project influence on spring Chinook salmon spawning habitat is described in Substrate effects discussion. Fine sediment yield, primarily from culvert replacement, road work, timber yarding and timber haul do not add sufficient quantities to negatively affect spawning habitat. The rationale for considering sediment delivered of insignificant quantity is due to: 1) the low density of surface water connection directly to the McKenzie River along much of the project area; 2) distance of ground disturbing activity from Critical Habitat; and 3) with the exception of culvert replacement, absence of concentrated areas of disturbance (generally non-point supply

of fine sediment). Risk of Bridge Thin project negatively affecting Spring Chinook spawning habitat or Chinook spawning survival is **insignificant**.

Freshwater Rearing Sites:

Potential project influence on spring Chinook rearing habitat is described in Habitat Indicator effects, and exists primarily through the potential to influence habitat quality through woody material supply. Project potential exists in the removal of woody mass, of potential benefit to in-stream habitat condition. Timber thinning activities are not expected to negatively affect rearing habitat by the following rationale: 1) the low density of woody material migration routes in the project area; 2) no project thinning of McKenzie River adjacent stands would occur; 3) the quality of potentially recruited trees is of low current value as an in-stream element, due to small diameter. The risk of Bridge thin project negatively affecting Spring Chinook rearing habitat is **discountable**.

Freshwater Migration Corridors:

As described above, the Bridge Thin project will not modify the quality or quantity of habitat contributing to migration corridors. The risk of Bridge Thin project negatively affecting Spring Chinook migration corridors is discountable.

G. Project Effects to Primary Constituent Elements (PCEs) of Columbia River Bull Trout Critical Habitat

Critical Habitat has been designated for Columbia River bull trout in the Willamette River basin (Final Rule September 26, 2005). This designation includes some river segments within the McKenzie River / Elk Creek 6th field sub-watershed (HUC). The USFWS has determined there are 8 primary constituent elements (PCEs) essential for the conservation of bull trout. These are sites and habitat components that support one or more life stages, including:

Water Temperature

- Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72^{o} F (0 to 22^{o} C) but are found more frequently in temperatures ranging from 36 to 59^{o} F (2 to 15^{o} C). These temperature ranges may vary depending on bull trout life history stage and form, geography, elevation, diurnal and season variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude any bull trout are specifically excluded from designation;

Summary: All trees within the primary shade zone will be left on site. The exception is trees needed to be felled for yarding corridors. Since the majority of streams on the landscape are intermittent or go subsurface before reaching the mainstem McKenzie River there would be **a negative effect of insignificant magnitude**.

Complex Stream Channel

- Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.

Summary: As described in the factor analysis large woody material, off-channel habitat, large pools, and streambank condition there is a **discountable probability of negative effects** to attributes that comprise complex habitat features.

Substrate

- Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. Should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.

Summary: Road work, timber hauling, and road decommissioning have the potential deliver some small amounts of sediment to the mainstem McKenzie River. Since the majority of streams on the landscape are intermittent or go subsurface before reaching the mainstem McKenzie River there would be **a negative effect of insignificant magnitude**.

Hydrograph

- A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation;

Summary: As described in the factor analysis project level effects are well above ARP mid-point thresholds. This project would primarily thin already managed stands and recovery is expected to occur shortly after project completion. Therefore project effects to the hydrograph in this subwatershed would be **short term negative effects of insignificant magnitude.**

Seeps, Springs and Groundwater Sources

- Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source;

Summary: Springs, seeps, groundwater sources, and subsurface water would be protected by Best Management Practices and project design criteria. Skid trails would be located outside drainages, seeps, springs and/or concave landforms, which could accumulate and transport overland flow and sediment. Existing skid trails that are outside drainages, seeps and springs that meet the needs of the yarding system should be used wherever possible (Table 13). Therefore, the project should have **no effect** on these features.

Migratory Corridors

- Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows;

Summary: As described in the environmental baseline, this project does would not create any migratory barriers for bull trout (either physical or thermal). Temperatures are well within limits for bull trout migratory needs and shade trees will remain on site. Therefore this project will have **no effect** on migratory corridors.

Food Base

- An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish;

Summary: Samples that have been collected in this subwatershed have shown the macroinvertebrate community to have high biotic integrity. Shade and bank trees will be protected and this in turn will protect macroinvertebrate habitat. In addition road decommissioning should improve watershed conditions and provide for a reduction in sediment sources. However, since most streams are intermittent or go subsurface before reaching the McKenzie River the project would have a **positive effect of insignificant magnitude.**

Permanent Water Quality

- Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.

Summary: As described in the factor analysis changes in peak and base flows are possible but the effect would be insignificant. Best Management Practices and project design criteria would protect water features (streams, seeps, springs) on the landscape. Potential effects to bull trout reproduction, growth, and survival are unlikely and the **probability is discountable.**

VI. ESA EFFECTS DETERMINATION

The potential effects to spring Chinook salmon and bull trout using a habitat approach was discussed in detail in the previous chapter. The results of this analysis are summarized in Table 35. The AP provides a dichotomous key which is utilized to reach the appropriate ESA effect determination. Utilizing the indicator summaries from Chapter V and Table 36 of this document, the key provided an effect determination of Not Likely to Adversely Affect (NLAA) for spring Chinook salmon and bull trout as well as spring Chinook salmon Critical Habitat and bull trout Critical Habitat as shown in Table 36.

Table 35. Results of effects from project elements to habitat indicators.

Indicator	Action Area Baseline Condition	Element Summary					Indicator Summary
		Timber Felling	Timber Yarding	Timber Hauling	Road and Landing Work	Fuels Treatment	
Temperature	PF	-D	-D	N	-D	-D	-D
Suspended sediment - DO/turbidity	FAR	-D	-D	-I	-I	-D	-I
Chemical contamination/nutrients	PF	-D	-D	-D	-D	-D	-D
Physical barriers	PF	N	N	N	N	N	N
Substrate character/Embeddedness	FAR	-D	-D	-I	-I	-D	-I
LWD	PF	-I	N	N	-I	-I	-I
Pool Frequency and Quality	NPF	-I	N	N	-I	-I	-I
Large pools	NPF	-I	N	N	-I	-I	-I
Off-Channel Habitat	FAR	-I	N	N	-I	-I	-I
Refugia	NPF	-I	N	N	-I	-I	-I
Ave. Wetted Width/Depth Ratio(scour pools)	NPF	-I	N	N	-I	-I	-I
Streambank condition	FAR	-I	N	N	-I	-I	-I
Floodplain connectivity	NPF	-I	N	N	-I	-I	-I
Change in peak/base flows	NPF	-I	-I	-D	-I	-D	-I
Increase in drainage network	NPF	N	N	N	-I	N	-I
Road density and location	NPF						-/+I
Disturbance History	NPF						-/+I
Riparian Reserves	NPF						-/+I
Disturbance Regime	NPF						-/+I

Notes: - = Negative effect; + = Positive effect; N = Neutral effect. D = Discountable probability; I = Insignificant magnitude; -/+ = short-term negative effect, long-term positive effect

Table 36. AP Project Effects Determination Key For Species and Designated Critical Habitat

AP Project Effects Determination Key For Species and Designated Critical Habitat		
1) Do any of the indicators summaries have a positive or negative conclusion?		
	X	Yes - Go to 2
		No – No Effect
2) Are the indicator summary results only positive?		
		Yes – NLAA
	X	No – Go to 3
3) If any of the indicator summary results are negative, are the effects insignificant or discountable?		
	X	Yes – NLAA
		No – LAA, fill out Adverse Effects Form

This project was designed to minimize negative effects to water quality and ESA listed fish species, while still meeting the resource objectives associated with the project. This project is located in close proximity to habitat utilized by spring Chinook salmon and bull trout and therefore, land management projects are more likely to expose these fish to negative effects. The implementation of this project will not likely result in negative effects of measurable magnitude to any of the indicators. Direct take to spring Chinook salmon or bull trout is not believed to occur under implementation of any project element.

VII. AGGREGATED FEDERAL EFFECTS

The Army Corps of Engineers are proposing a trap-and-haul facility at the base of Cougar Dam, upstream of the McKenzie River/Elk Creek 6th field sub-watershed. When combined with the maintenance of listed species habitat with Bridge Thin project, improvements in spring Chinook returns and bull trout connectivity the South Fork McKenzie, may be expected to more fully utilize available habitat in the project 6th field sub-watershed. We are not aware of additional proposed federal actions for which a Biological Assessment has been submitted contemporaneously with this BA for ESA consultation, which would affect the ESA action area for this project. All ongoing actions with potential negative effects (where ESA consultation has been concluded), and effects of completed federal actions, are included in the environmental baseline for each indicator and have been considered in this analysis.

VIII. EFH ASSESSMENT

Essential Fish Habitat is present in the action area (and overlaps spring Chinook salmon Critical Habitat). Evaluation of effects to Critical Habitat are the same for Essential Fish Habitat. The Bridge Thin project "Will Not Adversely Affect" EFH due to only insignificant impacts generated by project elements. Insignificant effects are expected in the short term, during project implementation. See the above effects analysis to habitat elements for a detailed description.

IX. MONITORING OF EFFECTS

Monitoring of project effects will consist of implementation monitoring to insure Best Management Practices and mitigations are utilized as described in Table 13. Implementation is monitored by the timber sale administrator. Periodic visual monitoring by fisheries and watershed personnel will be used, particularly during the first fall and winter storms, of sediment mobilization and magnitude.

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