4.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes the direct and indirect impacts as well as cumulative effects associated with the implementation of the alternatives described in Chapter 2 - Alternatives on the physical and biological environment as well as the human environment (e.g., social and economic), described in Chapter 3 – Affected Environment sections on these resource areas.

The bases for the analysis presented in this chapter are the detailed technical reports and additional analyses prepared by the USFS and consultants. A number of these reports are included in the appendices to this FEIS (see Volume 4 – Appendices), and all reports are available for review as part of the Analysis File maintained for this project at the MBSNF Supervisor's Office, which is located at 2930 Wetmore Ave, Suite 3A, Everett, Washington, 98201. References are provided in Chapter 5 - References.

The Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 CFR 1502.2) require federal agencies to identify relevant information that may be incomplete or unavailable for an evaluation of reasonably foreseeable, significant adverse effects in an EIS. If the information is essential to an informed choice between alternatives, it must be included or addressed in the EIS.

The information base regarding many aspects of the physical and biological, and human environments is dynamic. New information becomes available every day, yet new questions regarding this information are also generated on a daily basis. Consequently, the basic physical, biological, and social relationships in the Project Area have been established over time. A substantial amount of credible information concerning the project area has been generated by the USFS, The Summit-at-Snoqualmie, consultants, other agencies, Indian Tribes, and the general public. The alternatives were evaluated using the best available information concerning these resources and their relationships. While many questions still exist, new information concerning the biological, physical, and human environments would not foreseeably alter the current understanding of the resources and their relationships.

This FEIS responds to the proposal by Ski Lifts Inc. to upgrade and expand the recreational infrastructure, associated facilities, and SUP area for The Summit-at-Snoqualmie. The purpose of this proposal is to update The Summit-at-Snoqualmie MDP for the long-range (10-15 years) management and development of The Summit-at-Snoqualmie.

The intended useful life of a MDP would be approximately 10-15 years. The components of the MDP would be phased over a period of years, as discussed in Chapter 2 - Alternatives. This FEIS discloses project specific impacts and cumulative effects that are projected to occur during this period, and which would be present at the end of the implementation period. It is important to note that the disclosure of impacts in this FEIS is meant to provide a worst case projection of the impacts. Throughout the lifetime of the MDP, Mitigation Measures, Management Requirements, and Other Management Provisions would be implemented with each phase of development in order to avoid, minimize, reduce, rectify or

compensate for impacts to the physical, biological or human environments. For example, the transportation analysis presented in this chapter uses the worst possible projected scenarios as the basis for comparison of the alternatives. It is anticipated that the transportation impacts would be less than projected in this FEIS, however Management Requirements and Other Management Provisions are provided in Chapter 2 - Alternatives to reduce the projected impacts. Mitigation Measures, Management Requirements, and Other Management Provisions for each resource area are presented in Chapter 2 - Alternatives, Table 2.4-2.

4.0.1 Definition of Impacts

The analysis of environmental consequences assesses the direct, indirect, and cumulative environmental consequences of implementing the alternatives described in Chapter 2 - Alternatives. The analysis also forms the basis for comparison of the alternatives. This chapter also includes an evaluation of irreversible or irretrievable commitments of resources. The impacts identified in this chapter assume full build-out of all MDP elements proposed in the alternatives.

An effect is described as any change in physical, biological, social, or economic factors, which directly or indirectly results from implementation of an action. The terms effect and impact are used interchangeably in this chapter. An impact is described as any change in physical, biological, social, or economic factors, which directly or indirectly result from implementation of an action. Impacts may be adverse or beneficial, depending upon the type of change and the resource area being discussed. The following impact definitions are used in this FEIS:

- **Short-Term Impact** – An impact that occurs during construction and/or for one to two growing seasons thereafter; or an impact that may occur after brief activities associated with operation and maintenance.
- **Long-Term Impact** – An impact that continues for an extended period of years or may be permanent.
- **Direct Impact** – An impact that occurs as the direct result of an action, at the same time and place, including construction, operations and maintenance.
- **Indirect Impact** – An impact that occurs as the result of an action and is later in time or farther removed in distance, but still reasonably foreseeable.

CEQ regulations (40 CFR 1508.7) require that cumulative impacts be considered in the analysis of the alternatives. A cumulative effect is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions.” Cumulative actions applicable to this FEIS are identified under each resource area, along with an indication of the spatial and temporal scale of the cumulative impact.

An irreversible commitment of resources refers to non-renewable resources, such as heritage resources, or to those factors that are renewable only over long periods of time, such as soil productivity. An irretrievable commitment of resources refers to losses of production, harvest or use of renewable natural resources. For example, the timber production capability of an area is irretrievably lost while it is used as a winter recreation site, but the action is not irreversible.

4.0.2 Summary of Projects Analyzed in This EIS

The following section outlines and discusses the MDP components that will be analyzed and impacts reported for each of the alternatives. Section 4.0.2.1 – Projects Common to All Action Alternatives outlines impacts common to EACH of the Action Alternatives (Alternatives 2-Modified Alternative 5). Several specific MDP components comprise the range of alternatives identified in this FEIS. Those components include construction of the *Pulse Gondola* and associated mountain-top restaurant at Alpental, the reroute of Alpental Road near parking lots 4, 5, 6 and 7 at Alpental, development of lifts and trails in Section 16 (*Creek Run* and *Rampart* chairlifts) and the proposed land donation in Alternative 3 and Modified Alternative 5.

4.0.2.1 Projects Common to All Action Alternatives

The following list outlines the MDP projects that do not change throughout the alternatives. Impacts associates with these projects will be discussed by resource area in subsequent sections.

South Fork Snoqualmie River Watershed

Public

Proposed projects within the South Fork Snoqualmie River Watershed (S.F. Snoqualmie Watershed) that occur on public land and are common to all Action Alternatives include:

- Proposed *Internationale* chairlift and duty station (proposed night skiing on Trail 20)
- Proposed realignment of *St. Bernard* and *Sessel* chairlifts at Alpental
- Proposed upgrade and/or realignment of *Julie's Chair* chairlifts at Summit West
- Proposed *Northside* and *Baby Double* chairlifts at Summit West
- Proposed Surface Lifts I and II at Summit West
- Proposed Magic Carpets at Alpental and Summit West
- Proposed ski patrol bump shack at upper terminal of *Armstrong Express* chairlift at Alpental
- Proposed regrade along Trail 7 at Alpental
- Proposed blasting for Trail 20 at Alpental
- Removal of the existing *Drei* lift at Alpental

- Fuel facility and maintenance facility relocated from Parking Lot 3 to private land at Alpental
- New visitor service building at base of *Sessel* chairlift
- Stormwater management would be integrated into Parking Lots 3, 4, 5 and 6 at Alpental and Parking Lot 1 at Summit West
- Renovation to Slide-Inn lodge and base area buildings at Summit West
- Proposed expansion of Parking Lot 1 at Summit West
- Construction of a permanent native surface road from the upper terminal of the existing *Pacific Crest* chairlift to the proposed upper terminal of the *Northside* chairlift
- Proposed revegetation and planting of tree islands

Private

Proposed projects within the S.F. Snoqualmie Watershed that occur on private land and are common to all Action Alternatives include:

- Parking Lots 1 and 2 at Alpental would be paved
- Existing fuel and maintenance facilities would be relocated from Parking Lot 3 (public land) to private land at Alpental
- Proposed revegetation and planting of tree islands

Upper Yakima River Watershed

Public

Proposed projects within the Upper Yakima River Watershed (U. Yakima Watershed) that occur on public land and are common to all Action Alternatives include:

- Proposed fuel facility and maintenance facility would be constructed near the existing maintenance area at Summit West
- Summit West Parking Lot 2 and Silver Fir Parking Lot 1 would be paved and include stormwater management
- Proposed upgrade and/or realignment of *Wildside*, *Dodge Ridge* and *Little Thunder* chairlifts at Summit West
- The existing *Pacific Crest* duty station at Summit West would be expanded.
- Night skiing would be expanded to include all the runs within the *Silver Fir* and *Easy Street* pods at Summit Central
- Proposed grading within the *Little Thunder* pod at Summit West, and clearing and/or grading within the *Easy Street* and *Silver Fir* pods at Summit Central

- SUP expansion/consolidation along Hyak Creek between Summit Central and Summit East
- Existing Road M-5 (approximately 1,300 feet - native surface) would be abandoned and revegetated
- Proposed revegetation and planting of tree islands

Private

Proposed projects within the U. Yakima Watershed that occur on private land and are common to all Action Alternatives include:

- Proposed Silver Fir Parking Lot 4 and expansion of existing Silver Fir Parking Lot 2
- Silver Fir Parking Lots 2, 3 and 4; Summit Central Parking Lots 1 and 2; and Summit East Parking Lots 1 and 2 would be paved
- Proposed upgrade and realignment of *Easy Street, Ski School, Triple 60* and *Holiday* chairlifts at Summit Central and *Mill Creek* and *Easy Gold* chairlifts at Summit Central
- Proposed *Magic Carpet* at Summit Central
- The existing Thunderbird Lodge at Summit West would be renovated
- Proposed base lodge at Summit Central
- Proposed expansion of facilities at Silver Fir (including ski patrol)
- Renovated first aid facilities at the existing ski patrol building at Summit Central
- Proposed mountain-top restaurant and ski patrol duty station at the upper terminal of the *Mt Hyak* chairlift
- Night skiing would be expanded to include runs within the *Easy Street* pod
- Proposed grading along Trail 26 and clearing and/or grading within the *Easy Street* pod at Summit Central
- Proposed grading at the confluence of trails near the bottom terminal of the *Mill Creek* chairlift
- Proposed revegetation and planting of tree islands

4.0.2.2 Projects Associated with Alternative 2

Projects associated with implementation of Alternative 2 include actions discussed in Section 4.0.2.1 – Projects Common to All Action Alternatives as well as additional projects unique to Alternative 2 (as discussed below). These additional projects are located on public land and are the focus of the range of alternatives analyzed in this EIS.

South Fork Snoqualmie River Watershed

- Proposed *Pulse Gondola* from Alpental's base area to the summit

- Proposed Summit House restaurant and associated Americans with Disabilities Act (ADA) facilities
- Proposed replacement of the *Edelweiss* ski patrol duty station

Upper Yakima River Watershed

- Proposed *Creek Run* and *Rampart* chairlifts at Summit East
- Proposed grading along Trails 60 and 61 within the *Rampart* pod at Summit East
- Proposed Trail 49 (Summit Central to Summit East crossover) and associated SUP expansion at Summit Central
- Proposed Trail 71 (Summit East to Summit Central crossover) at Summit East
- Existing Trail 71 would be revegetated to a 12 inch width for mountain biking
- Proposed Trail 55A would include full clearing with no grading and glading
- Proposed night skiing within the *Rampart* pod
- Proposed ski patrol duty station at the upper terminal of the *Creek Run* chairlift
- Proposed construction of roads: 1) to the lower terminals of the *Creek Run/Rampart* chairlifts (approximately 500 feet of road), and 2) to the upper terminal of *Creek Run* chairlift (approximately 500 feet of road)
- Expansion of the SUP boundary to include an additional 53 acres between Summit Central and Summit East

4.0.2.3 Projects Associated with Alternative 3

Projects associated with implementation of Alternative 3 include actions discussed in Section 4.0.2.1 – Projects Associated with All Action Alternatives as well as additional projects unique to Alternative 3 (as discussed below). These additional projects are located on public land and are the focus of the range of alternatives analyzed in this EIS.

South Fork Snoqualmie River Watershed

Projects within the S.F. Snoqualmie Watershed for Alternative 3 do not include anything beyond the projects common to all Action Alternatives.

Upper Yakima River Watershed

- Proposed *Rampart* chairlift at Summit East
- Proposed grading along Trails 60 and 61 within the *Rampart* pod at Summit East
- Existing Trails 55, 66, and 67 at Summit East would be revegetated
- Proposed night skiing within the *Rampart* pod

- Proposed Trail 71 (Summit East to Summit Central crossover) at Summit East
- Existing Trail 71 would be revegetated to a 12 inch width for mountain biking
- Proposed road construction of road to the lower terminal of the *Rampart* chairlift (approximately 500 feet of road)
- Land donation to offset impacts to Section 16 (*Rampart* chairlift and associated trials) is proposed
- Expansion of the SUP boundary to include an additional 17 acres between Summit Central and Summit East

4.0.2.4 Projects Associated with Alternative 4

Projects associated with implementation of Alternative 4 include actions discussed in Section 4.0.2.1 – Projects Associated with All Action Alternatives as well as additional projects unique to Alternative 4 (as discussed below). These additional projects are located on public land and are the focus of the range of alternatives analyzed in this EIS.

South Fork Snoqualmie River Watershed

- Existing Alpental Road would be re-routed outside of Riparian Buffers between the existing bridge to Parking Lot 6
- Parking Lots 4, 5, and 6 at Alpental would be reduced in size as a result of the Alpental Road reroute
- Parking Lot 7 at Alpental would be removed as a result of the Alpental Road reroute

Upper Yakima River Watershed

- Expansion of the SUP boundary to include an additional 17 acres between Summit Central and Summit East

4.0.2.5 Projects Associated with Modified Alternative 5

Projects associated with implementation of Modified Alternative 5 include actions discussed in Section 4.0.2.1 – Projects Associated with All Action Alternatives as well as additional projects unique to Modified Alternative 5 (as discussed below). These additional projects are located on public land and are the focus of the range of alternatives analyzed in this EIS.

South Fork Snoqualmie River Watershed

- Proposed *Pulse Gondola* from Alpental's base area to the summit
- Proposed mountain-top restaurant and associated ADA facilities
- Proposed replacement of the *Edelweiss* ski patrol duty station
- Proposed capacity upgrade to the Edelweiss lift

Upper Yakima River Watershed

- Proposed *Creek Run* and *Rampart* chairlifts at Summit East (reduced trail clearing/development as compared to Alternative 2)
- Proposed grading along Trails 60 and 61 within the *Rampart* pod at Summit East
- Proposed Trail 49 (Summit Central to Summit East crossover) and associated SUP expansion at Summit Central (reduced trail clearing/development as compared to Alternative 2)
- Proposed Trail 71 (Summit East to Summit Central crossover) at Summit East
- Existing Trail 71 would be revegetated to a 12 inch width for mountain biking
- Proposed Trail 55A would not include full clearing. Only glading would occur north of the *Creek Run* chairlift alignment
- Proposed night skiing within the *Rampart* pod
- Proposed ski patrol duty station at the upper terminal of the *Creek Run* chairlift
- Proposed construction of roads: 1) to the lower terminals of the *Creek Run/Rampart* chairlifts (approximately 500 feet of road), and 2) to the upper terminal of *Creek Run* chairlift (approximately 500 feet of road)
- Expansion of the SUP boundary to include an additional 53 acres between Summit Central and Summit East
- Land donation to offset impacts to Section 16 (*Rampart* and *Creek Run* chairlifts and associated trials) is proposed

4.0.3 Cumulative Effects

In addition to the impact definitions detailed above, CEQ regulations (40 CFR 1508.7) require that cumulative effects be considered in the analysis of the alternatives. A cumulative effect is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions”(40 CFR 1508.7).

Therefore, the cumulative effects analysis in Chapter 4 – Environmental Consequences considered past, present, and reasonably foreseeable actions that have or may occur in the project and surrounding area, in addition to the Action Alternatives. The effects of past activities are represented in the baseline for each issue area consistent with the CEQ’s guidance on the *Consideration of Past Actions in Cumulative Effects Analysis* (CEQ 2005), which is hereby incorporated by reference. This guidance states that “ agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

Current guidance on cumulative effects analyses has been incorporated in the discussions of cumulative effects for each resource. Specifically, the strategy for preparing environmental effects analysis under NEPA and the NFMA provided in the course titled "Environmental Effects Analysis and Documentation" were incorporated (Glassford 2005). Additionally, temporal and spatial overlap considerations are included in the cumulative effects analysis (Hansen-Murray pers. comm.). Discussion on the impacts to each resource area have been incorporated based on case-study analyses provided by the course "Writing the Perfect Cumulative Impact Assessment" (Schmidt 2006).

Cumulative effects applicable under each resource area of this FEIS are identified, along with an indication of the spatial and temporal scale of the relevant cumulative impact. Projects not related to the Action Alternatives are evaluated to determine whether their effects overlap in time or space with the effects of the Action Alternatives. In order to support the evaluation of cumulative effects in the Study Area and to support the analysis of cumulative effects as they relate to the Aquatic Conservation Strategy (see Section 3.7 – Aquatic Conservation Strategy), cumulative actions and their effects are evaluated at both the site scale and the 5th field watershed scale for the physical and biological resource areas. Specifically, 5th field watersheds are the S.F. Snoqualmie Watershed and the U. Yakima Watershed, as shown in Figure 3.0-2, 5th Field Watersheds. Project effects that overlap temporally with the proposed Summit-at-Snoqualmie MDP or have ongoing effects are evaluated in the cumulative effects analysis. Projects whose effects do not overlap spatially or temporally with the effects of the Action Alternatives may be eliminated from cumulative effect analysis in certain resource areas.

Several projects that may occur in the Study Area or in the Snoqualmie Pass vicinity have been purposefully omitted from the cumulative effect analysis because they are not considered reasonably foreseeable (likely to occur within the next five years and/or has a written proposal) or not enough information is available for cumulative effects analysis. For example, lands in the Snoqualmie Pass area have been purchased by various conservancies to be managed for conservation in the U. Yakima Watershed (including Keechelus Ridge, Swamp Lake, Easton, etc.), however, no further information was available regarding this project at the time of publication. Therefore, it has been omitted from the cumulative effects analysis for this FEIS. In addition, the developed areas along the I-90 corridor at Snoqualmie Pass are likely to continue to be developed, resulting in impacts and cumulative effects in the area. However, aside from the private land developments project included in the cumulative effects analysis (U. Yakima Watershed), no formal proposals have been identified for inclusion in this FEIS.

Table 4.0-FEIS-1 and Table 4.0-FEIS-2 summarize the past, present, and reasonably foreseeable projects in the vicinity of the Study Area. The cumulative effects of these projects are evaluated within each specific resource area (e.g., Section 3.2 – Geology and Soils).

Table 4.0-FEIS-1:
Past, Present and Reasonably Foreseeable Projects
Occurring in the Upper Yakima River Watershed

Project Name	Project Summary	Time Frame
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately ten existing culverts have been replaced or repaired within the last five years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately two per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	Past and Reasonably Foreseeable
Projects Not Associated with The Summit-at-Snoqualmie		
Kachess Vegetation Management	The campground contained old growth trees suffering from various stages of root rot. Hazard trees were identified in the Kachess Lake Campground through an exhaustive survey. All identified trees were removed during the winter of 2004. A small amount of timber was sold as merchantable, and the rest was disposed of through firewood sales, lop and scatter, or burned.	Fall 2002 (Past)
Plum Creek Road Restoration	The Cle Elum Ranger District is performing a road analysis covering approximately 50-70 miles of harvest roads on 65,000 acres of land acquired in the last five years from Plum Creek Timber lands. Currently, approximately 18 miles of roads that were acquired and deemed to be unsafe or were already closed have been decommissioned by the USFS. Under the Proposed Action, approximately 30.57 miles of road would be decommissioned.	Summer 2007 (Past)
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	2003 until complete (Reasonably Foreseeable)
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for NFSL. The exchange was completed in 1998.	1998 (Past)
Keechelus Dam Repairs	The Keechelus Lake dam was repaired in 2003. The existing dam was rebuilt in place to correct structural problems. The project has been completed. Approximately 70 acres of vegetation was cleared to provide a work corridor. The project impacted 3.8 acres of wetlands.	2002-2003 (Past)
Gold Creek Pond Trail Development	A native surface foot trail was constructed approximately 100 feet long. This project was completed in 2001.	2001 (Past)
U.S. West Telephone Line	Installation of an underground telephone line in the old road prism. This project was completed in 2001.	2001 (Past)

Table 4.0-FEIS-1:
Past, Present and Reasonably Foreseeable Projects
Occurring in the Upper Yakima River Watershed

Project Name	Project Summary	Time Frame
WSDOT I-90 Maintenance	WSDOT maintains continuous custodian operations of the existing I-90 roadways. Maintenance includes application of sand and chemical deicers to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile are applied to I-90 within the Snoqualmie Pass area (WSDOT 1999, 2001).	Ongoing
Land Acquisitions: Cascade Conservation Partnership, Trust for Public Land, Land and Water Conservation Fund, and the Pacific Crest Trail Association	Purchase of private lands and probable donation to the National Forest System for management by the USFS. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	Ongoing as funds and a "willing seller" are available
Plum Creek Cascade Habitat Conservation Plan	A Habitat Conservation Plan was developed for the Plum Creek Timber Company to manage timber harvest and protect wildlife habitat over several 5th field watersheds in the vicinity of Snoqualmie Pass.	Multi-year (Reasonably Foreseeable)
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of The Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Reasonably Foreseeable
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the U. Yakima Watershed to accelerate the development of late-successional forest structure. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	Past and Reasonably Foreseeable
Snoqualmie Pass AMA Plan	Land management plan for the AMA emphasizing LSH maintenance and enhancement.	Ongoing
Cle Elum RD Roads Analysis	Analysis of road system to determine long-term need. Implementation is expected in 2010.	2010 (Reasonably Foreseeable)
WSDOT Road De-icing	Application of sand and chemical de-icers/ice-inhibitors to roadway surfaces.	Ongoing, winter months

Table 4.0-FEIS-1:
Past, Present and Reasonably Foreseeable Projects
Occurring in the Upper Yakima River Watershed

Project Name	Project Summary	Time Frame
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the OWNF Land and Resource Management Plan.	2008 (Reasonably Foreseeable)
Pro Guiding Service Area Expansion	Pro Guiding has requested expansion of their area of operation to include the cascade crest area from Kendall Lakes to Mt. Daniel, plus the Alta Mountain area. They have not requested an increase in number of service days.	2007 (Past)
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the U. Yakima Watershed (West Keechelus subwatershed). The proposed project includes thinning to accelerate LSH structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	2007 (Present)
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the U. Yakima Watershed (East Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate LSH structure in plantations, obliteration of roads, fish passage improvements, and other restoration projects.	2008 (Reasonably Foreseeable)
Snoqualmie Pass Summer Home Tract Permit Reissuance	This project proposes to authorize continued recreation residence use of the 14 cabins located in the Snoqualmie Pass Tract for a 20-year period beginning January 1, 2009 with no change to the current authorized use.	Early 2008 (Present)
Development of Suncadia Resort Community Near Roslyn[a]	Suncadia Resort is fully permitted and is planned to be developed in three phases. Plans include a mountain-style lodge and resort village, three 18-hole golf courses, a recreation center, 40 miles of multiple use trails, approximately 2,300 second-homes, 170 fractional units, and 150 timeshares.	Past

[a] The Development of Suncadia Resort Community Near Roslyn project is analyzed for cumulative effects only under Social and Economic Factors (4.10) and Recreation (4.11).

Table 4.0-FEIS 2:
Past, Present and Reasonably Foreseeable Projects
Occurring in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Time Frame
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately ten existing culverts have been replaced or repaired within the last five years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately two per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	Past and Reasonably Foreseeable
Alpental Covered Bridge Replacement	The existing covered footbridge at Alpental washed out during a storm in 2003. The Summit-at-Snoqualmie has replaced the bridge as of October 2005.	2005 (Past)
Cave Ridge Land Donation	The Summit-at-Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	Reasonably Foreseeable
Projects Not Associated with The Summit-at-Snoqualmie		
FS Road 58 Bridge Replacement	An existing steel bridge over the South Fork Snoqualmie River was replaced on Forest Service Road 58 due to structural problems. The new bridge was expanded from one to two lanes with upgraded load capacity. Construction of the bridge was completed in spring 2005.	2005 (Past)
Huckleberry Land Exchange	Exchange of NFSL for 6,798 acres of Weyerheauser lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	2001 (Past)
WSDOT 1-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical de-icers/ice-inhibitors to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile is applied to I-90 within the Snoqualmie Pass area.	Ongoing
Land Acquisitions: Cascade Conservation Partnership, Trust for Public Land, Land and Water Conservation Fund, and the Pacific Crest Trail Association	Purchase of private lands and probable donation to the National Forest System for management by the USFS. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	Ongoing as funds and a “willing seller” are available
U.S. West Telephone Line	Installation of an underground telephone line in the I-90 corridor.	2001 (Past)
WSDOT Road De-icing	Application of sand and chemical de-icers/ice-inhibitors to roadway surfaces.	Ongoing, winter months

Table 4.0-FEIS 2:
Past, Present and Reasonably Foreseeable Projects
Occurring in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Time Frame
BPA Proposed Additional Power Lines	Supplemental DEIS to examine development of an additional powerline. Options include adding lines to existing towers or adding new towers.	Reasonably Foreseeable
McClellan Butte Trail Reconstruction Project	The project relocated approximately 1.5 miles of trail to newly constructed trail or old road bed, abandoned 1.5 miles of trail, and rehabilitated tread, drainage and switchbacks as required along the remainder of the 4.4-mile trail.	2004 (Past)
Bandera Mountain/Mason Lake Trail Relocation Project	This project reorganized trail access to Mason Lake and Bandera Mountain in order to minimize social and resource impacts associated with the existing trails. The project involved construction of 1.5 miles of new trail, reconstructing 2.0 miles of existing trail and decommissioning 2.3 miles of existing trail.	2002 (Past)
High Lakes Trail #1012 and Snow Lake Trail #1013 Reconstruction	This project repaired seven switchbacks on the Snow Lake Trail and reconstructed 2 miles on the High Lakes Trail from Snow to Gem Lake.	2003 (Past)
South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project	This project involves the reduction in maintenance level (ML) on 11 roads (26.3 miles). 19.4 miles would be reduced to ML 1 (closed to motorized access) and utilized as loop and destination trail routes; 2.7 miles would be closed (placed in storage for future forest management); 1.1 miles would be removed from the transportation system and converted to trail; and approximately 22.2 miles of spur roads mostly associated with roads proposed for reduction to ML 1 would be closed and removed from the Forest Road Transportation System.	2007 (Present)
Denny Salvage	This project would salvage approximately 50 mbf of trees utilizing a ground based logging system. All undamaged trees with secure root systems would be left.	2007 (Present)
Annual Road Maintenance	Brushing/blading of roads on a rotating schedule as funds allow. Includes roads 55, 5510, 58, and road 9030 and 9031 systems.	Ongoing
Road 9020 ERFO Repair	This project proposes to either replace the culvert at Alice Creek or reduce the ML of Road 9020 past Alice Creek to 1 (closed to motorized access).	2008 (Reasonably Foreseeable)
I-90 Corridor Thin	The project involves commercially thinning approximately 338 acres in the I-90 Corridor. About 4.3 mmbf would be thinned from 14 units.	2008 (Reasonably Foreseeable)

Table 4.0-FEIS 2:
Past, Present and Reasonably Foreseeable Projects
Occurring in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Time Frame
SPUD Permit Amendment	The project would extend water and sewer lines along Forest Service Road 4832 from the I-90 Hyak interchange for approximately 3,000 feet. The new lines would stop before reaching Gold Creek. Lines would be laid within the existing road right-of-way.	2007 (Present)
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	2007 (Present)
Denny Creek Recreation Residence Permit Reissuance	Authorize continued recreation residence use of the 21 recreation residences located in the Denny Creek Tract for a 20-year period beginning January 1, 2009 with no change in the current authorized use.	2007 (Present))

4.1 CLIMATE AND SNOW

4.1.1 Impact Mechanisms

The actions associated with the alternatives that have the potential to affect climate and snow conditions are identified as impact mechanisms, which are defined in Section 4.0.1 - Definitions of Impacts.

- None of the projects proposed in the Action Alternatives would be considered direct impacts to snow conditions at The Summit-at-Snoqualmie. Activities that would be considered direct impacts to snow conditions would include snowmaking and active avalanche control in previously uncontrolled areas.
- Indirect impacts to snow conditions from the projects proposed in the Action Alternatives include active and passive avalanche control, skier compaction of the snow, the operation of new trails and parking (e.g., grooming and skiers), snowpack distributions and avalanche patterns from changes in forest cover for new trails and parking.
- The indirect impacts to snow conditions from the activities described above would be considered long-term impacts because impacts from ski area operations and avalanche control would reoccur every year.

4.1.2 Impacts - Alternative 1 (No Action Alternative)

4.1.2.1 Climate

No new development would occur under Alternative 1, therefore, no new impacts to the local or regional climate would occur due to the implementation of Alternative 1. As described in Section 3.1.2 – Local Climate Conditions, The Summit-at-Snoqualmie ski area would likely continue to witness variable weather conditions, resulting in low snow deposition during some weather cycles and excessive snowfall during other periods. However, a gradual decrease in annual snowfall associated with global warming may result in shortening of operations during some winters.

4.1.2.2 Snow Conditions

Avalanche control practices within the Study Area would not change under Alternative 1 and would continue as described in Section 3.1.3 – Avalanche Conditions.

4.1.3 Impacts - Alternative 2

4.1.3.1 Climate

Any impacts to the climate at The Summit-at-Snoqualmie from global warming over the next 30 – 40 years are outside the scope of this EIS. No significant increases in greenhouse gases are expected from the implementation of Alternative 2 (see Section 4.8 - Air Quality). Therefore, there would be no direct or indirect impact to the local and regional climate from implementation of Alternative 2. The Summit-at-Snoqualmie ski area would likely continue to witness variable weather conditions, resulting in low snow

deposition during some weather cycles and excessive snowfall during other periods. However, as described under Alternative 1, a gradual decrease in annual snowfall associated with global warming may result in shortening of operations during some winters.

No changes of the quality of the snow from a skiing perspective are expected under Alternative 2. The snow conditions would continue to be variable depending on the fluctuation of the air temperature; typically packed powder conditions during the winter months of December, January, and February and more variable snow conditions in the spring due to temperature fluctuations.

4.1.3.2 Snow Conditions

Avalanche control at The Summit-at-Snoqualmie under Alternative 2 would continue to be performed in the same areas where avalanche control is currently practiced, using the same methods as described in Section 3.1.3 - Avalanche Conditions. Under Alternative 2, The Summit-at-Snoqualmie would continue avalanche control activities on an as needed basis within the Alpental SUP in areas such as the Edelweiss bowl and ski pod, Snake Dance Area, the Upper Internationale area, and the Shot 6 area. The installation of the *Internationale* chairlift and the *Pulse Gondola* at Alpental would improve patrol access and the timeliness of avalanche control work and rescues in these areas. The anticipated increase in skier densities in the *Internationale* ski pod would increase snow stabilization in this area through skier compaction, which would reduce the avalanche risk in this area. As a result of the increased accessibility at Alpental and The Summit, the Pro Ski Patrol would be able to provide more timely avalanche control in these areas under Alternative 2.

Under Alternative 2, none of the proposed buildings and facilities would be located within avalanche slide paths. However, the upper lift terminal of the proposed *Internationale* chairlift and a proposed ski patrol duty station would be located immediately downslope of the runout zone of an existing avalanche slide path, which would be controlled with the development of the chairlift thereby reducing the avalanche hazard. The proposed lower terminals of the *Pulse Gondola*, the *Sessel* chairlift, the *St. Bernard* chairlift, and the Visitor Service Building would be located adjacent to the runout zone of an avalanche path as well. The avalanche path analysis contained in this EIS is a generalized analysis with a sufficient level of detail for master planning and NEPA analysis. The avalanche analysis in this EIS is not site-specific because The Summit-at-Snoqualmie will hire qualified avalanche zoning experts to perform site-specific avalanche dynamics studies before the site location and design is finalized for all structures and facilities located within and adjacent to avalanche slide paths as described in Other Management Provisions OMP1 (see Table 2.4-2).

Under Alternative 2, The Summit-at-Snoqualmie would continue to perform avalanche control on an as needed basis at The Summit and on Nordic trails where avalanche control currently takes place. Avalanche conditions would continue to be evaluated and controlled with active and passive control

methods as needed along the Nordic trails west of Summit East and in the Triple 60 Ski Pod at Summit Central.

Under Alternative 2, the installation of the *Internationale* chairlift would allow for lift-served skiing in an area that is currently considered lift-served backcountry (see Section 3.11-Recreation). With proposed lift access, the number of skiers accessing Internationale bowl and skier density within the bowl at any given time would increase. As a result, the snow in Internationale bowl would become skied out more quickly than under the existing condition.

4.1.4 Impacts - Alternative 3

4.1.4.1 Climate

Impacts to the local and regional climatic regime under Alternative 3 would be as described under Alternative 2.

4.1.4.2 Snow Conditions

Under Alternative 3, avalanche control at The Summit-at-Snoqualmie would be as described under Alternative 2 except that the *Pulse Gondola* is not proposed under Alternative 3. Therefore, the Pro Ski Patrol would have slower access to avalanche terrain for performing control work as compared to Alternative 2. Snow conditions in Internationale bowl would be as described under Alternative 2.

4.1.5 Impacts - Alternative 4 and Modified Alternative 5

4.1.5.1 Climate

Impacts to the local and regional climatic regime under Alternatives 4 and 5 would be as described under Alternative 2.

4.1.5.2 Snow Conditions

Under Alternatives 4 and 5, avalanche control and snow conditions at The Summit-at-Snoqualmie would be as described under Alternative 2.

4.1.6 Cumulative Effects

No identified projects or activities would result in cumulative effects to climate and snow conditions. As described under Alternatives 1 – Modified Alternative 5, the potential effects of global climate change may affect the operating schedule over the life of the MDP. However, no reasonably foreseeable actions have been identified that would cumulatively affect climate and snow conditions in conjunction with the MDP. With the projected increase in temperatures that has been predicted, it is possible that The Summit-at-Snoqualmie would realize reduced snowpack over time. No proposal has been made to the USFS to investigate acquisition of additional water rights for snowmaking, and no specific actions identified in the MDP are in response to global climate change.

The effects of increasing temperatures and reduced snowpack are not overlooked in this analysis. Rather, they are outside the scope of this analysis, which evaluates the installation of facilities and infrastructure over a projected ten-year period. The operating status of The Summit-at-Snoqualmie in 40 years has no bearing on the MDP under analysis in this EIS.

4.1.7 Irreversible and Irretrievable Commitments of Resources

Under all Action Alternatives, the expansion of avalanche control work represents operational modifications within The Summit-at-Snoqualmie's existing SUP area. Natural avalanche patterns within the expanded avalanche control area would be modified by avalanche control activities and be irretrievably lost during the life of The Summit-at-Snoqualmie ski area. In addition, snow conditions in Internationale bowl would be skied out more quickly than under the existing condition. During the lifetime of the *Internationale* chairlift, the current backcountry snow conditions in this area would be irretrievably lost.

Avalanche control and chairlift access would cease if the operation of The Summit-at-Snoqualmie was eliminated at some point in the future. Snow conditions would return to a predevelopment state and therefore, none of the alternatives would result in an irreversible commitment of resources.

4.2 GEOLOGY AND SOILS

This section describes the potential effects of the MDP alternatives on geology and soils within the Study Area. The Study Area is used to quantitatively discuss impacts associated with each Action Alternative (see Figure 3.0-1, Study Area). In addition, two watershed scales have been defined to address the effects of the alternatives on areas of particular concern to the aquatic environment. The Study Area on either side of the Cascade crest lies in the upper portion of two watersheds at the 5th field scale; the U. Yakima Watershed and the S.F. Snoqualmie Watershed. Smaller 7th field drainages provide detail and spatial context within each of the watersheds.

A description of the existing conditions in the Study Area within this hierarchy of watersheds is provided in Section 3.2 - Geology and Soils. Fifth-field watershed and seventh-field drainage boundaries are shown in Figure 4.2.1-1, Impacts by Soil Erosion Potential – Alternative 2 – The Summit.

Issues addressed in this section include the potential for the alternatives to impact the soil resources in the Study Area by:

- Accelerating natural erosion processes;
- Increasing the potential for mass wasting on hillslopes and stream channels;
- Increasing the volume and rate of sediment yields to mainstem valley bottom streams; and
- Reducing soil productivity.

4.2.1 Impact Mechanisms

The physical actions associated with any MDP project that result in impacts to resources are referred to as impact mechanisms. As described in Section 4.0.1 – Definition of Impacts, impacts can be classified and discussed in many different ways. For the purposes of this FEIS, the impacts of each alternative on earth resources within the Study Area are discussed in terms of direct versus indirect and short versus long-term in Sections 4.2.2 – Impacts – Alternative 1 through 4.2.6 – Impacts – Modified Alternative 5. In addition, cumulative effects incorporate the long-term effects of all direct and indirect impacts with both detrimental and beneficial effects, and evaluate them at the 5th field Yakima and S.F. Snoqualmie Watershed scales. They combine impacts within the Study Area with the incremental impacts of other past, present, and reasonably foreseeable projects identified within these watersheds. Cumulative effects for soil resources are discussed in Section 4.2.7 – Cumulative Effects.

Impact mechanisms evaluated for the MDP alternatives are identified as direct or indirect and short-term or long-term below.

4.2.1.1 Direct Impacts

Impact mechanisms with direct effects on earth resources include activities that immediately create impervious surfaces or modify soil structure. These activities include:

- Constructing roads, parking lots, buildings, chairlift terminals and towers, bridge footings, utilidors, and other impervious surfaces, which seal the soil surface and eliminate the ability of the soil to grow vegetation; or limit its ability to absorb, store, and release water and nutrients;
- Grading and blasting of ski trails to facilitate downhill skiing, resulting in the modification of soil structure and mountain slope topography;
- Trenching for the burial of utility lines which could mix local soil horizons;
- Road decommissioning, stream and wetland restoration, slop stabilization, and revegetation with trees and other native vegetation, which would have short-term direct disturbance of soil surface and long-term beneficial impacts to soil.

4.2.1.2 Indirect Impacts

Impact mechanisms that create indirect or delayed effects on earth resources generally include any soil-disturbing activity that exposes soil particles to erosion, transport, and deposition, thus affecting the productivity of both the source and receiving sites. Whereas direct effects are typically associated with construction projects, indirect effects may occur in association with a construction project, or during typical ski area maintenance operations after the construction of MDP projects is complete. Indirect impact mechanisms identified in this analysis include:

- Removal of overstory tree and shrub vegetation through ski trail clearing, potentially increasing erosion and changing organic nutrient inputs;
- Altered drainage patterns and increased erosion potential due to grading and utility trending;
- The application of magnesium chloride de-icer/ice-inhibitor or sand to improve winter traction;
- Snow avalanche control, which causes incidental, downslope movement of some soil and debris;
- Paving of parking lots, which would have beneficial effects in the reduction of surface erosion and would reduce sand deposition adjacent to these lots which could improve local soil productivity;
- Maintenance of the road and parking network, including the reconstruction of water bars and other Best Management Practices (BMPs) which would reduce road related erosion;
- Revegetation with trees and other native vegetation, which would have a beneficial impact of promoting soil development and stability and improving soil structure and promoting additional vegetative growth; and

- Altered water quality and quantity in runoff from created impervious surfaces, placing increased demands on remaining undisturbed soils to provide filtration and infiltration.

4.2.1.3 Short-Term

Short-term impacts are impacts that diminish over time as the impacted site stabilizes. They are often associated with increased erosion potential after temporary impacts on vegetation. Short-term impacts are expected to diminish to an imperceptible level during the post-construction monitoring period. Indirect impact mechanisms resulting in short-term soil impacts, include:

- Erosion or soil movement associated with ski trail grading,
- Vegetation removal and ground disturbance during trenching for the installation of utility lines; and
- Removal or disturbance of vegetation *adjacent to* newly constructed roads, parking lots, buildings, and ski facilities and infrastructure (lift terminals).

The MDP alternatives include a phased implementation and monitoring process (see Section 2.6 - Phasing, and Appendix F – MDP Implementation, Operations, Restoration and Management Plan). Although many indirect impacts would be temporary (short-term) in duration because of natural vegetative recovery, monitoring would enable the detection and rectification of most trouble areas as MDP implementation would progress. In some instances, however, indirect effects could become long-term. For example, a gully or severely eroded area originating on an excavated slope could persist for many years. The extension of short-term impacts to long-term impacts is often associated with the failure of revegetation and other erosion control efforts.

4.2.1.4 Long-Term

Long-term impacts are generally associated with the permanent conversion of vegetation to impervious land cover, such as roads, parking lots, buildings, chairlift terminals and towers, bridge footings, utilidors, and similar structures.

- Maintenance (mowing/brushing) of herbaceous and shrub vegetation for ski trails that would prevent natural forested vegetation from reestablishing on native forest soils;
- Maintenance of the road and parking network, including the application of magnesium chloride de-icer/ice-inhibitor or sand to improve winter traction;
- Paving of parking lots, road decommissioning, revegetation with trees and other native vegetation, increased use of magnesium chloride de-icer/ice-inhibitor, and maintenance of water bars and other BMPs-all of which would have beneficial effects in the reduction of erosion; and
- Snow avalanche control, which causes incidental, downslope movement of some soil and debris.

4.2.2 Impacts – Alternative 1 (No Action Alternative)

Under Alternative 1, there would be no additional effects on geology and soils resulting from the construction of new facilities. Existing impacts, as discussed in Section 3.3 – Water and Watershed Resources, would continue and are summarized in this section.

4.2.2.1 Upper Yakima River Watershed

Mass Wasting

Mass wasting events, including snow avalanches, debris avalanches, debris flows, rockfalls, streambank slumps, and soil creep have all been observed in the Study Area. These events have been related to natural and management related conditions. Ski area management related mass wasting events include events at road cut and fill slopes, slope regarding, and a partially displaced culvert. Natural conditions including steep slopes, steep channel banks, and heavy snow predispose the Study Area to occasional mass wasting events as well.

The largest mass wasting event observed in the U. Yakima Watershed portion of the Study Area was associated with a regrade area at Summit Central. A failed water bar on a road at the upper portion of this area appears to have triggered the debris flow in unstable, regraded soil.

Under Alternative 1, no actions are proposed that would increase the probability or frequency of mass wasting events from the existing conditions. Occasional mass wasting events can be expected to continue to occur under Alternative 1 from natural processes and associated with roads and culverts on steep slopes.

The relative impacts on mass wasting from management measures would vary in proportion to the amount of new roads and the amount of road decommissioning. Road decommissioning would not occur in Alternative 1 as in the proposed action. Road density of 6.43 miles per square mile would continue under Alternative 1 and would continue to present a potential risk for mass wasting events associated with road cut or fill slopes.

Erosion

Under Alternative 1, the MDP would not be implemented and no construction related soil disturbance would occur. However, the existing ski area infrastructure, especially the road network, would continue to provide the potential for indirect erosion impacts. As described in Section 3.2.1.3 - Soils, a total of 18.9 miles of roads in the U. Yakima portion of the Study Area would be maintained at a road density of 6.43 miles per square mile.

About 4.5 miles (23 percent) of the 18.9 miles of roads in the U. Yakima Watershed would continue to be located on soils with greater erosion potential (erosion classes 3 and 4). More than 7 miles of road would

lie within Riparian Buffers, increasing the risk of sediment production near streams. Roads would continue to cross streams at 88 locations (see Table 4.3.3-1).

Sanding of base area roads and parking lots would continue under Alternative 1. Movement of the well drained, porous traction sand to adjacent rights-of-way would not likely impact the drainage of the coarse, well-drained to moderately well-drained soils in the Study Area, except possibly in localized depressions where the finer fraction could settle and reduce permeability. Such settlement of fines would be an exception and would not generally occur. Traction sand deposition would continue to cover adjacent vegetation and organic soil material reducing soil productivity adjacent to sanded roads and parking lots.

Maintenance of ski trails under Alternative 1 would also continue to contribute to greater soil erosion potential than a natural forested condition. On ski trails with shallower and drier soils, the herbaceous and shrub cover of ski trails provides less protection against erosion relative to the organic duff layer of the forest floor. Typically these effects would continue to be in the steeper trails toward the top of slopes. Lower portions of the slopes generally have dense herbaceous and shrub cover with dense roots that would continue to provide protection against surface erosion. Traffic associated with maintenance activities, such as periodic trimming of brush on the trails, would continue to cause local disturbance to soils under Alternative 1.

Sediment Yield

Annual sediment yields to all mapped streams in the U. Yakima Watershed would total 1,408 tons, or about 71 percent of the total sediment yield in the Study Area (see Table 3.2.1-5). This includes hillslope yields of 1,093 tons per year in the Coal Creek subwatershed, and 315 tons per year in the Mill Creek subwatershed (see Table 3.2.1-3). Road sand would continue to be the largest single source of sediment in the analysis area contributing 36 percent of the total sediment yield to all streams draining to Coal Creek. The lower sediment yield in the Mill Creek drainage reflects the absence of traction sand input (see Table 3.2.1-5).

A portion of the sediment in each stream is transported downstream, and delivered to one of the mainstem channels. In some stream segments additional sediment may be entrained through bank erosion processes, in others sediment deposition reduces the quantity delivered to mainstem channels. Sediment yield delivered to mainstem channels is shown in Table 4.2.3-2 and reflects the instream processes of entrainment and deposition.

Of the drainages delivering sediment to Coal Creek, the drainages with the largest overall area and largest developed area (Ski Acres and Summit South) contribute the largest fractions (242 and 106 tons per year respectively) of the total sediment yield to Coal Creek (670.56 tons per year).

Sediment yield to the mainstem of Mill Creek would continue to be 365 tons per year under Alternative 1 (see Table 4.2.3-2).

Soil Productivity

Of the 113.92 acres of detrimental soil conditions in the Study Area under Alternative 1 (see Table 4.2.3-3), approximately 86.9 acres (77 percent) are in the U. Yakima Watershed. Detrimental conditions include impervious surfaces and severely eroded, unproductive soils. The severely eroded, sparsely vegetated areas developed through inadequate revegetation of disturbed soils that were subjected to sheet wash and gully erosion. These soils support only sparse vegetation, but sediment yields have declined as larger stones not mobilized by water, wind, and gravity remain in place to armor or cover residual soil material. Soils in the U. Yakima Watershed under Alternative 1 are well within the 20 percent disturbance threshold (see Table 4.2.3-3).

As described in Section 3.2 - Geology and Soils, the potential for indirect erosion impacts resulting in additional detrimental soil conditions is greatest where converted forestland is maintained under herbaceous and shrub vegetation in ski trails on soils with high erosion hazard. There would continue to be 242.4 acres of higher hazard soils (erosion class 3 and 4) in the Study Area maintained in a modified vegetative cover under Alternative 1 (see Table 3.2.1-7). Most of this area (231.5 acres or 95 percent) is located in the U. Yakima Watershed.

Drainages of Particular Concern Analysis

As described in Section 3.2 - Geology and Soils, thresholds would continue to be exceeded in a majority of the 7th drainages within the U. Yakima Watershed. Ski Acres, Lower Mill Creek, Tunnel, Summit South and Beaver would continue have at least three out the five soils parameters exceeded under Alternative 1 (see Table 4.2.2-1).

Table 4.2.2-1:
Summary of DPC Analysis of Soil Conditions for Alternative 1
in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Upper Yakima River Watershed								
		L. Mill Creek	U. Mill Creek	Creek Run	Summit South	Hyak	Tunnel	Ski Acres	Beaver	Other
Drainage Area (acres)		**395.67**	**33.22**	**220.24**	**223.89**	**192.70**	**134.41**	**358.08**	**171.38**	**155.63**
Road Density (miles/square mile)	3.0	7.42	2.90	2.52	5.66	2.78	12.34	9.28	8.65	1.66
Road Crossing Density (number/ square mile)	6.0	27.50	0.00	20.34	14.29	9.96	85.71	50.04	33.61	4.11
Impervious Cover (% of total)	8.0	2.25	0.88	0.76	4.33	1.28	7.03	8.16	4.29	1.16
Bare Soils (acres)	0.0	1.46	0.00	0.00	2.14	0.00	0.00	9.39	0.00	0.31
Activities on High Erosion Soils (% of total)	1.5	1.99	0.00	0.00	1.42	1.45	1.58	7.93	2.41	0.54
Parameters over threshold:		**4**	**0**	**1**	**3**	**1**	**3**	**5**	**3**	**1**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

4.2.2.2 South Fork Snoqualmie River Watershed

Mass Wasting

Soils within the Study Area in the S.F. Snoqualmie Watershed would continue to experience the potential for occasional mass wasting events under Alternative 1. Steep slopes and heavy snowfall result in increased probability of snow avalanches that may entrain rocks soil and vegetation. Existing roads and trails would continue to elevate the chances of mass wasting events associated with culvert failures compared to a natural condition.

Erosion

Under Alternative 1, indirect erosion impacts would continue to occur as described in Section 3.2 – Geology and Soils. Of the 22.0 miles of roads maintained in the Study Area at a road density of 4.86 miles per square mile (see Table 4.2.3-1C), approximately 3.1 miles would be in the S.F. Snoqualmie Watershed (see Table 3.2.1-3). Road density would remain relatively low at the watershed scale (1.96 miles per square mile). Just under 0.33 mile of Study Area roads on soils with greater erosion potential (erosion class 3 and 4) would continue to occur in the S.F. Snoqualmie Watershed. Erosion risks associated with roads and the number of road-stream crossings would continue to occur under Alternative 1.

Sediment Yield

Annual sediment yields to all mapped streams in the S.F. Snoqualmie Watershed would total 563 (29 percent) of the 1,972 tons yielded across the Study Area (see Table 4.2.3-2). Road sand from I-90 (outside of the Study Area but within the modeled analysis area) would account for more than half of the modeled sediment yield (see Illustration 3.2.1-2). Sediment yield to the S.F. Snoqualmie River (including instream processes) would continue to be about 427 tons per year.

Soil Productivity

Approximately 24 percent of the 113.92 acres of detrimental soil conditions in the Study Area under Alternative 1 would occur in the S.F. Snoqualmie watershed (see Table 4.2.3-3). This would be the equivalent of about 3 percent of the watershed area, and is well within the 20 percent disturbance threshold established for NFSL. The potential for additional detrimental soil conditions would occur on approximately 31.3 acres of modified shrub and herbaceous cover maintained on higher hazard soils within the S.F. Snoqualmie Watershed (see Table 4.2.3-4).

Drainages of Particular Concern Analysis

As described in Section 3.2 - Geology and Soils, several soil parameter thresholds would continue to be exceeded in the S.F. Snoqualmie watershed. The Summit North drainage would continue to have 3 of the 5 soil parameters exceed thresholds (see Table 4.2.2-2).

Table 4.2.2-2:
Summary of DPC Analysis of Soil Conditions for Alternative 1 in the South Fork Snoqualmie Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Northside	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)		**49.04**	**72.11**	**270.19**	**89.37**	**318.76**	**214.67**
Road Density (miles/square mile)	3.0	4.88	7.02	0.50	0.68	1.70	2.34
Road Crossing Density (number/square mile)	6.0	0.00	26.62	4.76	7.16	12.05	11.93
Impervious Cover (% of total)	8.0	1.65	14.26	0.21	0.23	1.93	2.68
Bare Soils (acres)	0.0	0.00	0.00	0.00	0.00	0.00	0.22
Activities on High Erosion Soils (% of total)	1.5	0.55	0.36	0.07	0.00	0.11	0.00
Parameters over Threshold:		**1**	**3**	**0**	**1**	**1**	**2**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

4.2.3 Impacts – Alternative 2 (Proposed Action)

4.2.3.1 Upper Yakima River Watershed

Mass Wasting

Mass wasting, or mass soil movement through slumps, slides and debris flows, could be triggered by alterations in drainage or soil stabilizing features associated with implementation of Alternative 2. As noted in Section 3.2 - Geology and Soils, there is evidence of a variety of mass wasting processes in the Study Area, including shallow-rapid landslides, rotational slumps, avalanches, rockfall, and soil creep. It is impossible to predict exactly where and when this type of process will occur. Processes that increase the probability of mass wasting would include reduction in soil stabilizing features (such as overlying vegetation), increased slope, increased surface or subsurface water flow, and exposure to avalanche paths.

Section 3.2 - Geology and Soils, identified seven recorded mass wasting events observed in the Study Area that were most likely caused by human activities related to ski area management. Each of these seven events was a mass failure associated with a road or culvert. Of the seven events mentioned above, five were small slumps associated with road cutslopes or fillslopes. Such new events are less likely to occur under Alternative 2 because modern road construction and culvert installation requirements for new roads would be implemented on both private and federal lands. New construction methods designed to minimize and avoid the risk of such slope failures would be implemented under the MDP – Implementation, Operation, Restoration and Monitoring Plan. The Implementation plan would require road maintenance activities designed to reduce road drainage and culvert failures on new and existing roads.

Proposed road decommissioning and slope stabilization on the regraded surfaces under Alternative 2 would further reduce the probability of road related mass wasting. The decommissioning process involves restoring slope contours to assure increased slope stability in the formerly roaded areas, adding soil amendments and planting vegetation. Slope stabilization restoration projects proposed in the Ski Acres, Beaver, Tunnel, and Creek Run drainages would reduce the potential for mass wasting events associated with sparsely vegetated road slopes and other bare soil areas.

The largest mass soil movement observed in the U. Yakima portion of the Study Area was a debris flow at Summit Central associated with a regraded former road area and failure of a water bar at the upper end of this unstabilized soil area. Under Alternative 2, high hazard soils that drain to this area would be stabilized as a restoration activity. This would reduce the probability of additional mass soil movement from the area.

Drainage from native roads has been a source of erosion and mass soil movement in the Study Area (see Section 3.2.1.3 - Soils). The risk of mass wasting from roads is related to total road length and density, and to the soil hazard potential. Under Alternative 2, no new road length would be added on the highest (class 4) hazard soils in the U. Yakima Watershed. Road length would decrease by 0.6 mile on class 3

soils and by 0.31 mile on class 2 soils. No changes to road length on the lowest (class 1) hazard class soils would occur. The net change in roads in the U. Yakima Watershed would be a reduction of 0.39 mile of road, with the reductions in road length occurring in the Summit South, Creek Run, Tunnel, Ski Acres and Beaver drainages (see Tables 4.2.3-1A-C and Appendix I – Physical and Biological Resource Data Tables). Alternative 2 would have an indirect beneficial effect of reducing mass wasting potential from roads.

Clearing and grading activities proposed under Alternative 2 may increase the risk of mass wasting, but these risks would be managed through the use of watershed protection management requirements and other management practices. Specific measures that would be used are found in Table 2.4-2 (MR1 – 19 and OMP7 - 20). The greatest potential for mass wasting would occur where the greatest area of grading on steep slopes is proposed, which is on Trail 26 in the Tunnel drainage. Because Tunnel Creek is located in a long culvert below this location, the risk of surface water impacts from a slump or slide at this location are much less than at a location with a direct path from the mass failure point to the nearest stream.

According to results from the stream flow model presented in Section 4.3.3.1 – Upper Yakima River Watershed, U. Yakima Watershed peak flows would increase slightly in most drainages in response to increased impervious surface area and changes in forest cover. Where increases in two-year peak flows occur, the frequency of bank exceeding flows would also increase. Peak flow events when streams exceed their ordinary high water mark are when the greatest bank erosion occurs and are the most likely to trigger bank slope failures.

The greatest projected increase in two-year peak flow under Alternative 2 would occur in the Creek Run drainage with an estimated 2.3 percent increase in two-year peak flow above the existing condition (see Table 4.3.3-5). This change would not be measurable by current monitoring technology (see Section 4.3.3.1 - Upper Yakima River Watershed). Therefore, the corresponding increased probability of bank exceeding flows that could trigger a mass wasting event along a stream bank would also be very low. The only other drainage projected to have an increase in peak flow greater than 1 percent is the Tunnel Creek drainage that would have an increased peak flow of 1.1 percent under Alternative 2. However, since most of the proposed development in this drainage is located low in the basin, and the middle reach of Tunnel Creek runs through a long culvert, only the lower reach would be affected. The lower reach of Tunnel Creek does not have steep bank slopes and the risk of increased mass bank failures would be very low.

Table 4.2.3-1A:
Summary of Sediment Risks MDP from Roads within the MDP Area of The Summit-at-Snoqualmie Study Area by Alternative

Parameter (units)	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Total Road Length (miles)	18.52	18.13	18.13	17.87	18.13
Road Density (mile/mile^2)	4.72	4.55	4.55	4.48	4.55
Road Length by Surfacing (miles)					
Native	16.98	15.95	15.95	15.74	15.95
Paved	1.53	1.88	1.88	1.83	1.88
Road Length by Soil Erosion Potential (miles)					
1 (lowest)	0.30	0.30	0.30	0.30	0.30
2	15.12	14.83	14.83	14.57	14.83
3	3.09	3.05	3.05	3.07	3.05
4 (highest)	0	0.02	0.02	0.02	0.02

Note: This table does not include the Mill Creek portion of the Study Area.

Table 4.2.3-1B:
Summary of Sediment Risks from Roads within the Mill Creek Area of The Summit-at-Snoqualmie Study Area by Alternative

Parameter (units)	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Total Road Length (miles)	3.52	3.52	3.52	3.52	3.52
Road Density (mile/mile^2)	5.77	5.77	5.77	5.77	5.77
Road Length by Surfacing (miles)					
Native	3.52	3.52	3.52	3.52	3.52
Paved	0	0	0	0	0
Road Length by Soil Erosion Potential (miles)					
1 (lowest)	0	0	0	0	0
2	1.84	1.84	1.84	1.84	1.84
3	1.64	1.64	1.64	1.64	1.64
4 (highest)	0.04	0.04	0.04	0.04	0.04

Note: This table includes only the Mill Creek portion of the Study Area.

Table 4.2.3-1C:
Summary of Sediment Risks from Roads within the Total SUP Area of The Summit-at-Snoqualmie Study Area by Alternative

Parameter (units)	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Total Road Length (miles)	22.04	21.35	21.35	21.09	21.35
Road Density (mile/mile^2)	4.86	4.79	4.79	4.74	4.79
Road Length by Surfacing (miles)					
Native	20.5	19.47	19.47	19.26	19.47
Paved	1.53	1.88	1.88	1.83	1.88
Road Length by Soil Erosion Potential (miles)					
1 (lowest)	0.3	0.3	0.3	0.3	0.3
2	16.96	16.67	16.67	16.41	16.67
3	4.73	4.69	4.69	4.71	4.69
4 (highest)	0.04	0.06	0.06	0.06	0.06

Note: This table includes the Mill Creek portion of the Study Area.

Erosion

Short-term erosion impacts would occur under Alternative 2 through scarification and exposure of the soil surface. Activities with the potential for short-term erosion include the grading of ski trails, trenching for utility corridors, disturbed areas adjacent to road facility construction, and construction of parking lots. Clearing of additional ski trails without grading is an indirect but permanent impact, as the removal of trees increases the potential for erosion from these areas. Clearing and grading areas are shown in Figure 4.2.1-1, Impacts by Soil Erosion Potential – Alternative 2 – The Summit and described in Section 2.3.3 – Alternative 3 – Proposed Action (see Table 2.7-2 for a comparison of clearing and grading impacts between the alternatives).

The use of erosion and sediment control BMPs is critical to completing clearing and grading without causing excessive erosion and sediment transport. Use of BMPs, can be effective at minimizing erosion risks at all of the types of construction, clearing and grading proposed (for specific measures see Management Requirements MR1-6, MR12-14, MR16, MR36 as well as Other Management Provisions OMP2-5, OMP7 and OMP9-17 in Table 2.4-2). It is anticipated that temporary minor increases in soil erosion and sediment delivery to streams would probably occur with trail grading and other ground disturbances, although the use of sediment control BMPs, described above, would minimize this risk by preventing sediment mobilization (e.g., mulching, revegetation) and by capturing any mobilized sediment prior to delivery to streams (e.g., silt fence, straw bales, water bars).

Important sediment sources in the portion of the U. Yakima Watershed in the Study Area, are roads with native surface material. The road surfaces are erodable, and waterbars and ditches along native roads can be sites of erosion as well. Paved roads can also be sources of sediment, but primarily where traction sand is applied. Alternative 2 includes construction of new roads, but it also includes road decommissioning

and restoration, and paving native surfaces roads and parking lots. Two new culverted road crossings of streams would be installed under Alternative 2, one culvert in Summit South drainage (unnamed stream), and one culvert in the Tunnel Creek drainage (unnamed stream). The proposed road decommissioning would remove two culverts in the Summit South drainage and one culvert in the Creek Run drainage, resulting in a net reduction of one road crossing of streams in the U. Yakima Watershed. Likewise, the net change in roads in the U. Yakima Watershed would be a long-term beneficial reduction in road length by 0.69 mile and density by 0.07 mile per square mile (see Tables 4.2.3-1A-C and Appendix I – Physical and Biological Resource Data Tables). A summary of sediment risks from roads is shown in Tables 4.2.3-1A-C. Table 4.2.3-1 displays impacts resulting only from implementation of the proposed MDP. Tables 4.2.3-1B displays impacts resulting from the proposed land donation and Table 4.2.3-1C displays the combined total impact of the proposed MDP and land donation. The locations of roads relative to soil hazard are shown in Figures 4.2.1-3, Road Impacts and Restoration by Soil Erosion Potential – Alternative 2 – The Summit and 4.2.1-4, Road Impacts and Restoration by Soil Erosion Potential – Alternative 2 - Alpental.

Paving parking areas proposed under Alternative 2 would have a long-term beneficial impact of reducing surface sheet erosion of traction, sand and gravel from parking lots on NFSL. In the U. Yakima Watershed, the Summit West Lots 1 and 2 (Beaver drainage-4.3 acres) and the Silver Fir Lot 1 would be paved. Chemical de-icer/ice-inhibitor would be used on paved parking lots in place of the traction sand that is currently used. This would reduce sand deposition on soils adjacent to parking areas.

Slope stabilization, road obliteration, and restoration projects proposed under Alternative 2 (see Section 2.3.3.11 - Restoration) would reduce ongoing and potential erosion sites at Summit East, Summit Central, and Summit West. Initial stabilization work may require some localized short-term soil disturbance during site preparation, but would have a long-term beneficial impact of reducing erosion in these problem areas. Specifically, restoration of an unnamed stream channel near the tubing center at Summit Central; planting tree islands on previously cleared slopes at Summit West, Summit Central, and Summit East; and removal of a culverted segment of Beaver Lake Creek at Summit West would have potential for minor, short-term sediment disturbance during construction followed by long-term beneficial impacts of reduced erosion at these sites. Deactivation of Road M-5 in the Summit South and Creek Run drainages and Road C in the Beaver Drainage would reduce surface erosion from these road areas. Under Alternative 2, bare soil area would be reduced from 13.5 acres to 9.1 acres reducing the area susceptible to erosion and expansion of bare soil area (see Table 4.2.3-4). Recovering bare soils in the Ski Acres and Lower Mill Creek drainages would provide the majority of these improvements in bare soil conditions. Lower Mill Creek would decrease by 1.1 acres of bare soil and Ski Acres would decrease by 3.1 acres of bare soil compared to the existing condition.

Sediment Yield

Sediment Yield to the streams draining the Study Area is determined by a combination of the weather, topography, soil type, and land use conditions. Using the Water Erosion Prediction Project (WEPP) model described in Section 3.2 - Geology and Soils, sediment yields were calculated by drainage area and alternative. Sediment yields were modeled using a conservative assumption that all MDP elements were constructed at once and that Mitigation Measures, Management Requirements and Other Management Provisions measures would not be implemented. The results then represent the Year-1 simulated condition. In actuality, projects would be phased, so that some project impacts would be fully recovered before others are implemented, reducing the sediment yield that would actually be experienced at any point in time during the lifetime of the MDP, as compared to the modeled sediment yield.

The results of the WEPP model calculations are shown in Table 4.2.3-2. Under Alternative 2, the annual sediment yield to Coal Creek from the 7th Field drainages within the Study Area would increase by approximately 6.16 tons per year (0.9 percent yield over the existing condition). This change in sediment yield would be from increases in the Tunnel, Hyak, Creek Run, and Summit South drainages, and reductions in sediment yield in the Beaver and Ski Acres drainages. The greatest increases would be in the Summit South and Tunnel drainages, where sediment yield would increase by 10.72 and 1.5 tons per year respectively. These increases are due to clearing and grading for trails, roads and parking lots. The Hyak and Creek Run drainages would increase by less than 1 ton per year in each drainage. The Beaver and Ski Acres drainages would show the benefits of restoration and revegetation projects and parking lot paving which decreases sediment yield by 4.72 and 3.03 tons per year respectively. The estimated increase in sediment yield to Coal Creek would likely not be measurable with current monitoring technology due to the small increase in yield relative to baseline levels and the high variability in yields seasonally and from year to year.

Mill Creek would experience a smaller increase in sediment yield of 2.71 tons per year (0.7 percent over the existing condition). The predicted changes in sediment yield represent the balance between trail clearing, grading and restoration. The estimated increase in sediment yield to Mill Creek would likely not be measurable with current monitoring technology due to the small increase in yield relative to baseline levels and the high variability in yields seasonally and from year to year. Over the entire Study Area, Alternative 2 would result in a reduction in sediment yield of 9.28 tons per year, due in large part to parking lot paving.

Table 4.2.3-2:
Summary of Sediment Yields to Main Stem Streams
in The Summit-at-Snoqualmie Study Area by Alternative

Receiving Stream	Modeled Watershed Area (acres)	Alt 1 Existing Condition (tons/year)	Alt 2 Sediment Yield Increase (tons/year)	Alt 3 Sediment Yield Increase (tons/year)	Alt 4 Sediment Yield Increase (tons/year)	Mod Alt 5 Sediment Yield Increase (tons/year)
Coal Creek	926.76	670.56	+6.16	+2.69	-5.48	+5.86
Mill Creek	682.81	365.20	+2.71	+2.71	+2.81	+2.71
S. F. Snoqualmie River	904.80	682.81	-18.16	-18.16	-18.29	-18.16
Study Area Totals	**2,514.37**	**1,462.67**	**-9.28**	**-12.76**	**-20.96**	**-9.59**

Note: WEPP modeled results

Soil Productivity

Under the Action Alternatives, long-term soil productivity would be lost through the conversion to impervious surfaces and short-term loss of productivity may be associated with ground disturbing activity through erosion of surface horizon, mixing of soil horizons, or through soil compaction. Conversion of forested land cover to herbaceous and shrub cover for ski trail construction would also reduce soil productivity in these areas by reducing organic input and depth of topsoil. Conversely, soil productivity would recover over the long-term through road decommissioning, stream and wetland restoration, revegetation, and slope stabilization. Tables 4.2.3-3A-C summarize detrimental soil conditions in the Study Area under each MDP alternative. Under Alternative 2, detrimental soil area (bare soil and impervious cover areas) would increase by 1.36 acres for the entire Study Area. In the U. Yakima Watershed, detrimental soil conditions would increase by 2.17 acres. The detrimental soil percentage would increase to 5 percent for the U. Yakima Watershed, but would be 4 percent for the entire Study Area due to restoration of bare soil areas.

Table 4.2.3-3A:
Summary of Detrimental Soil Quality Conditions within MDP Area of
The Summit-at-Snoqualmie Study Area by Alternative

Disturbance Source	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Study Area (acres)	2,510.31	2,509.08	2,509.08	2,509.08	2,509.08
Developed Area (acres)	87.77	99.35	96.12	96.83	98.38
Bare Area Soils (acres)	13.52	9.11	9.11	9.15	9.11
Total Detrimental Soil Conditions (acres)	107.10	108.46	105.23	105.98	107.49
Percent of Study Area in a Detrimental Soil Condition (percent)	4%	4%	4%	4%	4%
Detrimental Soil Conditions Below Study Area Threshold (yes or no)?	Yes	Yes	Yes	Yes	Yes

Note: This table does not include the Mill Creek portion of the Study Area.

Table 4.2.3-3B:
Summary of Detrimental Soil Quality Conditions within the Mill Creek area of The Summit-at-Snoqualmie Study Area by Alternative

Disturbance Source	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Study Area (acres)	389.05	389.05	389.05	389.05	389.05
Developed Area (acres)	6.82	6.82	6.82	6.82	6.82
Bare Area Soils (acres)	0	0	0	0	0
Total Detrimental Soil Conditions (acres)	6.82	6.82	6.82	6.82	6.82
Percent of Study Area in a Detrimental Soil Condition (percent)	2%	2%	2%	2%	2%
Detrimental Soil Conditions Below Study Area Threshold (yes or no)?	Yes	Yes	Yes	Yes	Yes

Note: This table includes only the Mill Creek portion of the Study Area.

Table 4.2.3-3C:
Summary of Detrimental Soil Quality Conditions within the Total SUP Area of The Summit-at-Snoqualmie Study Area by Alternative

Disturbance Source	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Study Area (acres)	2,899.36	2,898.13	2,898.13	2,898.13	2,898.13
Developed Area (acres)	94.59	106.17	102.94	103.65	105.2
Bare Area Soils (acres)	13.52	9.11	9.11	9.15	9.11
Total Detrimental Soil Conditions (acres)	113.92	115.28	112.05	112.8	114.31
Percent of Study Area in a Detrimental Soil Condition (percent)	4%	4%	4%	4%	4%
Detrimental Soil Conditions Below Study Area Threshold (yes or no)?	Yes	Yes	Yes	Yes	Yes

Note: This table includes the Mill Creek portion of the Study Area.

Of the different vegetation types in the Study Area, modified herbaceous and shrub that are sparsely vegetated are more susceptible to erosion and developing detrimental soil conditions, particularly on high hazard soils, than other land cover types. Clearing and conversion to modified herbaceous cover on high hazard soils could increase the risk of erosion and lost soil productivity. Removing forest cover would disrupt the natural cycle of organic litter fall (e.g., needles, twigs, lichens from trees) to the soil surface that creates a duff layer. The duff layer provides organic input into an undisturbed soil profile and also serves as a protection against soil erosion. A summary of the modified herbaceous and shrub cover by erosion potential and alternative are shown in Table 4.2.3-4. With the greatest trail development of any alternative, Alternative 2 would increase the area of modified herbaceous shrub cover in all soil erosion hazard potential classes increasing detrimental soil conditions by 44 acres (5.7 percent) above existing (Alternative 1) conditions for the entire Study Area.

Table 4.2.3-4:
Potential Impacts from Soil Erosion on Moderate and High Erosion Potential Soils within the Study Area

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Modified herbaceous and shrub cover by soil erosion potential (acres)					
1 (lowest)	24.77	27.79 (+3.02)	27.06 (+2.29)	25.44 (+0.67)	27.78 (+3.01)
2	508.67	540.33 (+31.66)	516.17 (+7.5)	510.11 (+1.44)	537.20 (+28.53)
3	231.83	239.94 (+8.11)	234.43 (+2.6)	230.39 (-1.44)	238.97 (+7.14)
4 (highest)	10.57	12.16 (+1.59)	12.15 (+1.58)	10.90 (+0.33)	11.89 (+1.32)
Total (acres)	**775.84**	**820.23 (+44.39)**	**789.81 (+13.97)**	**776.85 (+1.01)**	**815.84 (+40.0)**

Note: This table includes the Mill Creek portion of the Study Area.

Drainages of Particular Concern

Under Alternative 2, there would be two new threshold exceedances compared to Alternative 1.

- Summit South (Activities on High Erosion Soils – 2.15 percent)
- Tunnel (Impervious Cover – 8.11 percent)

Road density would increase slightly (0.05 mile/square mile) under Alternative 2 in the Lower Mill Creek drainage due to proposed construction for access to proposed lift terminals (see Table 4.2.3-5). Road density would decrease, but remain over threshold, in the Summit South, Tunnel, Ski Acres, and Beaver drainages due to proposed road decommissioning.

Table 4.2.3-5:
Summary of DPC Analysis of Soil Conditions for Alternative 2 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Upper Yakima River Watershed								
		L. Mill Creek	U. Mill Creek	Creek Run	Summit South	Hyak	Tunnel	Ski Acres	Beaver	Other
Drainage Area (acres)		**395.67**	**33.22**	**220.24**	**223.89**	**192.70**	**134.41**	**358.08**	**171.38**	**155.63**
Road Density (miles/square mile)	3.0	7.47	2.90	2.25	5.61	2.78	11.77	8.80	7.68	1.66
Change from Alternative 1 (miles/square mile)		0.05	0.00	-0.27	-0.05	0.00	-0.57	-0.48	-0.97	0.00
Road Crossing Density (number/square mile)	6.0	29.13	0.00	20.35	11.44	13.29	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	0.01	-2.85	3.33	4.80	0.02	-3.72	0.00
Impervious Cover (% of total)	8.0	2.27	0.88	0.84	4.34	1.32	8.11	9.45	4.35	1.16
Change from Alternative 1 (% of total)		0.02	0.00	0.07	0.01	0.04	1.08	1.29	0.06	0.01
Bare Soils (acres)	0.0	0.32	0.00	0.00	2.02	0.00	0.00	6.29	0.00	0.31
Change from Alternative 1 (acres)		-1.14	0.00	0.00	-0.12	0.00	0.00	-3.10	0.00	0.00
Activities on High Erosion Soils (% of total)	1.5	2.09	0.00	0.00	2.15	1.45	1.58	6.75	2.41	0.86
Change from Alternative 1 (% of total)		0.10	0.00	0.00	0.73	0.00	0.00	-1.17	-0.01	0.33
Parameters over Threshold		**4**	**0**	**1**	**4**	**1**	**4**	**5**	**3**	**1**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Road crossing density would increase in the Lower Mill Creek drainage, Creek Run, Hyak, and Tunnel as a result of the installation of new culverts and bridges. Crossing densities would decrease, but remain over threshold in Beaver and Tunnel drainages as a result of proposed culvert removal associated with the decommissioning of Road M5 and the restoration of Beaver Lake Creek.

Under Alternative 2, impervious surface area in the U. Yakima Watershed would increase from 3.76 percent under existing conditions to 4.11 percent through construction of facilities, roads, and parking. The greatest increases would be in the Tunnel (by 1.08 percent) and Ski Acres (by 1.29 percent) drainages (see Table 4.2.3-5) which would result in a new threshold exceedance. Under Alternative 2, the impervious surface area in these drainages would be greater than the threshold of concern (8 percent).

Impervious surface area in the Tunnel drainage would be increased from 7.03 percent under Alternative 1 to 8.11 percent under Alternative 2, which puts the impervious cover parameter over threshold. The Ski Acres drainage would have an impervious surface area of 8.16 percent under Alternative 1 and 9.45 under Alternative 2.

Vegetative restoration would reduce bare soil area in the U. Yakima Watershed by about 33 percent under Alternative 2, which is a decrease from 13.52 acres under Alternative 1 to 9.11 acres under Alternative 2. The proposed restoration would enhance soil productivity and reduce the potential for additional erosion expanding existing bare soil areas. The reductions in bare soil area would occur in the Lower Mill Creek, Summit South, and Ski Acres drainages (see Table 4.2.3-5).

Activities on high erosion soils would result in a new threshold exceedance in the Summit South drainage as a result of Alternative 2. The percentage would decrease in the Ski Acres drainage as a result of slope stabilization, but would continue to remain over threshold.

4.2.3.2 South Fork Snoqualmie River Watershed

Mass Wasting

Under Alternative 2, 0.2 mile of new road would be constructed on high hazard soils at the top of the Northside chairlift increasing the risk of mass wasting at this location. However, this location is at the top of a ridge far removed from any stream channels. No other roads proposed in the S. F. Snoqualmie Watershed would be located in high hazard soils. As discussed in Section 4.2.3.1 – Upper Yakima River Watershed, new roads would be subject to road construction standards to prevent road failures. Under Alternative 2, road maintenance measures would be required under *The Summit-at-Snoqualmie MDP – Implementation, Operation, Restoration and Monitoring Plan* that would prevent water bar failure that could otherwise lead to mass wasting along this road section (see Appendix F – Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

The location of the utility corridor serving the Alpental mountain-top restaurant would require engineering for the steep rocky conditions along the utility route. The proximity of the project to International Creek would increase the risk of a mass wasting event in the channel. The risk of such an event would be mitigated through Management Requirements MR1, MR36 and Other Management Provisions OMP2, OMP7, OMP9-11.

A culvert that was in disrepair at Alpental and had led to a debris flow into a tributary of International Creek has been replaced. Conditions at this site would not be impacted by the installation of the *Internationale* lift under Alternative 2 and would continue as described in Section 3.2.1.2 – Mass Wasting and Unstable Slopes.

According to results from the stream flow model presented in Section 4.3.3.2 – South Fork Snoqualmie River Watershed, changes in two-year peak stream flow would be essentially the same (i.e., less than 1

percent increase) under Alternative 2 in all S.F. Snoqualmie subwatershed drainages, except for the Summit North drainage. In this drainage, two-year peak stream flow would increase by approximately 1.5 percent due to increased impervious surface area from parking lots at Summit West. This modeled increase is not expected to be measurable by current monitoring technology and would only slightly increase the probability of stream bank failures. The affected stream draining this area is a small, modified channel (ditch) with low banks that are 2 to 3 feet high). If a channel bank were to slump in this channel, the volume of sediment involved would be relatively small and any increase in slump volume would not be attributable to a 1.5 percent increase in the two-year peak flow.

Erosion

Under Alternative 2, road length would increase by 0.05 mile in the Summit North drainage, otherwise road length and density would be unchanged from existing conditions. This small segment of new road located at the top of the Northside chairlift would traverse a steep area of mapped high hazard soils. As discussed above, road construction would be subject to USFS requirements to assure stability. Some surface erosion would occur, but would be located far from sensitive resources, such as surface waters.

Clearing and grading under Alternative 2 would involve increased risk of soil erosion. Proposed management activities on high hazard soils would increase the potential for development of detrimental soils in the Northside and other drainages. This risk would be minimized through MR1-2, MR5-6, MR13-14, OMP2, OMP7, OMP9 -14, OMP16-17 (see Table 2.4-2), Under Alternative 2, bare soil area would decrease by about 0.14 acre in the other S.F. Snoqualmie drainage due to restoration.

Paving Summit West Lot 1, Alpental Road, and Alpental Lots 3, 4, 5, 6, and 7 would reduce sheet erosion from these surfaces (10.3 acres) under Alternative 2.

Sediment Yield

As described earlier, clearing and grading for lift, trail, road, parking lot and building construction would increase the risk of temporary erosion and sediment delivery to streams. The long-term effects of Alternative 2 would, however, reduce sediment yield overall in the S.F. Snoqualmie Watershed. Parking lot paving (Summit West Lot 1, and Alpental Lots 3, 4, 5, 6, and 7) and road paving (Alpental Road) would reduce surface erosion and sediment production by eliminating the use of traction sand at these parking lot and road areas. Revegetation to create tree islands at the Summit West would improve soil retention in the S.F. Snoqualmie Watershed.

WEPP model calculations indicate that under Alternative 2, the sediment yield to the S.F. Snoqualmie River would be reduced by 18.16 tons per year (see Table 4.2.3-2). Although there would be an increase of 4.28 tons per year from the International drainage related to clearing and grading, the sediment yield would be reduced in the Nacrinomical drainage by 14.18 tons per year and by 8.29 tons per year and in the North Summit drainage. These reductions would be related to parking lot paving, stopping the application of traction sand, and revegetation.

Soil Productivity

Under Alternative 2, impervious surface area in the S.F. Snoqualmie Watershed would be increased by approximately 5 acres (0.5 percent). Relative to other drainages, the impervious surface area would increase to 18 percent in Summit North (which is well above the threshold for concern of 8 percent), the most in any of the drainages. Impervious surface area would remain well below the threshold for concern in the other S.F. Snoqualmie drainages and at the watershed scale. Bare soil area in the S.F. Snoqualmie Watershed would be reduced slightly (by 0.05 acre) under Alternative 2 through revegetation at Summit West. Tree island planting at Summit West would promote forest soils development in these areas, increasing soil productivity. Under Alternative 2, the total area with detrimental soil conditions would increase from 2 percent of the Study Area in the S.F. Snoqualmie Watershed to about 3 percent, well below the USFS standard of no more than 20 percent of detrimental soil conditions in the project area.

Clearing and grading may have short-term direct impacts on soil productivity by disturbing soil horizons and altering local conditions. However, these areas would be revegetated to maintain long-term soil productivity according to OMP3-4 (see Table 2.4-2).

Drainages of Particular Concern

Under Alternative 2, there would be no new threshold exceedances in any of the drainages. The Northside drainage would remain over threshold for road density as a result of proposed road construction to access the top terminal of the *Northside* lift (see Table 4.2.3-6). There would be one new stream crossing in the S.F. Snoqualmie Watershed under Alternative 2, located in the Nacrinomical drainage. Nacrinomical, Summit North, Upper Alpental and Other drainages would remain over threshold for road crossing density under Alternative 2.

Table 4.2.3-6:
Summary of DPC Analysis of Soil Conditions for Alternative 2 in the South Fork Snoqualmie Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Northside	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)		**49.04**	**72.11**	**270.19**	**89.37**	**318.76**	**214.67**
Road Density (miles/square mile)	3.0	5.48	7.02	0.50	0.68	1.70	2.35
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.00	0.00	0.00
Road Crossing Density (number/square mile)	6.0	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Impervious Cover (% of total)	8.0	1.89	18.18	0.26	2.36	1.95	2.68
Change from Alternative 1 (% of total)		0.25	3.92	0.05	2.13	0.03	0.00
Bare Soils (acres)	0.0	0.00	0.00	0.00	0.00	0.00	0.17
Change from Alternative 1 (acres)		0.00	0.00	0.00	0.00	0.00	-0.05
Activities on High Erosion Soils (% of total)	1.5	0.73	0.36	0.07	0.00	0.11	0.17
Change from Alternative 1 (% of total)		0.18	0.00	0.00	0.00	0.00	0.17
Parameters over Threshold		**1**	**3**	**0**	**1**	**1**	**2**
Change from Alternative 1		**0**	**0**	**0**	**0**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tablesand includes the area of impact and analysis area for each DPC parameter.

Impervious cover would increase, but remain under threshold in the International, Upper Alpental, Nacrinomical, Northside drainages as a result of the proposed facilities and paving of the existing Alpental Road. The greatest increase in impervious surface would occur in the Summit North drainage as a result of the proposed paving of parking lots. The amount of bare soils would decrease, but remain over threshold in the Other drainage. Activities on high erosion soils would increase, but remain under threshold in the Northside and Other drainages.

4.2.4 Impacts – Alternative 3

4.2.4.1 Upper Yakima River Watershed

Mass Wasting

With no change in road density or crossings relative to Alternative 2, road related mass wasting potential under Alternative 3 would be essentially the same as under Alternative 2.

Differences in impervious surface area and forest cover on trails 55, 66, and 67 would result in a slightly lower two-year peak flow in the Creek Run drainage (see Section 4.3.4.1 - Upper Yakima River Watershed). Under Alternative 3, two-year stream flow would increase by only 0.2 percent, compared to an increase of 2.3 percent under Alternative 2. This difference would slightly reduce the potential for mass wasting along Stream A and Stream B (see Figure 3.3.1-1, Hydrography – The Summit). Peak stream flow and related risk of stream bank mass failures would be essentially the same as described under Alternative 2 in all other drainages.

Erosion

Erosion impacts would be less under Alternative 3 than as described under Alternative 2 since the Creek Run chairlift and associated trails would not be constructed. Additionally, since existing trails 55, 66, and 67 would be revegetated, soils in these areas would be stabilized reducing the potential for erosion. The clearing and grading areas would be reduced in the Creek Run and Hyak drainages under Alternative 3 relative to Alternative 2.

Road and road crossing density in the U. Yakima Watershed under Alternative 3 (see Table 4.2.4-1) would be the same as under Alternative 2. Therefore road related erosion would be the same as under Alternative 2. Severely eroded (bare) soil area would also be the same under Alternative 3 as under Alternative 2. Parking lot paving and subsequent reduction in surface erosion under Alternative 3 would also be the same as under Alternative 2.

The land donation proposed under Alternative 3 would only affect soil erosion over a long-term time scale. Under the proposed land donation, acreage that becomes federal land would be managed for wildlife connectivity and would eventually mature into forested land with reduced erosion and increased soil productivity in the Lower Mill Creek drainage.

Sediment Yield

Sediment yield to Coal Creek would be reduced under Alternative 3 relative to Alternative 2. Under Alternative 3, the sediment yield to Coal Creek would be increased above existing conditions by 2.69 tons per year (compared to 6.16 tons per year above existing conditions under Alternative 2) (see Table 4.2.3-2). This difference would reflect a decrease in sediment yield from the Creek Run drainage by 4.16 tons per year (5.03 tons less than under Alternative 2), and an increase in sediment yield in the Summit South drainage of 12.32 tons per year (1.6 tons less than under Alternative 2).

Sediment yield to Mill Creek would be the same under Alternative 3 as under Alternative 2.

Soil Productivity

Impacts to soil productivity would be reduced under Alternative 3 compared to Alternative 2 due to the revegetation that would take place on Trails 55, 66, and 67. As these trails become forested, the organic input to the soils would increase and erosive soil loss would decrease. Under Alternative 3, impervious

surface area would be 4.05 percent for the U. Yakima Watershed, just slightly less than as described under Alternative 2 (4.11 percent) due to the reduction in impervious surfaces in the Creek Run, Tunnel, and Ski Acres drainages (see Table 4.2.4-1).

Bare soil area in the U. Yakima Watershed would be the same under Alternative 3 as described under Alternative 2. The total detrimental soil area in the subwatershed would be the same under Alternative 3 as under Alternative 2 (see Table 4.2.3-3).

The land donation proposed under Alternative 3 would increase soil productivity through a change in management objective from timber harvest to late successional forest in this area. Over the long-term this would increase soil productivity in the Mill Creek subwatershed.

Drainages of Particular Concern

Under Alternative 3, there would be one new threshold exceedance compared to Alternative 1.

- Summit South (Activities on High Erosion Soils – 2.15 percent)

Road density would be reduced, but remain over threshold, in the Summit South, Tunnel, Ski Acres and Beaver drainages compared to Alternative 1 (see Table 4.2.4-1). Road density would continue to remain under threshold in the Upper Mill Creek, Creek Run and Other drainages.

Table 4.2.4-1:
Summary of DPC Analysis of Soil Conditions for Alternative 3 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Upper Yakima River Watershed								
		L. Mill Creek	U. Mill Creek	Creek Run	Summit South	Hyak	Tunnel	Ski Acres	Beaver	Other
Drainage Area (acres)		**395.67**	**33.22**	**220.24**	**223.89**	**192.70**	**134.41**	**358.08**	**171.38**	**155.63**
Road Density (miles/square mile)	3.0	7.47	2.90	2.25	5.61	2.78	11.77	8.80	7.68	1.66
Change from Alternative 1 (miles/square mile)		0.05	0.00	-0.27	-0.05	0.00	-0.57	-0.48	-0.97	0.00
Road Crossing Density (number/ square mile)	6.0	29.13	0.00	20.35	11.44	13.29	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	0.01	-2.85	3.33	4.80	0.02	-3.72	0.00
Impervious Cover (% of total)	8.0	2.27	0.88	0.70	4.34	1.32	7.92	9.35	4.34	1.16
Change from Alternative 1 (% of total)		0.02	0.00	-0.06	0.01	0.04	0.89	1.19	0.05	0.01
Bare Soils (acres)	0.0	0.32	0.00	0.00	2.02	0.00	0.00	6.29	0.00	0.31
Change from Alternative 1 (acres)		-1.14	0.00	0.00	-0.12	0.00	0.00	-3.10	0.00	0.00
Activities on High Erosion Soils (% of total)	1.5	2.09	0.00	0.00	2.15	1.45	1.58	6.75	2.41	0.86
Change from Alternative 1 (% of total)		0.10	0.00	0.00	0.73	0.00	0.00	-1.17	-0.01	0.33
Parameters over Threshold		**4**	**0**	**1**	**4**	**1**	**3**	**5**	**3**	**1**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Road crossing density would increase in Lower Mill Creek, Hyak and Tunnel drainages. Crossing density would decrease, but remain over threshold in the Summit South and Beaver drainage under Alternative 3. Impervious surface area would increase slightly in all drainages except for Creek Run, as compared to Alternative 1, but would remain under threshold. Impervious cover would be reduced in Creek Run due to restoration activities and reduced development in the drainage.

The area of bare soils would be reduced in the Lower Mill Creek, Summit South, Ski Acres and Beaver drainages, compared to Alternative 1, due to proposed restoration projects. Activities on high erosion soils would increase over threshold in the Summit South drainage under Alternative 3. Slight increases would also occur in the Lower Mill Creek and Other drainages. Activities on high erosion soils would decrease in the Ski Acres drainage, but remain over threshold.

4.2.4.2 South Fork Snoqualmie River Watershed

Mass Wasting

Mass wasting potential would be slightly less under Alternative 3 as under Alternative 2 since the utility corridor for the Alpental mountain-top restaurant would not be constructed. The risk of mass wasting in this location is relatively small due to shallow soils underlain with bedrock or talus that are not prone to mass movement. As a result, elimination of this utility work (and the restaurant and gondola themselves) at Alpental would not be a substantial benefit to mass wasting. Otherwise, the risk of mass wasting events would be the same as under Alternative 2.

Two-year peak streamflow in the S.F. Snoqualmie Watershed (see Section 4.3 – Water and Watershed Resources) would essentially be the same as under Alternative 2, varying by no more than 0.2 percent in any drainage. Therefore, there would be no measurable difference in stream flow related mass wasting between Alternatives 1, 2 and 3.

Erosion

The risk of temporary erosion impacts would be less under Alternative 3 than under Alternative 2, since the Pulse Gondola, mountain-top restaurant and the associated utilities corridor would not be constructed and the clearing and grading area would be reduced. These activities occur primarily in the International and Nacrinomical drainage where the risk of erosion would decrease the most relative to Alternative 2. Management activities on high hazard soils would be identical under Alternative 3 to Alternative 2.

Road related erosion impacts would be the same under Alternative 3 as under Alternative 3 since road density, area of high hazard soil activities, and number of crossings would be the same (see Table 4.2.4-2).

Sediment Yield

Under Alternative 3, the sediment yield to the S.F. Snoqualmie River would be identical to that under Alternative 2. Elimination of the Pulse gondola and Mountain Top Restaurant at Alpental under Alternative 3 would not result in land use cover changes that would improve sediment yield in this subwatershed, as compared to Alternative 2.

Soil Productivity

No new severely eroded soils would result from Alternative 3. Under Alternative 3 the impervious surface area in the S.F. Snoqualmie Watershed would be 2.34 percent, slightly less than 2.88 percent under Alternative 2. Short-term impacts to soil productivity associated with soil disturbance for the Pulse Gondola terminals, mountain-top restaurant, and utility trenching would not occur under Alternative 3. Otherwise, the impacts to soil productivity would be the same as under Alternative 2.

Drainages of Particular Concern

Under Alternative 3, there would be no new threshold exceedances in any of the S.F. Snoqualmie River drainages. Road density would increase slightly in the Northside drainage compared to Alternative 1 as a result of proposed road construction (see Table 4.2.4-2). Road crossing density would increase in the Nacronomical drainage due to the proposed culvert for the expanded parking lot.

Table 4.2.4-2:
Summary of DPC Analysis of Soil Conditions for Alternative 3 in the South Fork Snoqualmie Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Northside	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)		**49.04**	**72.11**	**270.19**	**89.37**	**318.76**	**214.67**
Road Density (miles/square mile)	3.0	5.48	7.02	0.50	0.68	1.70	2.35
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.00	0.00	0.00
Road Crossing Density (number/ square mile)	6.0	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Impervious Cover (% of total)	8.0	1.89	17.73	0.24	0.23	1.95	2.68
Change from Alternative 1 (% of total)		0.25	3.47	0.03	0.00	0.03	0.00
Bare Soils (acres)	0.0	0.00	0.00	0.00	0.00	0.00	0.17
Change from Alternative 1 (acres)		0.00	0.00	0.00	0.00	0.00	-0.05
Activities on High Erosion Soils (% of total)	1.5	0.74	0.36	0.07	0.00	0.11	0.17
Change from Alternative 1 (% of total)		0.19	0.00	0.00	0.00	0.00	0.17
Parameters over Threshold		**1**	**3**	**0**	**1**	**1**	**2**
Change from Alternative 1		**0**	**0**	**0**	**0**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Impervious surface would increase slightly in the Northside, International, and Nacrinomical drainages compared to Alternative 1. The greatest increase would occur in the Summit North drainage resulting from the proposed parking lot paving. Bare soils would remain unchanged in most drainages and decrease slightly in the other drainage compared to Alternative 1. Activities on high erosion soils would increase from 0.55 percent to 0.74 percent in the Northside drainage and from 0 to 0.71 percent in the other drainage under Alternative 3.

4.2.5 Impacts – Alternative 4

4.2.5.1 Upper Yakima River Watershed

Mass Wasting

Mass wasting potential in the U. Yakima Watershed would be reduced under Alternative 4 compared to Alternatives 2 or 3 since the *Creek Run* and *Rampart* chairlifts and associated roads and trails would not be constructed. However, since the potential for soil movement associated with these projects would be addressed with BMPs under Alternative 2 the, risk of mass wasting associated with Alternative 4 would be only slightly less than under Alternative 2. In addition, road density would be slightly reduced in the Summit South drainage, reducing the potential for mass wasting associated with road slopes in this drainage.

Two-year peak streamflow in the Creek Run drainage would be only slightly (0.2 percent) greater than under existing conditions, compared to 2.4 percent greater than existing conditions under Alternative 2 (see Section 4.3 - Water and Watershed Resources). Although the probability of high flow related bank failures would be slightly less under Alternative 4 than under Alternative 2, neither alternative would have a probability of mass wasting that would be measurably different from existing conditions.

Erosion

Under Alternative 4, erosion impacts would be less than under Alternative 2 since the Creek Run and Rampart chairlifts and associated roads would not be constructed. Clearing and grading for lift, road, and trail construction under Alternative 4 would be less than under Alternative 2, reducing the area susceptible to short-term erosion.

Road density in the Summit South (5.08 miles per square mile) and Lower Mill Creek (7.43 miles per square mile) drainages would also be slightly less than under Alternative 2 (5.61 miles per square mile in the Summit South drainage and 7.47 miles per square mile in the Lower Mill Creek drainage) and there would be three fewer road–stream crossings (one in each of the Creek Run, Summit South, and Hyak drainages). These changes would reduce road related erosion in the subwatershed. Seventh-field drainage conditions are summarized in Table 4.2.5-1.

Sediment Yield

Sediment yield under Alternative 4 would be less to Coal Creek than under any other alternative (see Table 4.2.3-2). Alternative 4 is the only alternative that would reduce sediment yield to Coal Creek compared to existing conditions. Under Alternative 4, the sediment sources associated with the Creek Run and Rampart lifts, trails, and roads would not occur and the Creek Run and Summit South drainages would have no change in sediment yield from existing conditions. The restoration projects in the Beaver and Ski Acres drainages would be the same as under Alternative 2 resulting in the same reductions of 4.72 and 3.03 tons per year of sediment yield from those drainages to Coal Creek. The sediment yield to the

mainstem streams in the upper Yakima subbasin as a whole would be reduced by 5.48 tons per year from existing conditions, or a reduction of 11.64 tons per year compared to Alternative 2.

Sediment yield to Mill Creek would be essentially the same as under Alternative 2. Under Alternative 4, the sediment yield to Coal Creek, Mill Creek, and the S.F. Snoqualmie River combined would be reduced by 20.96 tons per year for the entire the Study Area compared to existing conditions, 8.2 tons per year less than under Alternative 2.

Soil Productivity

Soil productivity impacts in the U. Yakima Watershed under Alternative 4 would be less than as described under Alternative 2 due to a reduction in the loss of natural vegetation cover from soil clearing and grading.

Short-term impacts to soil structure associated with the *Creek Run* and *Rampart* lifts and trail grading under Alternative 2 would not occur under Alternative 4.

Under Alternative 4, the impervious surface area in the U. Yakima Watershed would be 4.02 percent compared to 4.11 percent under Alternative 2 (and 3.76 percent under Alternative 1). This difference would include reductions in impervious surface area in the Creek Run, Summit South, Hyak, Tunnel, and Ski Acres drainages.

Severely eroded (bare) soil area and percent of the Study Area with detrimental soil conditions would be essentially the same under Alternative 4 as under Alternative 2.

Drainages of Particular Concern

Under Alternative 4, there would be one new threshold exceedance compared to Alternative 1.

- Summit South (Activities on High Erosion Soils – 2.16 percent)

Road density would be reduced, but remain over threshold, in the Summit South, Tunnel, Ski Acres, and Beaver drainages due to proposed road decommissioning compared to Alternative 1 (see Table 4.2.5-1).

Table 4.2.5-1:
Summary of DPC Analysis of Soil Conditions for Alternative 4 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Upper Yakima River Watershed								
		L. Mill Creek	U. Mill Creek	Creek Run	Summit South	Hyak	Tunnel	Ski Acres	Beaver	Other
Drainage Area (acres)		**395.67**	**33.22**	**220.24**	**223.89**	**192.70**	**134.41**	**358.08**	**171.38**	**155.63**
Road Density (miles/square mile)	3.0	7.43	2.90	2.25	5.08	2.78	11.77	8.80	7.68	1.66
Change from Alternative 1 (miles/square mile)		0.00	0.00	-0.27	-0.58	0.00	-0.57	-0.48	-0.97	0.00
Road Crossing Density (number/ square mile)	6.0	29.13	0.00	17.44	8.58	9.97	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	-2.90	-5.71	0.00	4.80	0.02	-3.72	0.00
Impervious Cover (% of total)	8.0	2.26	0.88	0.68	4.16	1.30	7.92	9.33	4.35	1.16
Change from Alternative 1 (% of total)		0.01	0.00	-0.08	-0.17	0.02	0.89	1.17	0.06	0.01
Bare Soils (acres)	0.0	0.35	0.00	0.00	2.03	0.00	0.00	6.29	0.00	0.31
Change from Alternative 1 (acres)		-1.10	0.00	0.00	-0.11	0.00	0.00	-3.10	0.00	0.00
Activities on High Erosion Soils (% of total)	1.5	2.11	0.00	0.00	2.16	1.45	1.58	6.75	2.41	0.86
Change from Alternative 1 (% of total)		0.12	0.00	0.00	0.74	0.00	0.00	-1.17	-0.01	0.33
Parameters over Threshold		**4**	**0**	**1**	**4**	**1**	**3**	**5**	**3**	**1**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Road crossing density would be increased in Lower Mill Creek and Tunnel as a result of new culverts and bridges proposed under Alternative 4. Road crossing density would be reduced in Creek Run, Summit South and Beaver as a result of proposed restoration. Impervious surfaces would increase slightly in Hyak, Tunnel, Ski Acres and Beaver as a result of activities proposed under Alternative 4. Impervious surfaces would decrease in Creek Run and Summit South as a result of proposed restoration activities.

Under Alternative 4, bare soils would be reduced in Lower Mill Creek, Summit South and Ski Acres, compared to Alternative 1, due to proposed restoration projects. Activities on high erosion soils would increase over threshold in the Summit South drainage. Slight increases from Alternative 1 would also occur in the Lower Mill Creek and Other drainages. A slight decrease in the activities on high erosion soils would occur in the Ski Acres drainage.

4.2.5.2 South Fork Snoqualmie River Watershed

Mass Wasting

With development in the S. F. Snoqualmie watershed essentially the same as under Alternative 2, the risk of mass wasting would be as described under Alternative 2.

Erosion

Construction related to the Alpental Road realignment and parking lot reconfiguration under Alternative 4 would have a greater potential for short-term erosion during ground disturbing construction, but reduced long-term sediment impact potential relative to Alternatives 1 or 2 due to reduced parking and road area, and increased distance between the road and the S.F. Snoqualmie River.

Lift and mountain slope construction erosion impacts would be as described for Alternative 2.

Road length and crossings would be essentially the same under Alternative 4 as under Alternative 2, with only a slight reduction in road length (0.04 mile) in the Nacrinomical drainage associated with the Alpental Road realignment (see Table 4.2.5-2). Reduced surface erosion from parking lots would be the same as under Alternative 2, but the smaller new parking area proposed under Alternative 4 would be smaller and further from the S.F. Snoqualmie River.

Sediment Yield

Sediment yield to the S.F. Snoqualmie River (and the entire Study Area) under Alternative 4 would be the lowest under any alternative, with a reduction of 18.29 tons per year compared to existing conditions (a reduction of an additional 0.13 ton per year compared to Alternative 2). This difference would be the result of road and parking lot changes in the Nacrinomical drainage. Sediment yield from the other S.F. Snoqualmie Watershed drainages would be the same as under Alternative 2.

Soil Productivity

The Alpental road relocation and parking lot reconfiguration under Alternative 4 would reduce impervious surface area by 0.64 acre compared to Alternative 2. Severely eroded (bare) soil area in the S.F. Snoqualmie Watershed would be the same as under Alternative 2 (0.17 acre). Developed area in the watershed would be 1.52 acres less under Alternative 4 and the total area of detrimental soil conditions would be 1.01 acres less than under Alternative 2 (see Table 4.2.3-3).

Drainages of Particular Concern

Under Alternative 4, there would be no new threshold exceedances in any of the S.F. Snoqualmie drainages. Road density would increase in the Northside drainage as a result of proposed road construction for terminal access (see Table 4.2.5-2). Road density would decrease slightly in the Nacrinomical drainage.

Table 4.2.5-2:
Summary of DPC Analysis of Soil Conditions for Alternative 4 in the South Fork Snoqualmie Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Northside	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)		**49.04**	**72.11**	**270.19**	**89.37**	**318.76**	**214.67**
Road Density (miles/square mile)	3.0	5.48	7.02	0.50	0.68	1.62	2.35
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.00	-0.08	0.00
Road Crossing Density (number/ square mile)	6.0	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Impervious Cover (% of total)	8.0	1.89	17.73	0.27	2.36	1.73	2.68
Change from Alternative 1 (% of total)		0.25	3.47	0.06	2.13	-0.20	0.00
Bare Soils (acres)	0.0	0.00	0.00	0.00	0.00	0.00	0.17
Change from Alternative 1 (acres)		0.00	0.00	0.00	0.00	0.00	-0.05
Activities on High Erosion Soils (% of total)	1.5	0.74	0.36	0.07	0.00	0.13	0.17
Change from Alternative 1 (% of total)		0.19	0.00	0.00	0.00	0.02	0.17
Parameters over Threshold		**1**	**3**	**0**	**1**	**1**	**2**
Change from Alternative 1		**0**	**0**	**0**	**0**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Road crossing density would increase in the Nacrinomical drainage. Impervious cover would increase in the Northside, Summit North, International and Upper Alpental drainages as a result of activities proposed under Alternative 4 (see Table 4.2.5-2). A slight decrease in impervious surfaces would occur in the Nacrinomical drainage as a result of the removal of parking lot 7.

Bare soils would decrease slightly in the other drainages, but remain unchanged from Alternative 1. Activities on high erosion soils would increase in the Northside, Nacrinomical and Other drainages as a result of activities proposed under Alternative 4.

4.2.6 Impacts – Modified Alternative 5

4.2.6.1 Upper Yakima River Watershed

Mass Wasting

The mass wasting potential in the U. Yakima Watershed would be essentially the same under Modified Alternative 5 as under Alternative 2. The reduced trail development and clearing in Section 16 (at Summit

East) under Modified Alternative 5 would slightly reduce the risk. However, since the potential for soil movement associated with these projects would be addressed with BMPs as described under Alternative 2 the, risk of mass wasting associated with Modified Alternative 5 would differ little from Alternative 2.

Two-year peak streamflow in the Creek Run drainage would be 1.9 percent greater than under existing conditions, compared to 2.4 under Alternative 2 (see Section 4.3 – Water and Watershed Resources). Although the probability of high flow related bank failures would be slightly less under Modified Alternative 5 than under Alternative 2, neither alternative would have a probability of mass wasting that would be measurably different from existing conditions.

Erosion

Reduced trail development within the Rampart and Creek Run Pods and glading only north of the Creek Run chairlift centerline would reduce the risks of temporary erosion impacts associated with clearing and grading activity. Long-term erosive soil loss would also be reduced under Modified Alternative 5, relative to Alternative 2, due to the greater forested cover under Modified Alternative 5.

Road related erosion would be the same under Modified Alternative 5 as under Alternative 2. Road density and number of stream crossings would be identical under Modified Alternative 5 to Alternative 2. Likewise, management activities on high hazard soils would be the same as under Alternative 2. Seventh-field drainage conditions are summarized in Table 4.2.6-1.

Sediment Yield

Under Modified Alternative 5, the sediment yield to Coal Creek would be about 0.3 ton per year less than under Alternative 2. Sediment yield to Mill Creek would be identical under Modified Alternative 5 to that predicted under Alternative 2 (see Table 4.2.3-2).

Soil Productivity

Impacts to soil productivity would be only slightly less under Modified Alternative 5 than under Alternative 2 since the forested area would be greater and impervious surface area less than under Modified Alternative 5. Impervious surface area under Modified Alternative 5 would be slightly less than under Alternative 2 in the Tunnel (7.92 percent) and Ski Acres (9.33 percent) drainages, and identical in the other drainages in this watershed. Impervious surface for entire U. Yakima Watershed (4.07 percent) would be very slightly less than under Alternative 2 (4.11 percent). Bare soil area under Modified Alternative 5 would be the same as described under Alternative 2 in the U. Yakima Watershed.

Total detrimental soil conditions under Modified Alternative 5 would be 5 percent of the U. Yakima Watershed as it would under Alternative 2 (see Table 4.2.3-3).

Drainages of Particular Concern

Under Modified Alternative 5, there would be one new threshold exceedance compared to Alternative 1.

- Summit South (Activities on High Erosion Soils – 2.15 percent)

Impacts to drainages would be as described under Alternative 2.

Table 4.2.6-1:
Summary of DPC Analysis of Soil Conditions for Modified Alternative 5 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Upper Yakima River Watershed								
		L. Mill Creek	U. Mill Creek	Creek Run	Summit South	Hyak	Tunnel	Ski Acres	Beaver	Other
Drainage Area (acres)		**395.67**	**33.22**	**220.24**	**223.89**	**192.70**	**134.41**	**358.08**	**171.38**	**155.63**
Road Density (miles/square mile)	3.0	7.48	2.89	2.24	5.61	2.79	11.77	8.80	7.70	1.65
Change from Alternative 1 (miles/square mile)		0.05	-0.01	-0.28	-0.05	0.01	-0.58	-0.48	-0.95	-0.02
Road Crossing Density (number/ square mile)	6.0	29.13	0.00	20.35	11.44	13.29	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	0.01	-2.85	3.33	4.80	0.02	-3.72	0.00
Impervious Cover (% of total)	8.0	2.27	0.88	0.83	4.35	1.32	7.92	9.33	4.34	1.16
Change from Alternative 1 (% of total)		0.02	0.00	0.07	0.02	0.04	0.89	1.17	0.05	0.01
Bare Soils (acres)	0.0	0.32	0.00	0.00	2.02	0.00	0.00	6.29	0.00	0.31
Change from Alternative 1 (acres)		-1.14	0.00	0.00	-0.12	0.00	0.00	-3.10	0.00	0.00
Activities on High Erosion Soils (% of total)	1.5	2.09	0.00	0.00	2.15	1.45	1.58	6.75	2.41	0.86
Change from Alternative 1 (% of total)		0.10	0.00	0.00	0.73	0.00	0.00	-1.17	-0.01	0.33
Parameters over Threshold		**4**	**0**	**1**	**4**	**1**	**3**	**5**	**3**	**1**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

4.2.6.2 South Fork Snoqualmie River Watershed

Erosion

Erosion impacts under Modified Alternative 5 would be as described under Alternative 2.

Sediment Yield

Under Modified Alternative 5, Sediment Yield to the S.F. Snoqualmie River would be as described under Alternative 2 (see Table 4.2.3-2).

Soil Productivity

Under Modified Alternative 5, soil productivity impacts in the S.F. Snoqualmie Watershed would be as described under Alternative 2.

Drainages of Particular Concern

Under Modified Alternative 5, there would be no new exceedances of thresholds in any of the drainages (see Table 4.2.6-2). Impacts to individual drainages would be as described under Alternative 2.

Table 4.2.6-2:
Summary of DPC Analysis of Soil Conditions for Modified Alternative 5 in the South Fork Snoqualmie Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Northside	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)		**49.04**	**72.11**	**270.19**	**89.37**	**318.76**	**214.67**
Road Density (miles/square mile)	3.0	5.48	7.01	0.50	0.72	1.71	2.36
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.04	0.01	0.01
Road Crossing Density (number/square mile)	6.0	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Impervious Cover (% of total)	8.0	1.89	17.73	0.27	2.36	1.96	2.68
Change from Alternative 1 (% of total)		0.25	3.47	0.05	2.13	0.04	0.00
Bare Soils (acres)	0.0	0.00	0.00	0.00	0.00	0.00	0.17
Change from Alternative 1 (acres)		0.00	0.00	0.00	0.00	0.00	-0.05
Activities on High Erosion Soils (% of total)	1.5	0.74	0.36	0.07	0.00	0.11	0.17
Change from Alternative 1 (% of total)		0.19	0.00	0.00	0.00	0.00	0.17
Parameters over Threshold		**1**	**3**	**0**	**1**	**1**	**2**
Change from Alternative 1		**0**	**0**	**0**	**0**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

4.2.7 Cumulative Effects

Cumulative effects on geology and soil resources include those impacts associated with The Summit-at-Snoqualmie MDP, and other past, present, and reasonably foreseeable projects identified in the U. Yakima

and S.F. Snoqualmie Watersheds. This cumulative effects analysis is assessed at the 5th field watershed scale. Tables 4.2.7-1 and 4.2.7-3 list these projects and summarize their potential impacts. These projects occur on NFSL, as well as privately owned land. The effects of past projects at The Summit-at-Snoqualmie include areas developed within the existing ski area boundary and on private lands for recreational facilities and related infrastructure. The baseline conditions described in Chapter 3 include the effects of the past projects associated with the development, operation, and maintenance of The Summit and Alpental facilities.

4.2.7.1 Upper Yakima River Watershed

Table 4.2.7-1 summarizes the cumulative effects of past, present and reasonably foreseeable projects occurring within the U. Yakima Watershed on geology and soils.

Projects Associated with The Summit-at-Snoqualmie

Culvert replacements that would occur over time would contribute to the short-term soil disturbances in the U. Yakima Watershed. Over the long-term the culvert replacement projects would provide benefits to soil resources if native vegetation is replanted at construction sites. Soil productivity could increase the amount of streamside vegetation that grows on-site and produces organics. Although these projects would improve conditions at the site-specific location, they would not have a measurable effect on soils resources at the 5th field watershed scale. Sizing culverts to account for appropriate passage of rock and debris located upslope would reduce the potential to plug culverts and create small mass wasting events. Although the projects would provide beneficial impacts, they would provide immeasurable contributions at the 5th field watershed scale.

Projects Not Associated with The Summit-at-Snoqualmie

The majority of the projects presented in Table 4.2.7-1 that are not associated with The Summit-at-Snoqualmie would result in either a long-term loss of native soils, or are land management decisions that would ultimately result in an increase of the amount of forested lands that would improve soil resources. Based on soil types and timber harvest practices, the USFS estimated almost 10 percent of the U. Yakima Watershed is in a detrimental soil condition (USFS 1997). Specific projects that would remove forest communities and create impervious surfaces or disturbed soil profiles include road improvements, dam maintenance, or development activities. These would contribute to the amount of native soils already in a detrimental condition. Past activities that have occurred in the watershed and created these modified conditions include the development of rail and vehicle corridors, utility corridors, recreation facilities, and urban development. Natural disturbances such as intensive fire have also contributed to changes in soil conditions.

Beneficial impacts on soil resources would occur through implementation of the land management projects in Table 4.2.7-1. These projects that are associated with improving watershed conditions, such as road obliteration and culvert replacement, would result in an increase in vegetated areas that would, over

the long-term, improve soil productivity and reduce the potential for soil erosion. Forest roads would be ripped to decrease soil compaction to enhance natural or planted revegetation efforts. If road cut and fill slopes are re-shaped to more natural contours, soil erosion potential would be reduced if slopes were revegetated. Soil disturbed from culvert replacements would be revegetated to maintain or improve riparian vegetation conditions. Recent mass wasting events (1950s to present) are not well documented on NFSL (USFS 1997), but decommissioning roads and properly sized culverts would reduce the potential for inner gorge failures within the watershed.

In addition, approximately 52,100 acres of forest lands would be managed through the NFSL guidelines for late-successional habitat and multi-age forest, or under a Habitat Conservation Plan for private lands. Lands previously managed for timber production and have been, or would be, transferred to the USFS for ownership and management, would contribute to beneficial impacts on soils over the long-term.

Table 4.2.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Geology and Soils
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately ten existing culverts have been replaced or repaired within the last five years at the Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately two per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	The replacement and repair of culverts at The Summit-at-Snoqualmie overlaps spatially and temporally with the MDP at the site and 5th field watershed scale. Approximately 0.01 acre around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would be beneficial (i.e., reduced sediment delivery and erosion), and would, as a whole, improve the culvert conditions at the site scale. As the culverts occupy several hundred square feet within the watershed, they would directly contribute to improved sediment conditions downstream.
Projects Not Associated with The Summit-at-Snoqualmie		
Kachess Vegetation Management	Hazard trees were identified in the Kachess Lake Campground through an exhaustive survey. All identified trees were removed during the winter of 2004. A small amount of timber would be sold as merchantable, the rest would be disposed of through firewood sales, lop and scatter, or burned.	The removal of hazard trees reduced the canopy cover within the treated areas of the campground. Implementation of the vegetation management plan resulted in localized soil impacts associated with tree removal, yarding, lopping/scattering, and burning. Spatially, the vegetation removal was limited to the campground site, and did not overlap with the MDP at the site scale or other identified cumulative effects at the 5th field watershed scale. Temporally, the work has been completed and would not overlap with the MDP. At the 5th field scale, there are no measurable impacts to soil conditions as this project is assumed to have stabilized.

Table 4.2.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Geology and Soils
Plum Creek Road Restoration	The Cle Elum Ranger District is performing a road analysis covering approximately 50-70 miles of harvest roads on 65,000 acres of land acquired in the last five years from Plum Creek Timber lands. Currently, approximately 18 miles of roads that were acquired and deemed to be unsafe or were already closed have been decommissioned by the Forest Service. Under the Proposed Action, approximately 30.57 miles of road would be decommissioned.	Currently, approximately 26.2 acres of roads have been decommissioned within the watershed. Both spatially and temporally, this road decommissioning would overlap with the road obliteration, and other restoration projects identified in the MDP alternatives at the 5th field scale. As a result, the road obliteration under the MDP and the Cle Elum Roads Analysis would cumulatively reduce the available road mileage and area of detrimental soil conditions at the 5th field scale.
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	Depending on which alternative is selected, approximately 50.9 acres of soils would be impacted by road expansions. This project would directly overlap with the MDP in both space and time at the site and 5th field scales. Alternative 2 and Modified Alternative 5 would increase detrimental soil conditions at the site scale, cumulatively increasing detrimental soil conditions in the vicinity of Snoqualmie Pass. Alternatives 3 and 4 would reduce detrimental soil conditions through proposed restoration projects.
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	In the U. Yakima Watershed, the acquired lands would be managed under the SPAMA allocation with a late-seral habitat emphasis. The management of these acquired lands would spatially and temporally overlap with the MDP at the 5th field scale, resulting in cumulative benefits to the soil productivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions would contribute to overall improvement in soil conditions at the 5th field scale.
Keechelus Dam Repairs	The Keechelus Lake dam was repaired in 2003. The existing dam was rebuilt in place to correct structural problems. The project has been completed. Approximately 70 acres of vegetation was cleared to provide a work corridor. The project impacted 3.8 acres of wetlands.	While the dam replacement did not overlap in time with the MDP, stabilization (i.e., grow-in) of the site is projected to overlap with the MDP in both space (at the 5th field scale) and time. Cumulatively, stabilization of 70 acres of vegetation removal would contribute to reduced soil erosion in the U. Yakima Watershed. As Lake Keechelus serves as a sink for sediment, the downstream effects to the Yakima River are not measurable.

Table 4.2.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Geology and Soils
Gold Creek Pond Trail Development	A native surface foot trail, approximately 100 feet long was constructed. This project was completed in 2001.	Temporary impacts to 0.005 acre occurred during trail construction. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space (at the 5th field scale) or time with any projected soils impacts under the Action Alternatives.
U.S. West Telephone Line	Installation of an underground telephone line in old road prism. This project was completed in 2001.	Temporary impact of 1.82 acres to install an underground line created disturbance to an already modified soil profile in the road prism. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space (at the 5th field scale) or time with any projected soils impacts under the Action Alternatives.
WSDOT I-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical de-icer/ice-inhibitors to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile are applied to I-90 within the Snoqualmie Pass area (WSDOT 1999, 2001).	I-90 Maintenance would overlap with the MDP in both space and time at the site and 5th field scales. Increases in detrimental soil conditions and sediment yield would occur under the Action Alternatives (Alternative 2 having the largest impact and Alternative 4 having the lowest impact of the Action Alternatives). When added to the possible I-90 widening, repairs to the Keechelus dam and private land development, cumulative effects on soils from this project would affect the sediment regime in Coal Creek. Approximately 380 tons of sand reach Coal Creek each year from I-90 sanding operations alone.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	The recent purchase of Sections 5, 17, and 25 of Township 21N Range 11E occur within portions of the U. Yakima Watershed. These acquired lands would be allocated to the SPAMA and managed with an emphasis for late-seral habitat preservation. The management of these acquired lands would spatially (at the 5th field scale) and temporally overlap with the MDP, resulting in cumulative benefits to the soil productivity under Alternative 3 and Modified Alternative 5 (with a 390-acre-land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions would also contribute to overall improvement in soil conditions at the 5th field scale.
Plum Creek Cascade Habitat Conservation Plan	A HCP was developed for the Plum Creek Timber Company to manage timber harvest and protect wildlife habitat over several 5th field watersheds in the vicinity of Snoqualmie Pass.	Approximately 52,100 acres of land is managed under the HCP. Protection of wildlife habitat would temporally and spatially overlap at the 5th field scale with the MDP resulting in cumulative benefits to the soil productivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), lands managed under the HCP, combined with private land acquisitions would contribute to overall improvement in soil conditions at the 5th field scale.

Table 4.2.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Geology and Soils
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of The Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in both space (at the site scale) and time with the MDP development. Alternative 2 and Modified Alternative 5 would increase detrimental soil conditions in the Study Area, and in conjunction with the private land developments and other ground disturbing activities, would cumulatively affect soil productivity and sediment yield to Mill Creek.
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the U. Yakima Watershed. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	A total of 210 acres of forest would be commercially thinned to accelerate the development of late-successional forest structure. Short-term impacts resulting in soil disturbance would occur, some of which would overlap in space (at the 5th field) and time with the MDP implementation. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Protection of wildlife habitat under the Plum Creek HCP would also temporally and spatially (at the 5th field scale) overlap with the MDP, resulting in cumulative benefits to soil productivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek HCP and private land acquisitions would contribute to overall improvement in soil conditions at the 5th field scale.
Snoqualmie Pass AMA Plan	Land management plan for the AMA emphasizing late-successional habitat maintenance and enhancement.	The management of lands to emphasize late-successional habitat would overlap spatially and temporally with the MDP at the site and 5th field scales. The management of lands under the SPAMA would result in cumulative benefits to soil productivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek HCP and private land acquisitions would contribute to overall improvements in soil conditions at the 5th field scale.

Table 4.2.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Geology and Soils
Cle Elum RD Roads Analysis	Analysis of road system to determine long-term need. Implementation is expected in 2010.	The analysis of road systems and implementation of the plan would overlap spatially (at the 5th field) and temporally with the MDP. In conjunction with the Implementation, Operations, Restoration and Management Plan for The Summit-at-Snoqualmie MDP (see Appendix F), the roads analysis would improve road and trail management in the U. Yakima Watershed. The result will be a cumulative benefit to the sediment regime in the 5th field with improved road and trail management under both plans.
WSDOT Road De-icing	Application of sand and chemical de-icers to roadway surfaces	De-icing of roadways would overlap spatially, at the site and 5th field scales, and temporally with the MDP. Increases in sediment yield would result due to road maintenance from sanding operations. Coupled with the Action Alternatives and other road maintenance projects, this project could affect the sediment regime in Coal Creek.
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the Okanogan-Wenatchee National Forest Land and Resource Management Plan.	The study of lands to determine suitability for preservation as wilderness would overlap spatially (at the 5th field scale) and temporally with the MDP. If lands are re-allocated to Wilderness under this project, cumulative benefits to soil productivity would result. Coupled with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisitions, this project has the potential to contribute to overall improvement in soil conditions at the 5th field scale.
Pro Guiding Service Area Expansion	Pro Guiding has requested expansion of their area of operation to include the Cascade crest area from Kendall Lakes to Mt. Daniel, plus the Alta Mountain area. They are not requesting an increase in number of service days.	The expansion of Pro Guiding's area of operation would overlap spatially (at the 5th field scale) and temporally with the MDP. No impacts to geology and soils are expected from this project.

Table 4.2.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Geology and Soils
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the U. Yakima Watershed (W. Keechelus subwatershed). The proposed project includes thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	The thinning of forests to accelerate late-successional habitat structure and restore ecological conditions would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in soil disturbance would occur during thinning operations. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Combined with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisition projects, this project would result in cumulative benefits to soil productivity. Under Alternatives 2 and 4 (with no land donation), this project and the other private land acquisitions would contribute to overall improvement in soil conditions at the 5th field scale.
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the U. Yakima Watershed (E. Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, fish passage improvements, and other restoration projects.	The thinning of forests to accelerate late-successional habitat structure and restore ecological conditions would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in soil disturbance would occur during thinning operations. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Combined with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisition projects, this project would result in cumulative benefits to soil productivity. Under Alternatives 2 and 4 (with no land donation), this project and the other private land acquisitions would contribute to overall improvement in soil conditions at the 5th field scale.

Although implementation of the proposed MDP would contribute to detrimental soil conditions in the Study Area, the effect would be immeasurable at the larger 5th field watershed scale due to the prevalence of management for late-successional habitat in the Snoqualmie Pass Area. Implementation of the MDP, including restoration of bare soil areas, would increase the percentage of detrimental soil conditions in the watershed to approximately 0.11 to 0.12 percent under the alternatives (see Table 4.2.7-2). The total area of detrimental soil conditions within the entire U. Yakima Watershed, which is estimated at 10 percent, would remain well under the USFS detrimental soil condition threshold of 20 percent.

Projects not associated with The Summit-at-Snoqualmie MDP would impact approximately 2.93 percent of the 5th field watershed area. Projects such as road obliteration and commercial thinning are expected to result in a short-term detrimental soil condition; however, over time, these areas would return to being productive as the sites stabilize. For all alternatives, the amount of total impact (the Snoqualmie MDP and other projects identified) in this watershed is small compared to the overall size of the watershed,

approximately 3.04 percent of the 5th field. The effects would be negligible at the watershed scale and would be offset by the much larger amount of land to be managed to improve late-successional habitat, and therefore, soil productivity and sediment conditions.

Table 4.2.7-2:
Cumulative Acreage of Disturbance on Geology and Soils Resources from Past, Present and Reasonably Foreseeable Projects within the 5th Field Upper Yakima River Watershed

Impact Type	Alt. 1[a]		Alt. 2		Alt. 3		Alt. 4		Mod. Alt. 5	
	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th
Summit-at-Snoqualmie Projects										
Summit-at-Snoqualmie Impacts	84.13	0.11	86.30	0.12	85.35	0.11	84.82	0.11	85.60	0.11
Impacts Not Associated with The Summit-at-Snoqualmie										
Long-Term Impacts	50.90	0.07	50.90	0.07	50.90	0.07	50.90	0.07	50.90	0.07
Short-Term Impacts	2128.16	2.86	2128.16	2.86	2128.16	2.86	2128.16	2.86	2128.16	2.86
Total Long-Term and Short-Term Impacts	2179.06	2.93	2179.06	2.93	2179.06	2.93	2179.06	2.93	2179.06	2.93
Beneficial Impacts	2023.12	2.72	2023.12	2.72	2023.12	2.72	2023.12	2.72	2023.12	2.72
Total Cumulative Effects	**2263.19**	**3.04**	**2265.36**	**3.04**	**2264.41**	**3.04**	**2263.88**	**3.04**	**2264.66**	**3.04**

[a] The impacts associated with ongoing, maintenance related activities at The Summit-at-Snoqualmie are displayed in Alternative 1 (the No Action Alternative), since these activities would occur under all alternatives, they have been added to the impacts for Alternatives 2 through Modified Alternative 5.

4.2.7.2 South Fork Snoqualmie River Watershed

Table 4.2.7-3 summarizes the cumulative effects of past, present and reasonably foreseeable projects in the S.F. Snoqualmie Watershed on geology and soils.

Projects Associated with The Summit-at-Snoqualmie

Cumulative effects on the S.F. Snoqualmie Watershed soil resources would be similar to those described for the U. Yakima Watershed with the additional site-specific soil impacts associated with replacing the Alpental footbridge. These projects are of small enough size that any short-term soil disturbance occurring during construction would not be measurable at the larger scale. Similar beneficial impacts on soil resources, as described in Section 4.2.7.1 – Upper Yakima River Watershed, from culvert replacements, would occur over time.

Projects Not Associated with The Summit-at-Snoqualmie

Similar past impacts to soils have occurred in the S.F. Snoqualmie Watershed as in the U. Yakima Watershed. Timber harvest, transportation corridors, utility corridors, and development have removed forest vegetation or converted it to other modified conditions. The additional impacts on soils from the FS Road 58 project and trail construction and reconstruction projects would not be measurable at the watershed scale (see Table 4.2.7-3). Ongoing use of road sand would contribute to the distribution of sand on roadside soil profiles. This would create additional detrimental soil conditions if the accumulated sand is thick enough to disturb existing vegetation conditions and affect soil permeability.

Much larger projects that would result in beneficial impacts are associated with potential land exchanges. Of 6,798 acres of land received by the USFS in a land exchange (Huckleberry Land Exchange), 702 acres will be managed as Late-Successional Reserves and would improve soil conditions in the long-term. Additional land that could be under USFS management would be managed to improve forest conditions, including the Land Acquisitions project. Managing lands to improve forest cover would in the long-term improve soil conditions.

Table 4.2.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Geology and Soils
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately ten existing culverts have been replaced or repaired within the last five years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately two per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	Approximately 0.01 acre around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would likely be beneficial (i.e., reduced sediment delivery and erosion). These culvert replacements would overlap spatially (at the site and 5th field scale) and temporally with the MDP, and would, as a whole, improve the culvert conditions throughout the Study Area. As the culverts occupy several hundred square feet within the watershed, this project would directly contribute to improved sediment conditions downstream.
Alpental Covered Bridge Replacement	The existing covered footbridge at Alpental washed out during a storm in 2003. The Summit-at-Snoqualmie replaced the bridge in 2005.	No new permanent impacts occurred as the new bridge was placed within the footprint of the old bridge. Temporary soil disturbance occurred during construction and riparian vegetation was re-established in 2006. While the bridge replacement overlaps spatially with the MDP at the site scale, the re-establishment of riparian vegetation, and stabilization will not overlap in time with the MDP and therefore would not cumulatively affect soil productivity or sediment yield.

Table 4.2.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Geology and Soils
Cave Ridge Land Donation	The Summit-at-Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	The land donation would overlap spatially (in the site and 5th field watershed scale) and temporally with the MDP. Up to 100 acres would be added to Wilderness, and the remainder would continue to be managed in its current unroaded character. This project would result in no cumulative effects to geology and soils at the site or 5th field watershed scales.
Projects Not Associated with The Summit-at-Snoqualmie		
FS Road 58 Bridge Replacement	An existing steel bridge over the South Fork Snoqualmie River was replaced on Forest Service Road 58 due to structural problems. The new bridge was expanded from one to two lanes with upgraded load capacity. Construction of the bridge was completed in spring 2005.	Approximately 0.05 acre was graded to provide an expanded roadway approach. Bridge footings were installed below the ordinary high water mark and required temporary flow diversion structures to create a dry work zone. Although the bridge replacement overlaps spatially (in the 5th field scale) with the MDP, with completion of the project in 2005, the bridge replacement does not temporally overlap with the MDP. Thus, the bridge replacement would not cumulatively affect soils at the 5th field scale.
Huckleberry Land Exchange	Exchange of NFSL for Weyerhaeuser Lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	Approximately 6,798 acres of Weyerhaeuser land was received by the Forest Service. 702 acres are managed as Late-Successional Reserve. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP, resulting in cumulative benefits to the soil productivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions contribute to a cumulative improvement in soil conditions at the 5th field scale.
WSDOT 1-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical de-icer/ice-inhibitors to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile is applied to I-90 within the Snoqualmie Pass area.	Approximately 294 tons of sand enter the South Fork Snoqualmie River each year from I-90 sanding operations. I-90 Maintenance would overlap with the MDP in both space and time at both the site and 5th field scale. Increases in detrimental soil conditions and sediment yield under the Action Alternatives (Alternative 2 having the largest impact and Alternative 4 having the lowest impact of the Action Alternatives) would cumulatively affect soil productivity and sediment yield.

Table 4.2.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Geology and Soils
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The recent purchase of Section 19 of Township 22N Range 11E occurs within portions of the S.F. Snoqualmie Watershed, and its management overlaps spatially (in the 5th field) and temporally with the MDP. These lands will be allocated to Late Successional Reserve. Coupled with other land acquisitions in the Snoqualmie Pass area, cumulative soil conditions would improve at the 5th field scale, with a greater improvement under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation).
U.S. West Telephone Line	Installation of an underground telephone line in the I-90 corridor.	Temporary impacts to soils occurred during installation of an underground line, which created disturbance to an already modified soil profile in the road prism. This project is assumed to have been stabilized as of 2005, and therefore does not overlap spatially or temporally with any projected soils impacts under the MDP.
WSDOT Road De-icing	Application of sand and chemical de-icer/ice-inhibitors to roadway surfaces.	De-icing and maintaining roadways during the winter overlaps spatially and temporally with the MDP at the site and 5th field scales. Increases in detrimental soil conditions and sediment yield under the Action Alternatives (Alternative 2 having the largest impact and Alternative 4 having the lowest impact) and other soil disturbing projects, combined with roadway deicing, would cumulatively affect soil productivity and sediment yield in the S.F. Snoqualmie River.
BPA Proposed Additional Power Lines	Supplemental DEIS to examine development of an additional powerline. Options include adding lines to existing towers or adding new towers.	The construction of additional power lines would overlap spatially (in the 5th field scale) and temporally with the MDP. This project, coupled with other soil-disturbing activities and the Action Alternatives, could result in cumulative effects to detrimental soil conditions and sediment yield if new towers are constructed.
McClellan Butte Trail Reconstruction Project	The project will relocate approximately 1.5 miles of trail to newly constructed trail or old road bed, abandon 1.5 miles of trail, and rehabilitate tread, drainage and switchbacks as required along the remainder of the 4.4-mile trail.	Temporary impacts along 5.9 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected soils impacts under the MDP.

Table 4.2.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Geology and Soils
Bandera Mountain/Mason Lake Trail Relocation Project	Project reorganized trail access to Mason Lake and Bandera Mountain in order to minimize social and resource impacts associated with the existing trails. The project involved construction of 1.5 miles of new trail, reconstructing 2.0 miles of existing trail and decommissioning 2.3 miles of existing trail.	Temporary impacts along 3.5 miles of trail occurred during trail reconstruction. Although the project overlaps spatially (in the 5th field scale) with the MDP, the project is assumed to have been stabilized. Therefore, cumulative effects do not overlap spatially or temporally with any projected soils impacts under the MDP.
High Lakes Trail #1012 and Snow Lake Trail #1013 Reconstruction	This project repaired seven switchbacks on the Snow Lake Trail and reconstructed 2 miles on the High Lakes Trail from Snow to Gem Lake.	Temporary impacts along 3.5 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected soils impacts under the MDP.
South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project	Reduce the maintenance level (ML) on 11 roads (26.3 miles). 19.4 miles would be reduced to ML 1 (closed to motorized access) and utilized as loop and destination trail routes; 2.7 miles would be closed - placed in storage for future forest management; 1.1 miles would be removed from the transportation system and converted to trail; approximately 22.2 miles of spur roads mostly associated with roads proposed for reduction to ML 1 would be closed and removed from the Forest Road Transportation System.	The road decommissioning and maintenance level reductions would overlap spatially (in the 5th field scale) and temporally with the MDP. Road closure and decommissioning would contribute to a decrease in detrimental soil conditions at the 5th field scale. Coupled with the Implementation, Restoration, Operation, and Monitoring Plan (see Appendix F) and other road management projects, this project would result in cumulative benefits to soil conditions at the 5th field scale.
Denny Salvage	This project would salvage approximately 50 mbf of windblown trees utilizing a ground based logging system. All undamaged trees with secure root systems would be left.	The salvage of approximately 50 mbf would not overlap spatially (in the 5th field scale) or temporally with the MDP. Stabilization of the salvage area is expected to overlap temporally with implementation of the MDP at the 5th field scale. Short-term impacts resulting in increased soil erosion would occur due to tree removal and logging equipment. Following the stabilization of disturbed areas, approximately two to three years, this project is not expected to contribute cumulative effects to soil resources at the 5th field scale.

Table 4.2.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Geology and Soils in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Geology and Soils
Annual Road Maintenance	Brushing/blading of roads on a rotating schedule as funds allow. Includes roads 55, 5510, 58, and road 9030 and 9031 systems.	Brushing and blading of roads would overlap spatially (at the 5th field scale) and temporally with the MDP. Increases in soil erosion would result from this project as the roads are disturbed. Coupled with the Action Alternatives and other roadway projects, this project would cumulatively affect sediment yield at the 5th field scale.
Road 9020 ERFO Repair	The project proposes to either replace the culvert at Alice Creek or reduce the ML of Road 9020 past Alice Creek to 1 (closed to motorized access).	The replacement of a culvert or closure of the road to motorized access would overlap spatially (at the 5th field scale) and temporally with the MDP. If the road is decommissioned, this project would result in an improvement in detrimental soil conditions. If the culvert is replaced, the long-term effects of the project would likely be beneficial, resulting in reduced sediment delivery and erosion, but would result in short-term increases in sediment yield due to soil disturbance during construction.
I-90 Corridor Thin	The project involves commercially thinning approximately 338 acres in the I-90 Corridor. About 4.3 mmbf would be thinned from 14 units.	The thinning of approximately 338 acres would overlap spatially (in the 5th field scale) and temporally with the MDP. The thinning project would result in short-term impacts to soils due to soil disturbance and sediment yield.
Snoqualmie Pass Utility District Permit Amendment	The project would extend water and sewer lines along Forest Service Road 4832 from the I-90 Hyak interchange for approximately 3,000 feet. The new lines would stop before reaching Gold Creek. Lines would be lain within the existing road right-of-way.	Temporary impacts from extension of water and sewer lines within the previously disturbed soils of the road prism would overlap spatially (in the 5th field scale) and temporally with the MDP. Short-term impacts to soils would result from soil disturbance and could, combined with other soil-disturbing activities including the Action Alternatives, result in impacts to the sediment regime at the 5th field scale.
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	The construction of a new trail and trailhead parking would overlap spatially (in the 5th field scale) and temporally with the MDP. Short-term increases in soil erosion would result from trail and parking area construction. Long-term impacts to soil productivity from new impervious surfaces, coupled with other soil-disturbing activities and the Action Alternatives, would result in increases in detrimental soil conditions and potential impacts to sediment regime at the 5th field scale.

Implementation of the proposed MDP would contribute to detrimental soil conditions in the S. F. Snoqualmie Watershed portion of the Study Area; however, the effect would be immeasurable at the larger 5th field watershed scale. The Action Alternatives would result in an increase in the percentage of

detrimental soil conditions in the watershed by approximately 0.09 to 0.10 percent (see Table 4.2.7-4). The South Fork Snoqualmie Watershed Analysis (USFS 1995) did not indicate the percentage of the watershed with detrimental soil conditions, however it is assumed to be below the 20 percent threshold. For all alternatives, the amount of total impact (the Snoqualmie MDP and other projects) in this watershed is very small compared to the overall size of the watershed, approximately 1.25 to 1.27 percent of the 5th field. The effects would be negligible at the 5th field watershed scale and would be offset by the much larger amount of land to be managed to improve forested cover, and therefore, soil conditions. As a result, there are no anticipated detrimental cumulative effects within the watershed as a result of the implementation of any of the Action Alternatives.

Table 4.2.7-4:
Cumulative Acreage of Disturbance on Geology and Soil Resources from Past, Present, and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed

Impact Type	Alt. 1[a]		Alt. 2		Alt. 3		Alt. 4		Mod. Alt. 5	
	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th
Impacts from The Summit-at-Snoqualmie										
Short and Long-Term Impacts	23.98	0.08	28.98	0.10	26.70	0.09	27.98	0.09	28.71	0.10
Impacts Not Associated with The Summit-at-Snoqualmie										
Long-Term Impacts	0.26	0.00	0.26	0.00	0.26	0.00	0.26	0.00	0.26	0.00
Short-Term Impacts	346.55	1.17	346.55	1.17	346.55	1.17	346.55	1.17	346.55	1.17
Total Short-Term and Long-Term Impacts	346.82	1.17	346.82	1.17	346.82	1.17	346.82	1.17	346.82	1.17
Beneficial Impacts	7167.9	24.26	7167.9	24.26	7167.9	24.26	7167.9	24.26	7167.9	24.26
Total Cumulative Effects	**370.80**	**1.25**	**375.80**	**1.27**	**373.52**	**1.26**	**374.80**	**1.27**	**375.53**	**1.27**

[a] The impacts associated with ongoing, maintenance related activities at The Summit-at-Snoqualmie are displayed in Alternative 1 (the No Action Alternative), since these activities would occur under all alternatives, they have been added to the impacts for Alternatives 2 through Modified Alternative 5.

4.2.8 Irretrievable and Irreversible Commitment of Resources

Irreversible commitments of geology and soils are those that cannot be reversed, such as mining for minerals. Irretrievable commitments of geology and soils are those that are lost for a period of time and can be restored with time and effort (for example, parking lot construction).

Irreversible commitments of earth resources resulting from implementation of any of the Action Alternatives would be limited to the loss of minor topographical features such as rock outcrops and soil mounds that would be removed by blasting or excavation during construction of project elements.

Examples include footings for lift towers and terminals, road construction, the preparation of foundations for buildings, and the recontouring of ski trails. No known prominent features would be removed or otherwise impacted.

Implementation of the Action Alternatives would result in the irretrievable commitment of soils to the permanent development of facilities such as parking lots, roads, buildings, lift towers, and lift terminals during the life of the ski area. These project elements would alter soil structure, change the drainage patterns of the site(s), and interrupt development of vegetative communities.

4.3 WATER AND WATERSHED RESOURCES

This section describes the potential effects of the MDP alternatives on water and watershed resources within the Study Area. The Study Area is used to quantitatively discuss impacts associated with each Action Alternative (see Figure 3.0-1, Study Area). In addition, the effects of the alternatives on areas of particular concern to the aquatic environment are addressed at two defined watershed scales. The Study Area on either side of the Cascade crest resides within two watersheds at the 5th field scale: U. Yakima Watershed and the S.F. Snoqualmie Watershed. Smaller 7th field drainages provide detail and spatial context within each of the watersheds. Fifth-field watershed and 7th-field drainage boundaries are shown in Figure 3.0-1, Study Area.

A description of the existing conditions in the Study Area within this hierarchy of watersheds is provided in Section 3.3 - Water and Watershed Resources. The MBSNF and OWNF Land and Resource Management Plans, as Amended (USDA 1990a, 1990b; USDA and USDI 1994), directs that the existing conditions are the basis by which management actions are evaluated.

Issues addressed in this section include the potential for the alternatives to impact the following aspects of watershed resources:

- Stream channels, wetlands, and Riparian Buffers
- Surface water flows and hydrologic maturity
- Water quality of streams

4.3.1 Impact Mechanisms

The physical actions associated with any MDP project that result in effects to resources are referred to as *impact mechanisms*. As described in Section 4.0.1 – Definition of Impacts, impacts can be classified and discussed in many different ways. For the purposes of this EIS, the impacts of each alternative on water and watershed resources within the Study Area are discussed in terms of direct versus indirect and short versus long-term. In addition, cumulative effects incorporate the long-term effects of all direct and indirect impacts, considering both detrimental and beneficial effects. Cumulative effects are evaluated at the 5th field U. Yakima and S.F. Snoqualmie Watershed scales, and combine impacts within the Study Area with the incremental impacts of other past, present, and reasonably foreseeable projects identified within these watersheds. Cumulative effects for water and watershed resources will be discussed in Section 4.3.8 – Cumulative Effects.

Impact mechanisms evaluated for the MDP alternatives are identified as direct or indirect and short-term or long-term below.

Direct

Where MDP projects occur up-gradient, within, and/or adjacent to watershed features, construction activities can directly and immediately affect the flow regime, and physical form and stability of streams, lakes, and wetlands, as well as the quantity and quality of both surface and ground waters. These activities include:

- Construction of stream and wetland crossings, including culvert placement, construction of bridge footings, the placement of fill material, and associated stabilization measures can result in the modification or loss of streams and wetlands and the degradation of water quality.
- Placement of power, water, and sewer utility lines across streams and wetlands, either by trenching and burying lines, or building above-ground protective structures (called *utilidors*) that could impact physical structure and flow regimes.
- Any of the above activities occurring within Riparian Buffers that could interrupt riparian functions, such as shading, bank stabilization, sediment filtration, nutrient inputs, recruitment of LWD.
- Stream stabilization, wetland restoration, and other native vegetation—all of which would have beneficial, restorative effects on water and watershed resources.[59]

Indirect

Construction projects can also have an indirect or delayed effect on water and watershed resources. Indirect impact mechanisms are often associated with activities in upland areas, and indirect impacts are often described as having potential to occur, because there are many unknown factors controlling the degree to which the off-channel impacts are transmitted to and realized in the water bodies. Thus, indirect impacts identified in this analysis do not always occur. Indirect impact mechanisms identified in the MDP alternatives include:

- Construction of roads, parking lots, buildings, and chairlift terminals and towers that create impervious surfaces and alter paths and rates of runoff, particularly at the 7th field drainage scale.
- Removal of trees and other natural vegetation and the modification of topography reduces the hydrologic maturity of watershed and alters the paths, rates, and timing of runoff, including:
  - Full clearing of forests without grading for chairlift corridors;
  - Full clearing of forests without grading for ski trails;
  - Full clearing of forests with grading or blasting for ski trails;
  - Partial clearing of forests without grading for gladed ski trails;

[59]Note that stream stabilization, wetland restoration and other restoration projects outlined in Appendix F are included under each applicable Action Alternative. The beneficial, restorative effects on resource areas is included in the calculation and discussion of impacts under each alternative.

- Indirect impacts to wetlands and riparian areas would also occur from operational and maintenance activities that require removal or management of vegetation. Indirect impacts would include mowing and brushing vegetation to maintain a modified land cover for ski trails and buildings and other ski area facilities.
- Construction of ski area facilities, grading of ski trails, and trenching for utility lines that could result in turbidity and other water quality degradation in streams and wetlands from upland erosion or mass wasting.
- Introduction of noxious weeds into wetland and riparian areas from road and trail construction in adjacent areas.
- Construction of ski area facilities and permanent changes in land cover that alter the rates and timing of discharge in streams.
- Windthrow along the perimeter of cleared ski trails (in forests that are less windfirm) can result in the loss of riparian functions, and could increase the water available for runoff by expanding hydrologically immature areas.
- Application of magnesium chloride de-icer/ice-inhibitor to base area roads and parking lots could result in localized water quality degradation in soils and small streams.
- Paving of parking lots, road decommissioning, revegetation with trees and other native vegetation, and reconstruction of water bars and other BMPs - all of which would have beneficial effects in the improvement of water quality.

Short-Term

Short-term impacts are those impacts that attenuate over time to preconstruction levels as the impact site stabilizes. Short-term impacts are often associated with the temporary modification of vegetation, which begins to stabilize the site as it regrows over one to two years following disturbance. Impact mechanisms resulting in short-term impacts include:

- Vegetation removal and ground disturbance during trenching for the installation of utility lines, which could generate indirect water quality impacts.
- The direct trenching of streams and wetlands for utilities, after which they would be restored to their natural configuration.
- Removal or disturbance of vegetation adjacent to newly constructed roads, parking lots, buildings, and ski facilities and infrastructure (lift terminals), resulting in potential water quality impacts before revegetation occurs.

Long-Term

Long-term impacts are sustained relative to preconstruction levels. They are generally associated with the permanent loss of vegetation or the maintenance of land cover in a modified, non-forested condition,

including ski trails, roads, and base area facilities. These impact mechanisms also include regular maintenance activities consistent with The Summit's typical operations. With the exception of those impacts identified as short-term, all of the impact mechanisms identified above would generate long-term effects.

4.3.2 Impacts – Alternative 1 (No Action Alternative)

As required by NEPA, a No Action Alternative is included in this EIS as a benchmark against which the Action Alternatives can be compared. The No Action Alternative also serves as a means of analyzing the effects of no future development within the Study Area. If additional projects should be proposed in the future by Ski Lifts, Inc., they would require USFS NEPA review and approval. Under Alternative 1, there would be no additional effects on water and watershed resources resulting from the construction of new facilities. Existing impacts, as discussed in Section 3.3 - Watershed Resources, would continue and are summarized in this section. See Figures 3.3.1-1, Hydrography – The Summit and 3.3.1-2, Hydrography - Alpental for the existing hydrography (streams, wetlands, Riparian Buffer boundaries, stream crossing structures), and 7th field drainages at The Summit and Alpental and Figures 3.3.1-3, Existing Riparian Conditions – The Summit and 3.3.1-4 for the existing riparian conditions (Riparian Buffer boundaries, hydrologic conditions, streams, and wetlands) at The Summit and Alpental.

4.3.2.1 Upper Yakima River Watershed

Drainages of Particular Concern

Table 4.3.2-1 portrays the results of the Drainages of Particular Concern (DPC) analysis for the drainages in the U. Yakima watershed.

Table 4.3.2-1:
Summary of DPC Analysis of Watershed Conditions for Alternative 1 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	L. Mill Creek	U. Mill Creek	Creek Run	Sum-mit South	Hyak	Tun-nel	Ski Acres	Beaver	Other
Area (acres)	**N/A**	**395.50**	**33.21**	**220.15**	**223.79**	**192.61**	**134.35**	**357.93**	**171.30**	**155.56**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.16	100.00	18.87	45.06	27.37	42.00	52.78	56.38	44.52
Stream Length w/ Management Concerns (% of total)	10	7.78	18.33	1.89	6.60	5.81	27.23	44.48	48.63	32.40
Road Density (miles/square mile)	3	7.42	2.90	2.52	5.66	2.78	12.34	9.28	8.65	1.66
Road Crossing Density (number/square mile)	6	27.50	0.00	20.34	14.29	9.96	85.71	50.04	33.61	4.11
Impervious Cover (% of total)	8	2.25	0.88	0.76	4.33	1.28	7.03	8.16	4.29	1.16
Modified Channel Length (% of total)	8	0.00	0.00	0.00	1.69	0.00	5.60	12.68	10.45	0.00
Culverted Channel Length (% of total)	8	0.00	0.00	0.00	0.00	5.76	26.07	16.09	21.96	38.46
Parameters over Threshold		**3**	**2**	**1**	**3**	**1**	**5**	**7**	**6**	**3**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Several impact mechanisms, such as road density, stream crossings, and length of channels within ditches or in an altered/modified condition, would continue to directly affect the stream channels of the Study Area in the U. Yakima Watershed under Alternative 1 (see Table 4.3.2-2).

Approximately 1.84 miles of stream would remain realigned and contained in 30 extended culverts (greater than 100 feet long) at various locations around the Study Area. These culverts were constructed to permit the egress of skiers during low snow conditions. Other segments of streams would remain straightened and generally degraded as a modified channel type through historic excavation and re-alignment. Most of the culverted and modified channel types are concentrated in the Ski Acres, Tunnel, and Beaver 7th-field drainages (see Table 4.3.2-1). Stream crossing structures (culverts, bridges, and fords) exist currently at 88 locations within the U. Yakima Watershed. These crossings constrain streams and

increase the potential for erosion and sediment recruitment. The density of road crossings is greatest in the Tunnel, Ski Acres, and Beaver 7th field drainages (see Table 4.3.2-1).

The watershed conditions of the 7th field drainages within the Study Area, as described in Section 3.3 – Water and Watershed Resources, would remain unchanged under Alternative 1. All of the drainages in the U. Yakima Watershed would still have at least one parameter that is over the thresholds established in Appendix I – Physical and Biological Resource Data Tables. The Tunnel, Ski Acres, and Beaver drainages would continue to exceed thresholds for a majority of the seven parameters relevant to watershed resources (see Table 4.3.2-1). The Riparian Buffers in a non-natural condition and road density parameters are those most commonly exceeded in the U. Yakima Watershed.

The modified channel length parameter indicates the percentage of channels exhibiting modified channel morphology due to straightening, ditching, or re-routing of natural stream channels, relative to the total channel length in that drainage. The Ski Acres and Beaver drainages are over threshold for this parameter, indicating that channel integrity and drainage network function has been compromised in these drainages due to past timber harvest and ski area development (see Table 4.3.2-1). The culverted channel length represents the percentage of channel segments that have been placed in long culverts (greater than 100 feet), relative to the total channel length in that drainage. The Tunnel, Ski Acres, Beaver, and Other drainages are over threshold for this parameter, indicating that a high proportion of the stream segments in these drainages have been modified and disconnected from the adjacent floodplains and riparian zones (see Table 4.3.2-1). Finally, the road crossing density parameter quantifies the direct impact of high density culvert installations on the structural integrity of stream channels and the indirect impacts of these crossing structures on channel erosion and subsequent water quality. Seven of the nine drainages in the U. Yakima Watershed are over threshold for this parameter due to the high road density in the Study Area. Upper Mill Creek is the only drainage without threshold exceedences for this parameter.

Wetlands

Under Alternative 1, no additional projects would be approved. The Summit-at-Snoqualmie would continue to its current operations under existing conditions. Since no new clearing or grading would occur, no additional direct or indirect impacts to wetlands would occur in the U. Yakima Watershed. Under Alternative 1, The Summit-at-Snoqualmie would continue its current management program of ski trail maintenance of the wetlands located in existing ski trails within the U. Yakima Watershed. A total of 177 wetlands with a combined area of 63.06 acres exist within the U. Yakima Watershed. Of these 177 wetlands, 115 of them are considered modified by either past and/or ongoing land management. Covering 27.81 acres, 82 of 118 palustrine emergent wetlands would continue to exist in a modified condition. A total of 33 out of 56 Study Area palustrine scrub-shrub wetlands are in modified condition, covering 17.19 acres. Scrub-shrub wetlands on slopes modified for skiing are small and generally less than 0.1 acre in size. There are 11.41 acres of emergent wetlands in a natural condition located outside maintained ski trails and other developed area within the Study Area. There are also 23 palustrine scrub-shrub wetlands

in natural conditions covering 3.98 acres within the Study Area. Three palustrine forested wetlands in a natural condition total 2.68 acres in the Study Area (see Table 3.3.1-4). Nearly two-thirds (70+ percent) of the wetlands surveyed in the U. Yakima Watershed would be maintained in a modified condition under Alternative 1 (see Table 4.3.3-3). Several small (less than 0.10 acre) wetlands that are dominated by shrubs, or have shrubs growing within the wetland, are located in ski trails and would require brushing or mowing to maintain low vegetation level to facilitate skier egress. Emergent wetlands, which are typically larger and located on ski trails, contain some shrubs that would also require vegetation maintenance. Mowing of vegetation would only cut above-ground plant material and not require soil scraping, digging of soil, or plowing, so any indirect impacts to wetlands under Alternative 1 from ongoing maintenance would be short-term in nature. This type of vegetation maintenance in wetlands is not considered a discharge of fill material and is not regulated by the USACE.

Water Quantity

Under Alternative 1, no snowmaking is proposed, and groundwater and sufacewater withdrawal would be as described in the existing condition. Under Alternative 1, approximately 933 acres of land cover (nearly half of that portion of the U. Yakima Watershed that is within the Study Area) is hydrologically immature (see Table 4.3.3-4). This immature vegetation is comprised mostly of modified shrubs and herbaceous vegetation on the ski trails (596 acres) as well as some naturally non-forested vegetation (51.2 acres). Under current maintenance practices at The Summit-at-Snoqualmie, modified vegetation would continue to be maintained in a hydrologically immature condition to support ski area operations. Another 285 acres of second-growth sapling forest would transition into intermediate hydrologic maturity (and eventually fully hydrologic maturity) as the stand matures and the uniform canopy of pole-sized trees begins to develop a mosaic of holes in a canopy of multiple layers that would hold and release snow and rain more slowly. Another 70.8 acres of developed and impervious land cover would be maintained in the U. Yakima Watershed in Alternative 1 (see Table 4.3.3-4). The Ski Acres drainage exhibits the highest impervious surface area as a percent of 7th-field drainage area (see Table 4.3.2-1). Roads act as a web of linear impervious features that intercept and concentrate overland and shallow subsurface runoff. Roads would continue to be most dense in the Tunnel, Ski Acres, Beaver, and Summit South drainages (see Table 4.3.2-1). Illustration 3.3.1-1 depicts the annual hydrograph at sites S-2 and A-2 for water years 2002 and 2003, showing fluctuations from base flow to seasonal peak flows that are typical of snow fed drainage basins that have increased flows associated with rain on snow events and spring snowmelt. These hydrographs represent a typical alpine hydrograph characteristic of the streams around Snoqualmie Pass.

The road density parameter reflects the level of drainage network and groundwater flow path disruption by roads within the drainage. As shown in Table 4.3.2-1, the Lower Mill Creek, Summit South, Tunnel, Ski Acres, and Beaver drainages are over the established threshold for this parameter. The flow regime of these drainages has likely been measurably impacted by the high road density with higher base and peak flow and an artificially fast flow response to storm events. Research indicates that the percentage of

impervious surfaces (e.g., roads, parking lots, buildings) within a drainage affects stream flow response to rainfall. Effects are first observed when impervious surfaces exceed 5 to10 percent of basin area. Effects become severe at greater than 15 percent of basin area. To facilitate an analysis of the effects of impervious surfaces on the watershed resources of a drainage, the threshold was established at 8 percent, which when exceeded can result in changes to the biological community. Ski Acres is the only drainage in the U. Yakima Watershed that is over threshold for this parameter (see Table 4.3.2-1).

Water Quality

Under Alternative 1, stream water quality in the Study Area within the U. Yakima Watershed would likely remain impaired for aquatic life uses, particularly with respect to temperature and dissolved oxygen. As described in Section 3.3.1.4 - Surface Water Quality, it is not uncommon for Coal Creek to warm to temperatures that would stress or interfere with char (where present) particularly in July and August during the summer rearing window (see Illustration 3.3.1-3). Dissolved oxygen would also continue to remain low during these summer low flow periods, although this is not uncommon even in undisturbed headwater stream segments. Most of the 7th-field drainages in the U. Yakima Watershed exhibit significant portions of their Riparian Buffers in a modified or developed condition (Table 4.3.2-1). This contributes to warmer temperatures and depressed dissolved oxygen concentrations.

Exceedences of the turbidity State Water Quality Standard (SWQS) would continue to occur on an intermittent basis, particularly in the fall when snow depths are not yet adequate to protect soils from high intensity storms and rain-on-snow events. The application of traction sand to base area roads and parking lots, and to SR 906 and I-90 would continue to elevate turbidity levels in Coal Creek during spring snowmelt.

Stream water quality in the Study Area within the U. Yakima Watershed would likely remain unimpaired for contact recreation during the life of the MDP under Alternative 1. The risk of exceedences of the fecal coliform water quality standard would increase, however, with increasing recreation use by people and pets.

The road crossing density parameter can also reflect the potential increase in soil erosion and sediment yield to waterbodies within drainages with a high number of crossings. As stated in the streams analysis, almost all of the drainages within the U. Yakima Watershed are over threshold for this parameter. Upper Mill Creek is the only drainage not over threshold (see Table 4.3.2-1). The stream length with management concerns parameter reflects the length of stream channels in a drainage whose banks exhibit modified, nonforested vegetation. These modifications can lead to bank instability, decreased shade, and decreased filtration of sediment from adjacent areas. The Upper Mill Creek, Tunnel, Ski Acres, Beaver, and other drainages are over threshold for this parameter (see Table 4.3.2-1).

Riparian Buffers

Under Alternative 1, approximately 182 acres of Riparian Buffers would continue to be maintained under modified or developed land cover for the purposes of ski area operations (Table 4.3.3-6). Riparian Buffers around approximately 5 miles of adjacent streams and riparian habitat would continue to exist in a non-natural condition because of historic development at The Summit-at-Snoqualmie. These Riparian Buffers in modified or developed conditions would continue to result in degradation of stream channel conditions, temperatures, LWD input, bank cover, and inputs of fine organic matter, nutrients and insects relative to natural conditions in several 7th field drainages in the U. Yakima Watershed (see Table 4.3.3-1).

Most of the Riparian Buffers in the Mill Creek 7th field drainage would be maintained in second-growth sapling forest, and would continue to have limited riparian functions, such as shading and LWD recruitment (see Figure 3.5.1-1, Existing Vegetation Cover – The Summit). Under Alternative 1, the impact to riparian function would be reduced as the stand matures over time.

The Riparian Buffers in a non-natural condition parameter reflects the area of Riparian Buffers in a drainage that has been modified and no longer properly functions. These modified Riparian Buffers do not provide adequate thermal buffering via shading, sediment filtration and retention, or LWD recruitment. Most of the drainages in the U. Yakima Watershed are over threshold for this parameter. In fact, only the Creek Run and Hyak drainages are not over the 30 percent threshold (see Table 4.3.2-1). The stream length with management concerns parameter is another measure of impacts to Riparian Buffers. As described in the water quality section above, the Upper Mill Creek, Tunnel, Ski Acres, Beaver, and other drainages are over threshold for this parameter (see Table 4.3.2-1).

4.3.2.2 South Fork Snoqualmie River Watershed

Drainages of Particular Concern Analysis

Impacts to stream channels in the S.F. Snoqualmie Watershed under Alternative 1 are similar to those described for the U. Yakima Watershed in Section 4.3.2.1 – Upper Yakima River Watershed. Table 4.3.2-2 portrays the results of the DPC analysis for the drainages in the S.F. Snoqualmie Watershed.

Table 4.3.2-2:
Summary of DPC Analysis of Watershed Conditions for Alternative 1 in the South Fork Snoqualmie Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	North-side	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)	**N/A**	**49.02**	**72.08**	**270.07**	**89.34**	**318.62**	**214.58**
Riparian Buffers in a Non-Natural Condition (% of total)	30	81.47	83.90	41.12	27.22	38.97	11.32
Stream Length w/ Management Concerns (% of total)	10	0.00	49.76	2.44	3.89	21.40	3.98
Road Density (miles/square mile)	3	4.88	7.02	0.50	0.68	1.70	2.34
Road Crossing Density (number/square mile)	6	0.00	26.62	4.76	7.16	12.05	11.93
Impervious Cover (% of total)	8	1.65	14.26	0.21	0.23	1.93	2.68
Modified Channel Length (% of total)	8	0.00	88.43	1.96	0.00	25.17	5.49
Culverted Channel Length (% of total)	8	0.00	11.57	0.00	0.00	3.84	0.36
Parameters over Threshold		**2**	**7**	**1**	**1**	**4**	**1**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Under Alternative 1, the watershed conditions of the 7th field drainages within the Study Area, as described in Section 3.3 – Water and Watershed Resources, would remain unchanged. At least one parameter would exceed the thresholds established in Appendix I – Physical and Biological Resource Data Tables for all of the drainages in the S.F. Snoqualmie Watershed (see Table 4.3.2-2). A majority of the seven parameters relevant to watershed resources would continue to be exceeded in the Summit North and Nacrinomical drainages. For the S.F. Snoqualmie Watershed, the Riparian Buffers in a non-natural condition and the road density parameters are the most commonly exceeded (see Table 4.3.2-2).

Approximately 0.22 mile of stream would remain realigned and contained in 7 extended culverts (greater than 100 feet long). Another 1.70 miles of stream would remain channelized in a modified condition (see Table 4.3.3-8). All of the culverted channel types and half of the modified channel types are located in the Summit North drainage within the Summit West ski area. The remaining modified channels are in the Nacrinomical drainage at Alpental (see Table 4.3.3-2). Under Alternative 1, there would continue to be 2 bridges, 12 culverts, and 2 ford stream crossings within the S.F. Snoqualmie Watershed as shown in Table 4.3.3-8, and the road density would remain fairly low at 1.96 mile/mile^2.

The Summit North and Nacrinomical drainages are over threshold for the modified channel length parameter indicating that channel integrity and drainage network function has been compromised in these

drainages by past timber harvest and ski area development (see Table 4.3.2-2). The Summit North drainage is over threshold for the culverted channel length parameter, indicating that a high proportion of the stream segments in this drainage have been modified and disconnected from the adjacent floodplains and riparian zones. The Summit North, Upper Alpental, Nacrinomical, and Other drainages are over threshold for the road crossing density parameter due to the high road density in the Study Area (see Table 4.3.2-2).

Wetlands

Under Alternative 1, wetlands in ski trails and in natural settings within the S.F. Snoqualmie Watershed at The Summit-at-Snoqualmie would continue to be maintained under the current management program of ski trail maintenance. A total of 7.8 acres of the wetlands surveyed in the S.F. Snoqualmie Watershed would be maintained in a modified condition under Alternative 1 (see Table 4.3.3-9). Wetland impacts in the S.F. Snoqualmie Watershed under Alternative 1 would be similar to those described for the U. Yakima Watershed in Section 4.3.2.1 – Upper Yakima River Watershed.

As shown in Table 3.3.1-4, several small (less than 0.10 acre) wetlands that are dominated by shrubs, or have shrubs growing within the wetland, are located in ski trails and would require brushing or mowing to maintain low vegetation level for early season skiing. Other emergent wetlands located on ski trails also contain scattered shrubs that would require vegetation maintenance. Brush removal or of mowing vegetation would cut above-ground plant material with no disturbance to soils. Therefore, this type of vegetation maintenance would not be considered a land clearing activity and would not be regulated by the USACE.

Water Quantity

Under Alternative 1, about 180 acres (representing about 18 percent of that portion of the overall Study Area that is tributary to the S.F. Snoqualmie River) would continue to be maintained in a modified, hydrologically immature condition to support ski area management (see Table 4.3.3-10). Another 23.8 acres would be maintained as developed and impervious land cover. Most of this impervious surface area is concentrated in the Summit North drainage (see Table 4.3.3-7) at Summit West. Road densities would also remain high in the drainages at the Summit West ski area. All 7th field drainages within the Alpental ski area would remain within accepted limits for these two parameters.

According to the analysis presented in Table 4.3.2-2, the Northside and Summit North drainages are over threshold for the road density parameter. The flow regime of these drainages has likely been measurably impacted by the high road density which leads to higher base and peak flows and an artificially fast flow response to storm events. Summit North is the only drainage in the S.F. Snoqualmie Watershed that is over threshold for this parameter (see Table 4.3.2-2).

Water Quality

Under Alternative 1, stream water quality in the Study Area within the S.F. Snoqualmie Watershed would likely remain high, and generally unimpaired for aquatic life uses. As described in Section 3.3.1.4 - Surface Water Quality, no exceedences of SWQS for temperature, dissolved oxygen (with one exception), turbidity, and pH have been observed in the S.F. Snoqualmie River at Alpental. Dissolved oxygen was observed to be below the minimum of 9.5 mg/L on one instance. It should be noted that no monitoring of the small tributaries of the S.F. Snoqualmie draining from the Summit West ski area has been conducted. Given the numerous parameters over threshold for drainages within Summit West, impairment of temperature, oxygen, and turbidity in these streams would not be unexpected.

Like the U. Yakima Watershed, stream water quality in the Study Area within the S.F. Snoqualmie Watershed would likely remain unimpaired for contact recreation under Alternative 1, with some increased risk of fecal coliform contamination caused by increasing recreation use by people and pets.

As stated in the streams analysis, almost all of the drainages within the S.F. Snoqualmie Watershed are over threshold for the road crossing density parameter. Only the Northside and International drainages are not over threshold (see Table 4.3.2-2). The Summit North and Nacrinomical drainages are over threshold for the stream length with management concerns parameter (see Table 4.3.2-2).

Riparian Buffers

Under Alternative 1, approximately 150 acres of Riparian Buffers in the S.F. Snoqualmie Watershed would continue to be maintained under modified or developed land cover for the purposes of ski area management, affecting about 4.95 miles of adjacent streams and their habitats (see Table 4.3.3-12). Riparian disturbances would be distributed across many of the 7th field drainages in the S.F. Snoqualmie Watershed, but would have the greatest direct effect on streams in the Summit North and Nacrinomical drainages (see Table 4.3.3-7). Also, 0.22 mile of culverted streams would continue to be completely excluded from all riparian functions (see Table 4.3.3-8).

The proximity of the upper Alpental parking lots to the S.F. Snoqualmie River limits the effectiveness of the Riparian Buffers for filtering and storage of sediment from the parking lots and access road, which introduce sediment generated from traction sand applied during winter operations. Under Alternative 1, this situation would continue, and sediment from the road and parking lots would continue to discharge to the S.F. Snoqualmie River. Snow removal activities would also continue to contribute sediment to Riparian Buffers along the S.F. Snoqualmie River.

Most of the drainages in the S.F. Snoqualmie Watershed are over threshold for the Riparian Buffers in a non-natural condition parameter, with the Upper Alpental and Other drainages as the only ones that are not over the 30 percent threshold (see Table 4.3.2-2). As described in the water quality section above, the Summit North and Nacrinomical drainages are over threshold for the stream length with management concerns parameter (see Table 4.3.2-2).

4.3.3 Impacts – Alternative 2 (Proposed Action)

See Figures 2.3.3-1, Alternative 2 Proposed Conditions – The Summit and 2.3.3-2, Alternative 2 Proposed Conditions - Alpental for the proposed conditions under Alternative 2 at both The Summit and Alpental. See Figures 4.3.1-1, Hydrography – The Summit and 4.3.1-2, Hydrography – Alpental for the hydrography (streams, wetlands, Riparian Buffer boundaries, stream crossing structures, and 7th field drainages) under Alternative 2 at The Summit and Alpental. See Figures 4.3.1-3, Impacts to Riparian Conditions – Alternative 2 – The Summit and 4.3.1-4, Impacts to Riparian Conditions – Alternative 2 – Alpental for the riparian conditions (Riparian Buffer boundaries, hydrologic conditions, streams, and wetlands) under Alternative 2 at The Summit and Alpental.

4.3.3.1 Upper Yakima River Watershed

Streams

Summary

Table 4.3.3-1 shows infrastructural impacts to streams within the U. Yakima Watershed. A summary analysis was conducted in order to differentiate the individual effects of:

- MDP implementation.
- The Mill Creek land donation.
- The combined effects of implementation of both of the above, as would occur in Alternative 3 and Modified Alternative 5.

Therefore, Table 4.3.3-1 is divided into three parts. Each part of the Table portrays one of the project components listed above, and analyzes the infrastructural impacts at a different spatial scale. The scale associated with each Table is portrayed spatially in Illustration 4.3.3.1-1. The pertinent scale for each Table part is outlined narratively as follows:

- Table 4.3.3-1A portrays the infrastructural impacts to Study Area stream reaches, associated with the projects for each alternative of MDP Implementation. The spatial extent of interest for Table 4.3.3-1A is restricted to the portion of the Study Area within the U. Yakima watershed, shown as the Table A polygon in Illustration 4.3.3.1-1.
- Table 4.3.3-1B outlines the infrastructural impacts to streams within the Section 21 land parcel of the Mill Creek land donation. The area of interest for Table 4.3.3-1B is restricted to the Section 21 land parcel associated with the Mill Creek land donation, shown as the Table B polygon in Illustration 4.3.3.1-1.

Table 4.3.3-1C shows the total infrastructural effects to streams for both the MDP Implementation and the Mill Creek land donation combined. The area of interest for Table 4.3.3-1C is the combined area of the Study Area and the Section 21 Mill Creek land parcel.

Table 4.3.3-1A:
Impacts to Study Area Streams
within the Upper Yakima Watershed - MDP Implementation

Disturbance Source	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Road Density (miles/square mile)	4.72	4.55	4.55	4.48	4.55
Number of Stream Crossings (all channel types) by Crossing Structure[a]					
Culvert	61	60	60	59	60
Bridge	1	3	3	1	3
Ford[b]	12	12	12	12	12
Total Number of Stream Crossings	**74**	**75**	**75**	**72**	**75**
Length of Altered or Channelized Channel Types[a]					
Long Culverted Channels (miles)	1.84	1.9	1.9	1.9	1.9
Ditches Conveying Natural Streamflow (miles)	0.89	0.83	8.3	0.83	0.83
Number of Culverted Segments	30	35	35	35	35

[a] Includes Jurisdictional streams
[b] Does not include temporary crossings
Note: This table does not include the Mill Creek portion of the Study Area.

Table 4.3.3-1B:
Impacts to Mill Creek Parcel Streams within the Upper Yakima Watershed

Disturbance Source	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Road Density (miles/square mile)	5.77	5.77	5.77	5.77	5.77
Number of Stream Crossings (all channel types) by Crossing Structure[a]					
Culvert	14	14	14	14	14
Bridge	0	0	0	0	0
Ford[b]	0	0	0	0	0
Total Number of Stream Crossings	**14**	**14**	**14**	**14**	**14**
Length of Altered or Channelized Channel Types[a]					
Long Culverted Channels (miles)	0	0	0	0	0
Ditches Conveying Natural Streamflow (miles)	0	0	0	0	0
Number of Culverted Segments	0	0	0	0	0

[a] Includes Jurisdictional streams
[b] Does not include temporary crossings
Note: This table includes only the Mill Creek portion of the Study Area.

Table 4.3.3-1C:
Total Impacts to Streams within the Upper Yakima Watershed,
MDP Implementation and Mill Creek Land Donation

Disturbance Source	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Road Density (miles/square mile)	6.43	6.29	6.29	6.23	6.29
Number of Stream Crossings (all channel types) by Crossing Structure[a]					
Culvert	75	74	74	73	74
Bridge	1	3	3	1	3
Ford[b]	12	12	12	12	12
Total Number of Stream Crossings	**88**	**89**	**89**	**86**	**89**
Length of Altered or Channelized Channel Types[a]					
Long Culverted Channels (miles)	1.84	1.90	1.90	1.90	1.90
Ditches Conveying Natural Streamflow (miles)	0.89	0.83	0.83	0.83	0.83
Number of Culverted Segments	30	35	35	35	35

[a] Includes Jurisdictional streams
[b] Does not include temporary crossings
Note: This table includes the Mill Creek portion of the Study Area.

As shown in Table 4.3.3-1C, within the U. Yakima Watershed under Alternative 2, there would be a total of 89 stream crossings (culverts, bridges, and/or fords), an increase of one crossing structure over Alternative 1 conditions. In addition, there would be 1.90 miles of culverted channels and 0.89 mile of ditches conveying streamflow, both of which would directly impact stream channels, mostly in the long-term (see Table 4.3.3-1). Indirect impacts to streams under Alternative 2 include the removal of 16 acres of mature and immature forests within Riparian Buffers due to clearing and grading activities as well as the construction of 3.7 acres of impervious surfaces within Riparian Buffers, which could modify the flow paths of runoff and erosion patterns. Beneficial impacts would result from the application of MgCl to I-90, SR 906, and paved parking lots would reduce the amount of sediment transported to streams and decrease the filling of pools in streams.

Drainages of Particular Concern Analysis

Under Alternative 2, there would be two new threshold exceedences, versus Alternative 1 conditions:

- Summit South (Stream length with management concerns - 13.50 percent)
- Tunnel (Impervious cover – 8.11 percent)

Table 4.3.3-2:
Summary of DPC Analysis of Watershed Conditions for Alternative 2 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	L. Mill Creek	U. Mill Creek	Creek Run	Sum-mit South	Hyak	Tun-nel	Ski Acres	Bea-ver	Other
Area (acres)	**N/A**	**395.50**	**33.21**	**220.15**	**223.79**	**192.61**	**134.35**	**357.93**	**171.30**	**155.56**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.76	100.00	28.44	67.67	28.58	51.26	55.29	59.30	44.52
Change from Alternative 1 (% of total)		0.59	0.00	9.58	22.61	1.22	9.26	2.51	2.92	0.00
Stream Length w/ Management Concerns (% of total)	10	8.37	18.33	4.88	13.50	5.34	37.77	45.11	27.98	32.40
Change from Alternative 1 (% of total)		0.59	0.00	3.00	6.91	-0.47	10.54	0.63	-20.65	0.00
Road Density (miles/square mile)	3	7.47	2.90	2.25	5.61	2.78	11.77	8.80	7.68	1.66
Change from Alternative 1 (miles/square mile)		0.05	0.00	-0.27	-0.05	0.00	-0.57	-0.48	-0.97	0.00
Road Crossing Density (number/ square mile)	6	29.13	0.00	20.35	11.44	13.29	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	0.01	-2.85	3.33	4.80	0.02	-3.72	0.00
Impervious Cover (% of total)	8	2.27	0.88	0.84	4.34	1.32	8.11	9.45	4.35	1.16
Change from Alternative 1 (% of total)		0.02	0.00	0.07	0.01	0.04	1.08	1.29	0.06	0.01
Modified Channel Length (% of total)	8	0.00	0.00	0.00	1.69	0.00	5.61	12.65	5.48	0.00
Change from Alternative 1 (% of total)		0.00	0.00	0.00	0.00	0.00	0.01	-0.03	-4.97	0.00
Culverted Channel Length (% of total)	8	1.56	0.00	0.00	0.00	5.76	26.82	17.16	15.70	38.46
Change from Alternative 1 (% of total)		1.56	0.00	0.00	0.00	0.00	0.75	1.07	-6.26	0.00
Parameters over Threshold		**3**	**2**	**1**	**4**	**1**	**6**	**7**	**5**	**3**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**1**	**0**	**-1**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Under Alternative 2, the watershed conditions of many of the 7th field drainages within the Study Area would change as a result of proposed tree removal, road and parking lot building, construction of facilities, and implementation of restoration projects. Most of the drainages in the U. Yakima Watershed would be affected by the Proposed Action, while the Upper Mill Creek and Other drainages would not have any impacts affecting watershed conditions parameters (see Table 4.3.3-2). The Tunnel, Ski Acres, and Beaver Lake Creek drainages would continue to exceed the majority of the seven watershed resources parameter thresholds. However, the number of parameters that are over threshold in the Tunnel drainage would increase from five to six due to a new exceedence in the impervious cover parameter (see Table 4.3.3-2). The number of parameters that are over threshold would also increase in the Summit South drainage. This additional parameter exceedence is due to increased stream length with management concerns caused by proposed trail clearing and grading a road building. Impacts within the Summit South drainage would be partially offset by restoration projects (see Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, Table 5-1) that would reduce the parameter scores for road density, road crossing density, and bare soil area, but would not reduce the parameter scores to below threshold (see Table 4.3.3-2). The number of parameters that are over threshold for the Beaver drainage would decrease from existing conditions. The modified channel length parameter would decrease to below the threshold due to the restoration project (see Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, Table 5-1) to daylight Beaver Lake Creek (see Table 4.3.3-2). The parameter scores for the Lower Mill Creek, Creek Run, Hyak, Ski Acres, and Other drainages would increase as a result of the Proposed Action, but none of the increases in these drainages would be sufficient to create new threshold exceedences.

Under Alternative 2, The Summit-at-Snoqualmie would implement the MDP Implementation Plan, Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, which includes restoration projects such as slope stabilization, road deactivation, revegetation, and stream and wetland restoration. These restoration projects would help to address areas of concern identified in the DPC analysis. These restorations, outlined in Section 5.0 - Restoration of Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, incorporate the concepts of creation, enhancement, revegetation, and road deactivation activities as means to achieve restoration. Table 5-1, Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, outlines and describes the restoration projects that would be implemented by The Summit-at-Snoqualmie under Alternative 2.

Direct Impacts

Direct impacts to stream channels within the U. Yakima Watershed under Alternative 2 would occur during the construction of or removal of stream crossing structures (culverts, bridges, and fords) at road and ski trail crossings of streams. Properly designed and installed stream crossing structures help to protect development investments and downstream infrastructural resources, and they are not detrimental in themselves, apart from the loss of natural stream structure. Ski and/or road crossings and their

associated structures create sediment sources, increase streambank erosion potential, and add to the road maintenance requirements.

Three new culverts would be installed under Alternative 2. Enclosing a total of 5 additional unique stream segments, the three new culverts would be constructed at the following locations:

- One in the Lower Mill Creek drainage at the intersection of Trail 52D and an MS2 channel.
- One near the proposed locations of the lower terminals of the Creek Run and Rampart chairlifts from a new road being built to the bottom of these chairlifts.
- One in the Tunnel Creek drainage where the new Silver Fir Base Lodge would be built.

As specified in Management Requirement MR8 (see Table 2.4-2), all new culverts would be sized to pass water from 100-year storm events with considerations for sediment and debris likely to be encountered. Installing a new culvert would have an adverse impact on stream channels resulting from the direct in-stream disturbance and because culverts constrain stream channels to non-natural locations and elevations that might otherwise change naturally through time. Management Requirements MR3, MR8, MR9, MR10, and Other Management Provisions OMP9 (Table 2.4-2) would be implemented during culvert installation to reduce channel down-cutting and sediment delivery to streams in tandem with the MDP Implementation Plan, which outlines the sequence of events that would occur before, during, and after implementation of the MDP. Under Alternative 2, four culverts would be removed:

- Three culverts would be removed associated with the decommissioning of road M-5 (see Figure 4.2.1-3, Road Impacts and Restoration by Soil Erosion Potential – Alternative 2 – The Summit).
- One extended culvert would be removed due to the planned daylighting of Beaver Lake Creek (see Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

The removal of culverts during these projects would result in long-term beneficial impacts to stream channels, but would impact streams in the short-term via instream disturbance and temporary sediment impacts. The restoration project to daylight Beaver Lake Creek would cause the modified channel length parameter in the Beaver drainage to decrease below the threshold. In addition, this restoration project would decrease the culverted channel length in the Beaver drainage, but not to below the threshold (see Table 4.3.3-2).

Under Alternative 2, two new bridges would be constructed in that portion of the Study Area within the U. Yakima Watershed. One bridge would be built at the intersection of Trail 71 and Hyak Creek, and the other bridge would be built at the junction of Trail 49 and Stream A in the Creek Run pod. Bridge footings would be located outside of the ordinary high water zone of these streams and would not constrict or otherwise impact the channel. In tandem with the MDP Implementation Plan, which outlines the sequence

of events that would occur before, during, and after implementation of the MDP, Management Requirements MR9, MR10 and Other Management Provisions OMP10, and (see Table 2.4-2) would be implemented during bridge installation to reduce channel down-cutting and sediment delivery to streams.

Under Alternative 2, no new fords would be built, but the existing fords would receive maintenance, as described in the MDP Implementation Plan (see Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

In addition to stream crossing structures, Alternative 2 would require the channelization of stream segments via the placement of long culverts (greater than about 100 feet) in two new places within the U. Yakima Watershed. These culverted segments (represented as type CV channels, described according to the channel classification system of Section 3.3.1.2 - Hydrography) directly affect stream channels by removing all their stream characteristics and riparian functions. One CV channel would be created near the bottom terminal of the proposed Mill Creek chairlift on the backside of Summit East. The other CV channel would be built upslope from the upper terminal of the realigned Little Thunder chairlift at Summit West. The total impacted stream length for both of these CV channels would be about 0.06 mile. Like culverts, these CV channels would be sized to pass water from 100-year storm events with considerations for sediment and debris likely to be encountered (Management Requirement MR8, see Table 2.4-2).

The trenching of utilities would directly impact streams under Alternative 2, although it would only be over a short-time period. Within the U. Yakima Watershed there would be 13 crossings of streams by utility trenching. These new utility crossings would directly impact streams, disturbing the streambank and streambed in order to place the utility piping below the surface. Utility trenching impacts would be short-term because Management Requirements such as MR27, and Other Management Provisions such as OMP2, OMP9, and OMP14 (see Table 2.4-2) would be implemented and the disturbed streambank would be stabilized as outlined in the MDP Implementation Plan (see Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Restoration of streams within the U. Yakima Watershed, as described in the MDP Implementation plan (see Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, Section 5.0 - Restoration), would have a beneficial direct impact to streams under Alternative 2. The stream just north of the tubing area in the Ski Acres drainage, located in an abandoned roadbed, would be restored by installing checkdams, raising the channel bed, reducing downcutting, and improving the functions of the Riparian Buffers. This restoration project would result in a slight decrease in the modified channel length in the Ski Acres drainage, but not to below threshold (see Table 4.3.3-2). Sections of Beaver Creek would also be daylighted, meaning that culvert segments would be removed and the Riparian Buffers would be revegetated with saplings. The Beaver Creek restoration project would decrease the score of the modified channel length parameter to decrease below the threshold in the Beaver drainage (see Table 4.3.3-2). Restoration projects intended to improve stream and riparian vegetation zone

functions would nonetheless result in temporary, direct impacts to stream channels from increased erosion potential during project implementation. However over the long-term, these restoration projects would be beneficial to these streams because their natural functions would be restored.

Indirect Impacts

The paving of Silver Fir Parking Lot 1 and Summit West Parking Lot 2 in Alternative 2 would indirectly impact streams within the U. Yakima Watershed by creating impervious surfaces that alter flow paths and the rate of drainage runoff. As described in the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan), surface water controls would be implemented for both of these parking lots, to collect and route surface drainage water, improve water quality by filtering out sediments, and treat the water for hydrocarbon contaminants. Measures within the Stormwater Management Plan would include paving, BMPs, and adaptive management to control sediment. The plan would also include the removal/storage of plowed snow and monitoring of other sediment sources, which would indirectly benefit stream channels through reduction of sediment delivery.

Operation and maintenance activities, such as road and ski trail maintenance to control potential erosion problems, maintaining the drainage network to ensure no accumulated sediment or debris is obstructing the water pathways, and making sure stream crossing structures (bridges, culverts, and fords) are functioning properly, as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). Performed on a regular basis, these activities would have beneficial indirect impacts to streams in the U. Yakima Watershed under Alternative 2, reducing erosion and sediment impacts to stream channels could result.

The slope stabilization projects within the U. Yakima Watershed as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), would result in beneficial long-term indirect impacts to stream channels because of the reduced sediment yield to nearby streams. These slope stabilization projects would lower the stream length with management concerns and modified channel length parameters in some drainages, but not below the threshold (see Table 4.3.3-2).

In the U. Yakima Watershed under Alternative 2, there would be 0.19 mile of new roads built, while 0.37 mile of road would be restored to natural conditions, resulting in a road density of 6.43 mile/mile^2 (see Table 4.3.3-2). The 0.19 mile of new roads would indirectly impact stream channels over the long-term through increased potential for sediment delivery. This sediment would have the potential to be delivered to streams at stream crossings (bridges, culverts, and fords), and could alter stream functions and the flow dynamics of the streams within the Summit South 7th field drainage.

Implementation of Management Requirements MR15, MR24, and MR36, as well as Other Management Provisions OMP2, OMP3, OMP4, and OMP5 (see Table 2.4-2) would minimize potential sediment yields reaching streams from newly constructed roads. The 0.37 mile of road to be restored would indirectly

affect stream channels within the Summit South and Creek Run 7th field drainages over the short-term until the former road bed is revegetated and stabilized. Ski area maintenance activities, as outlined in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), would repair degraded channels at road crossings, and reduce existing indirect sediment and flow regime impacts from road crossings within the U. Yakima Watershed.

Implementation of the Stormwater Management Plan, which includes application of the ice inhibitor MgCl to melt snow in parking lots instead of using sand for traction, is expected to reduce the impact of sediment delivery on stream channel conditions (e.g., bank erosion, pool filling, cobble embeddedness, etc.). Because of the use of MgCl, under Alternative 2, the yield of sand to streams would be reduced from existing conditions. Consequently sediment delivery and channel stability impacts on streams within the U. Yakima Watershed under Alternative 2 would decrease over the long-term, improving the condition of stream channels.

Other off-channel construction activities under Alternative 2, such as tree clearing or glading to create ski trails in Section 16, or new roads within the Creek Run and Rampart pods, at Summit Central in the Silver Fir and Easy Street pods could impact channels indirectly if large quantities of sediment or other contaminants are transported to streams. Forested areas would become ski trails, which typically have shrub and herbaceous cover. This could reduce channel stability, habitat complexity, and many riparian functions. With time, stream channels within the Summit South, Creek Run, and Tunnel 7th field drainages could exhibit increased instability and a reduction in the quantity and quality of aquatic habitat. Management Requirement MR15, Other Management Provisions such as OMP2, OMP4, OMP7, and OMP11 (see Table 2.4-2) as well as the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would reduce these indirect stream channel impacts.

Under Alternative 2, proposed changes in vegetation communities within Riparian Buffers could cause other indirect impacts. Alternative 2 would increase ski trails and other modified vegetative conditions within Riparian Buffers of the U. Yakima Watershed by approximately 16 acres, and an additional 3.7 acres would be developed into base area and other support facilities (see Table 4.3.3-6). Approximately 0.73 mile of naturally forested or naturally non-forested streambanks would be converted to modified vegetation (ski trails) or developed areas (see Table 4.3.3-6). Changes in land cover within Riparian Buffers can indirectly impact the physical condition and ecological functions of streams over the long-term. These changes would reduce the current shade and litter input that the trees currently provide to the streams, change the water quality (turbidity, temperature, and dissolved oxygen), and affect the channel conditions via the potential sediment delivery to streams. Sediment introduced to the stream would be transported to depositional areas, where it can fill pools, reduce channel capacity, create unstable stream segments, and degrade aquatic habitat. Implementation of appropriate BMPs, Mitigation Measures,

Management Requirements, and Other Management Provisions from Table 2.4-2, revegetation, prompt site stabilization and monitoring would minimize indirect impacts to stream channels.

Wetlands

Summary

Under Alternative 2, there would be approximately 4.1 acres of direct impacts to 39 wetlands within the portion of the Study Area in the U. Yakima Watershed. The total projected wetland impacts would include 2.2 acres of proposed clearing impacts and 1.9 acres of proposed grading impacts (see Table 4.3.3-3C). These proposed direct impacts would result from construction of lift terminals and towers, buildings, utility trenching, and the clearing and grading of land for ski trails. The application of a sand/de-icer/ice-inhibitor on I-90 and SR-906 by WSDOT, application of MgCl on Silver Fir Parking Lot 1 and Summit West Parking Lot 2, various operation and maintenance activities occurring during the summer, implementation of revegetation and stabilization measures, and construction activities on adjacent lands would indirectly impact wetlands within the U. Yakima Watershed at The Summit-at-Snoqualmie. With the exception of utility trenching and stabilization measures, which would only impact wetlands for a short period of time, most of the activities described above would be considered long-term impacts to wetlands.

Table 4.3.3-3A:
Summary of Study Area Wetlands and MDP Implementation Impacts in the Upper Yakima River Watershed

Parameter	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Clearing Impacts (acres)					
PEM	0.00	1.32	1.05	1.05	1.33
PFO	0.00	0.00	0.00	0.00	0.00
PSS	0.00	0.87	0.64	0.05	0.94
Total	**0.00**	**2.19**	**1.7**	**1.1**	**2.27**
Grading Impacts (acres)					
PEM	0.00	1.53	1.59	1.53	1.56
PFO	0.00	0.06	0.06	0.06	0.06
PSS	0.00	0.31	0.23	0.18	0.25
Total	**0.00**	**1.9**	**1.87**	**1.77**	**1.87**
Total Clearing and Grading Impacts (acres)	0.00	4.09	3.57	2.87	4.14
Total Wetland Impacts (number)	0	39	36	31	42
Total Natural Wetlands (acres)	18.07	16.69	16.98	17.91	16.85
Total Modified Wetlands (acres)	44.76	45.35	45.00	44.21	45.18
Total Wetlands (acres)	**62.83**	**62.04**	**61.98**	**62.11**	**62.02**

Note: This table does not include the Mill Creek portion of the Study Area.

Table 4.3.3-3B:
Summary of Mill Creek Wetlands and
Impacts in the Upper Yakima River Watershed

Parameter	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Clearing Impacts (acres)					
PEM	0.00	0.00	0.00	0.00	0.00
PFO	0.00	0.00	0.00	0.00	0.00
PSS	0.00	0.00	0.00	0.00	0.00
Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Grading Impacts (acres)					
PEM	0.00	0.00	0.00	0.00	0.00
PFO	0.00	0.00	0.00	0.00	0.00
PSS	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00
Total Clearing and Grading Impacts (acres)	0.00	0.00	0.00	0.00	0.00
Total Wetland Impacts (number)	0	0	0	0	0
Total Natural Wetlands (acres)	0	0	0	0	0
Total Modified Wetlands (acres)	0.23	0.23	0.23	0.23	0.23
Total Wetlands (acres)	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**

Note: This table includes only the Mill Creek portion of the Study Area.

Table 4.3.3-3C:
Summary of MDP Study Area and Mill Creek Wetlands and
Impacts in the Upper Yakima River Watershed

Parameter	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Clearing Impacts (acres)					
PEM	0.00	1.32	1.05	1.05	1.33
PFO	0.00	0.00	0.00	0.00	0.00
PSS	0.00	0.87	0.64	0.05	0.94
Total	**0.00**	**2.19**	**1.7**	**1.1**	**2.27**
Grading Impacts (acres)					
PEM	0.00	1.53	1.59	1.53	1.56
PFO	0.00	0.06	0.06	0.06	0.06
PSS	0.00	0.31	0.23	0.18	0.25
Total	0.00	1.9	1.87	1.77	1.87
Total Clearing and Grading Impacts (acres)	0.00	4.09	3.57	2.87	4.14
Total Wetland Impacts (number)	0	39	36	31	42
Total Natural Wetlands (acres)	18.07	16.69	16.98	17.91	16.85
Total Modified Wetlands (acres)	44.76	45.35	45.00	44.21	45.18
Total Wetlands (acres)	**62.83**	**62.04**	**61.98**	**62.11**	**62.02**

Note: This table includes the Mill Creek portion of the Study Area.

Direct Impacts

Under Alternative 2, approximately 1.9 acres of wetlands would be directly impacted by construction activities that require grading. Grading displaces wetland area and removes all functionality of the wetland through the placement of fill material and/or soil excavation in wetlands. Grading activities can also modify the hydrology of wetlands via the creation of impervious surfaces in the wetland, such as buildings and parking lots, or by changing existing drainage patterns. These actions can alter the hydrologic regime and cause a wetland to transition to a non-wetland. All grading impacts to wetlands are considered long-term impacts unless they are part of a restoration or road obliteration project. The short-term consequences of restoration or road obliteration would be negative but would be outweighed by long-term positive reclamation impacts. Grading impacts in wetlands in the U. Yakima Watershed would occur at several locations, including the lower terminals of the proposed Creek Run and Rampart chairlifts, the expansion of Parking Lot 3 at Silver Fir, expansion of the Base Lodge at Summit Central, and within the base area of Summit West. Approximately 1.13 acres of these grading impacts to wetlands would be avoided. Flagging and surveying wetlands in the proposed impact areas and using this information in detailed construction plans would facilitate avoidance in the on-the-ground project design. This would result in avoidance or minimization of unnecessary impacts to wetlands. Thus, actual impacts would be less than those currently identified through GIS analysis.

Other construction activities proposed would not result in grading impacts, but would only require the clearing of vegetation in wetlands. This would include the removal of trees and shrubs in wetlands for new ski trails, only removing some of the wetland functions. The alteration of the plant communities in wetlands associated with vegetation clearing can change the wetland functions, such as shading and nutrient and organic carbon cycling, resulting in long-term impacts. Several locations, such as the proposed chairlift corridors for the Creek Run and Easy Street chairlifts and some of the ski trails within the Creek Run pod, would involve clearing of wetlands vegetation. Approximately 1.02 acres of these grading impacts to wetlands can be avoided. Wetlands in the proposed impact areas would be flagged and surveyed. The information derived from these surveys would be used in detailed construction plans, which would facilitate avoidance in the on-the-ground project design. This would result in avoidance or minimization of unnecessary impacts to wetlands. Thus, actual impacts would be less than those currently identified through GIS analysis.

In Alternative 2, the restoration of Wetland #207 and Wetland #142, as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), would take place in the U. Yakima Watershed. These wetland restorations would be performed in conjunction with tree island revegetation at Summit West and Summit Central respectively. These wetland restorations would result in a beneficial direct effect because wetland functions such as the hydrologic regime, shading, and nutrient and carbon cycling would be restored to more natural conditions. However, the restoration projects would not decrease any DPC parameters below the threshold (see Table 4.3.3-2).

Under Alternative 2, some of the wetlands in the U. Yakima Watershed would be affected by the short-term direct impacts of utility trenching, such as the proposed chairlift corridors for the realigned chairlifts at Summit Central. Utility trenching would not result in any long-term loss of wetland acreage or wetland function, because the wetland area would be restored immediately after installation of the utility line. Construction within each wetland would generally be completed within one day because of the narrow width, shallow depth, and short distance of trenching and the small size of the wetlands. This short-term construction time frame would further minimize the impact to wetlands. Trenching impacts to wetlands may be avoided by trenching around wetlands where possible. The use of Management Requirements such as MR24, as well as Other Management Provisions OMP7, OMP14, and OMP16 (see Table 2.4-2) would also minimize the potential impacts to wetland functions from utility trenching.

Indirect Impacts

Under Alternative 2, operational and maintenance activities would indirectly impact wetlands, primarily on existing and proposed ski trails (mainly modified PEM and PSS wetlands). These activities include mowing vegetation, the maintenance of contour ditch lines, and snow management, which are all described in further detail in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). Operation and maintenance activities can indirectly impact wetlands both beneficially and adversely. Regular performance of maintenance activities can help maintain wetlands viability, by reducing adverse impacts, such as sediment delivery and the potential growth of noxious weeds, which can lead to loss of some of wetlands functions. Implementation of Other Management Provisions OMP16 (see Table 2.4-2) would help prevent substantial impacts to wetlands within ski trails during maintenance activities. Natural forested or open meadows wetlands within the Study Area would not be affected by the maintenance of ski area facilities.

Development activities in the uplands adjacent to wetlands can indirectly affect wetland functions. The degree and type of impact to wetlands function is dictated by the location and type of development activity with respect to the wetland. Changes in hydrology and sediment sources are the primary indirect impact mechanisms. Under Alternative 2, the Riparian Buffers of several wetlands in all of the 7th field drainages within the U. Yakima Watershed would experience some level of grading. The potential for increased sediment delivery to wetlands would be increased during construction. Implementation of Other Management Provisions, such as OMP7, OMP14, OMP16 (see Table 2.4-2), and the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), would minimize the potential for these indirect impacts. The introduction of new disturbance in Riparian Reserves, such as areas of grading activities and proposed roads (temporary and permanent), as well as ski trail clearing and utility trenching would increase the potential for the introduction of noxious species into wetlands, which would be reduced via implementation of Management Requirements such as MR24 (see Table 2.4-2).

The application of sand/de-icer/ice-inhibitor mix on SR-906 and I-90 by WSDOT as well as the proposed paving of Silver Fir Parking Lot 1 and Summit West Parking Lot 2 could potentially indirectly impact the large wetland complexes and individual wetlands in these areas. The use of MgCl on these proposed parking lots could disrupt the ecology of the wetland by enhancing the growth potential of some wetland plants, or by creating more saline soils that could foster a favorable environment for salt-tolerant noxious weeds. Implementation of Management Requirement MR24 (see Table 2.4-2) would minimize the risk of the introduction of noxious species into wetlands. Indirect impacts on roadside vegetation wetlands could occur if the applications exceed recommended application rates. Based on applications of magnesium chloride at other Washington ski areas, use of chemical de-icer/ice-inhibitors has not elevated chloride concentrations in soil or water beyond state water quality standards or vegetation thresholds (SE GROUP 2002). Studies have shown that magnesium chloride can have adverse environmental effects, particularly to vegetation along roadsides (D'Itri 1992; Lewis and Kraege 1999). However, as mentioned above, monitoring of other sites in Washington has not detected water quality standards or soil thresholds have been exceeded. In addition, the use of MgCl on parking lots would allow a reduction in the use of sand which would reduce the amount of sediment delivery to wetlands adjacent to the parking lots.

Consultation with the USACE and other appropriate agencies regarding federal and state wetland permitting requirements would be required for this project. Required implementation permits for implementation of the MDP are listed in Table 1.7-1. As engineering plans are developed for any approved project, permit applications would be sent to the USACE as appropriate to ensure compliance with the federal wetland permit process. Permit compliance requirements would include identification of mitigation ratios and development of a conceptual mitigation plan, as well as identification of sites for wetlands enhancement, restoration, or creation.

Water Quantity

Summary

Under Alternative 2, no snowmaking is proposed, and there would be no new groundwater or surface water withdrawals. The existing SNOPAC standards (no change in water rights) would be maintained. Wastewater would continue to be treated via sewer under SPUD. This would be as the primary groundwater-related operational impact that would occur under Alternative 2, however, no new impacts to groundwater are expected from the Proposed Action (see Section 4.13 - Utilities).

It is well documented that removal of forest cover and creation of new impervious surfaces in a watershed will increase the available surface and groundwater, and can alter the flow regime of a watershed (Dunne and Leopold 1978; Naiman and Bilby 1998).

Differences in land cover between the No Action Alternative and Alternative 2 may locally affect snow accumulation and snowmelt, and could affect the runoff patterns of the watershed. In Alternative 2, the main change in land use patterns would be in Section 16 where land would be cleared and graded in order

to install the Creek Run and Rampart chairlifts and their respective pods. The existing backside chairlift would be replaced with the Mill Creek chairlift and there would also be clearing and grading to install this chairlift and its corresponding pod. Tree islands would be planted to provide separation of ski trails at Summit Central and at Summit West,. Some clearing and grading would occur within the ski runs of the Central Express and Silver Fir pods at Summit Central as well as the Wildside and Little Thunder pods at Summit West. New buildings within the U. Yakima Watershed include the mountain-top restaurant at Summit East, the Central Base lodge and the Silver Fir Base lodge at Summit Central, and Thunderbird Lodge at Summit West.

Table 4.3.3-4:
Hydrologic Landcover in the Upper Yakima River Watershed

Parameter	Alt. 1 (acres)	Alt. 2 (acres)	Alt. 3 (acres)	Alt. 4 (acres)	Mod. Alt. 5 (acres)
Study Area[a]	1,885.21	1,884.41	1,884.41	1,884.41	1,884.41
Land Cover Types (Hydrologic Maturity) within the Study Area[b]					
Forested – Mature (Mature)	574.25	534.55	550.37	562.20	535.53
Forested – Immature (Intermediate)	307.51	290.33	290.85	294.37	289.67
Forested – Sapling (Immature)	285.21	301.01	313.04	304.19	305.91
Naturally Non-forested (Immature)[c]	51.22	49.78	50.15	51.04	49.91
Modified (Immature)	596.19	631.39	603.59	596.78	626.72
Developed (Impervious)	70.83	77.36	76.41	75.84	76.66

[a] The Study Area total acreage differs between Alternative 1 and the Action Alternatives due to small rounding errors within the summation of many-record GIS data files.
[b] Includes wetland cover type
[c] Includes 1.34 acres of lake landcover type
Note: This table includes the Mill Creek portion of the Study Area.

Indirect Impacts

Alternative 2 land use changes within the U. Yakima Watershed would continue to indirectly influence the surface water quantity at The Summit-at-Snoqualmie for the life of the MDP. Approximately 28 percent of the Study Area within the U. Yakima Watershed (534.6 acres) would remain as hydrologically mature forest under Alternative 2, which is 2 percent less than under Alternative 1. Cover types such as mature forest, generally retain more of the precipitation input, and release the retained water slowly over time. Cover types such as herbaceous vegetation and partially developed facilities release an increased volume of water to runoff at a more rapid rate. These land cover types are considered hydrologically immature. Proposed development and restoration would result in the conversion of 35.2 acres of land cover from a hydrologically mature to a hydrologically immature state. Hydrologically immature cover types include naturally non-forested areas, young saplings planted for restoration, and ski trails (both new and existing) consisting of modified shrubs and herbaceous vegetation (see Table 4.3.3-4C). Creation of ski trails and

other development-related tree removal clearing would result in a 2.6 percent increase the amount of immature land cover in the U. Yakima Watershed portion of the Study Area. Under Alternative 2, due to the construction of the mountain-top restaurant, Central Base Lodge, Silver Fir Base Lodge and Thunderbird Lodge, 6.5 acres of land would be converted to a developed condition. As a result all hydrologic properties would be lost. Land conversions (ski trails and impervious areas) would likely generate a slight net export of water from the U. Yakima Watershed. Differences in land cover between Alternative 1 and Alternative 2 may indirectly affect snow accumulation and snowmelt locally, which could affect the runoff patterns of the watershed.

Construction techniques, including the embedding of coarse woody debris within the ground surface, along with Other Management Provisions OMP25, OMP26, and OMP33 (see Table 2.4-2) would minimize localized increases in sheet flow on construction sites during and after construction. Under Alternative 2, current vegetation maintenance practices at The Summit-at-Snoqualmie would continue. As a result, modified vegetation would continue to be maintained in a hydrologically immature condition to support ski area operations. Water from these areas generally runs off quickly to streams. It should be noted that several streams within the U. Yakima Watershed portion of the Study Area are typically ephemeral or intermittent at this elevation. Additionally, implementation would include source protection measures, as outlined in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). As a result, the effects of lift and trail construction would be unlikely to cause any measurable increase in flow in either Coal Creek or Mill Creek.

Flow Model

As described in Section 3.3.1.3 – Surface Water Quality, a custom stream flow model was created to estimate the potential changes in stream flow conditions in all of the 7th field drainages within the Study Area. The custom model predicts the change in flow resulting from the proposed land cover changes of the Proposed Action, for three separate parameters: low flow; mean annual flow; and two-year peak flows. The calculations for each flow parameter are a function of two variables:

- The spatial extent of proposed forest clearing; and
- The proposed impervious surfaces within each 7th field drainage

The results of the model portray the potential change in stream flow at the outlet of each 7th field drainage and are not intended to predict the actual stream flow numbers for the three flow parameters.

Table 3.3.1-6 shows the estimated increase in streamflow over natural conditions due to past management activities. Within the U. Yakima Watershed, Alternative 2 would further increase streamflow due to proposed areas of tree removal and new impervious surfaces in the 7th field drainages within the U. Yakima Watershed. Therefore, the flow model analysis for the U. Yakima Watershed was performed using proposed land cover changes from Alternative 2 in all the 7th field drainages to show the percentage of

flow relative to baseline conditions. The equations presented in Illustrations 3.3.1-1, 3.3.1-2, and 3.3.1-3 (as shown in Section 3.3.1.3 – Surface Water Quality) were used to calculate the potential change in flow for the three analysis parameters as a function of the acreage of tree removal and the acreage of new impervious surfaces proposed under Alternative 2 (see Table 4.3.3-4).

Under Alternative 2, relative to Alternative 1 conditions, the model predicts (see Table 4.3.3-5):

- The annual low flow of the Beaver Lake Watershed would increase by 0.4 percent.
- The average annual flow would increase by 0.1 percent.
- The two-year peak flow would increase by 0.1 percent.

Table 4.3.3-5:
Projected Changes in Flow of the 7th Field Drainages in the Upper Yakima River Watershed

Watershed Name	Alt. 1[a] Change in Flow (%)	Alt. 2[b] Change in Flow (%)	Alt. 3[b] Change in Flow (%)	Alt. 4[b] Change in Flow (%)	Mod. Alt. 5[b] Change in Flow (%)
Beaver Lake (196.22 acres)					
Low Flow	63.9%	0.4%	0.4%	0.4%	0.4%
Mean Annual Flow	20.3%	0.1%	0.1%	0.1%	0.1%
Two-Year Peak Flow	15.2%	0.1%	0.1%	0.1%	0.1%
Creek Run (256.91 acres)					
Low Flow	13.9%	9.8%	0.8%	-0.1%	7.8%
Mean Annual Flow	4.4%	3.1%	0.3%	0.0%	2.5%
Two-Year Peak Flow	3.3%	2.3%	0.2%	0.0%	1.9%
Hyak (275.66 acres)					
Low Flow	34.0%	1.0%	0.3%	0.0%	0.7%
Mean Annual Flow	10.8%	0.3%	0.1%	0.0%	0.2%
Two-Year Peak Flow	8.1%	0.2%	0.1%	0.0%	0.2%
Lower Mill Creek (566.13 acres)					
Low Flow	46.6%	1.6%	1.6%	1.6%	1.6%
Mean Annual Flow	14.8%	0.5%	0.5%	0.5%	0.5%
Two-Year Peak Flow	11.1%	0.4%	0.4%	0.4%	0.4%
Ski Acres (387.68 acres)					
Low Flow	62.3%	1.5%	1.5%	1.5%	1.5%
Mean Annual Flow	19.8%	0.5%	0.5%	0.5%	0.5%
Two-Year Peak Flow	14.8%	0.4%	0.4%	0.4%	0.4%
Summit South (358.22 acres)					
Low Flow	49.9%	3.3%	3.2%	0.2%	2.7%
Mean Annual Flow	15.9%	1.1%	1.0%	0.1%	0.9%
Two-Year Peak Flow	11.8%	0.8%	0.8%	0.1%	0.6%

Table 4.3.3-5:
Projected Changes in Flow of the 7th Field Drainages in the Upper Yakima River Watershed

Watershed Name	Alt. 1[a] Change in Flow (%)	Alt. 2[b] Change in Flow (%)	Alt. 3[b] Change in Flow (%)	Alt. 4[b] Change in Flow (%)	Mod. Alt. 5[b] Change in Flow (%)
Tunnel (191.12 acres)					
Low Flow	42.8%	4.5%	4.5%	4.5%	4.5%
Mean Annual Flow	13.6%	1.4%	1.4%	1.4%	1.4%
Two-Year Peak Flow	10.2%	1.1%	1.1%	1.1%	1.1%
Upper Mill Creek (572.76 acres)					
Low Flow	6.0%	0.0%	0.0%	0.0%	0.0%
Mean Annual Flow	1.9%	0.0%	0.0%	0.0%	0.0%
Two-Year Peak Flow	1.4%	0.0%	0.0%	0.0%	0.0%

[a] Alternative 1: baseline for percentage change in flow is un-developed, natural conditions.
[b] Alternative 2 through Modified Alternative 5: baseline for percentage change in flow is Alternative 1 conditions.

Based on the results of the flow model displayed in Table 4.3.3-5, under Alternative 2, Creek Run, Summit South, and Tunnel Creek are the 7th field drainages whose streamflow would be most impacted by forest clearing and creation of new impervious surfaces. By contrast, there would be little or no impact to the Upper Mill Creek and Beaver Lake 7th field drainages.

The model's predictions of relatively small changes in flow conditions are expected, and are in general agreement with prior studies. Other watershed studies performed in the Pacific Northwest indicate that even relatively large changes in stream flow in small headwater basins cause comparatively small increases in flow in larger watersheds (Harr et al. 1979; Beschta et al. 2000; Hewlett 1982). It is anticipated that measurable changes to bank full discharge would not occur. Bank full flows in mountainous terrain typically have 11 to 100-year return intervals. Both the custom model, and regional studies indicate that the effects of watershed treatments do not significantly affect large peak flows (recurrence interval of 25 to 100-years) (Beschta et al. 2000; Harr et al. 1975). The majority of sediment transport and changes in channel morphology occur during peak flow events. Therefore, the relatively small changes in low flow and peak flow conditions estimated in this model indicate that the development of Alternative 2 is unlikely to measurably affect sediment transport or channel morphology at the Watershed Scale (Dunne and Leopold 1978; Beschta et al. 2000). In addition, local increases in streamflow in the U. Yakima Watershed due to the 6.53 acres of new impervious surfaces are expected to be mitigated through Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Water Quality

Summary

Under Alternative 2, there would be one additional stream crossing (culverts, bridges, fords) and 13 additional utility crossings. These crossings would increase sediment delivery to streams, which could

result in increased turbidity. Temperature and dissolved oxygen could increase due to the removal of 0.63 mile of mature and immature forest along streambanks. The pH of streams could increase under Alternative 2 due to the construction of 3.72 acres of impervious surfaces within Riparian Buffers. Other water pollutants, such as oil and grease, are expected to decrease under Alternative 2 due to implementation of the Stormwater Management Plan. Upon implementation of all projects in Alternative 2, water quality characteristics would likely remain similar to current conditions. Proper implementation and installation of Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 would reduce the possibility of potential exceedences of WSDOE water quality standards.

Direct Impacts

Potential sediment delivery to streams would be the major water quality impact associated with project construction under Alternative 2 in the U. Yakima Watershed. Stream crossing (bridges and culverts) installation, culvert removal during road deactivation, and utility trenching across streams would all result in direct sediment loading and turbidity increases to streams. Increases in fine sediment could increase turbidity of the streamflow, resulting in degradation impacts to aquatic organisms, and reduce aesthetics. Most of these impacts would be short-term in duration. Where projects would directly impact stream channels, Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2, along with the implementation of a Stormwater Pollution Prevention Plan (SWPPP), would limit the increases in turbidity to a few hours duration during installation.

Under Alternative 2, there would be 3 new culverts installed in streams within the U. Yakima Watershed: one in the Lower Mill Creek drainage near the bottom terminal of the Mill Creek chairlift; one in the Summit South drainage near the bottom terminal of the Rampart chairlift; and one in the Tunnel Creek drainage near the bottom terminal of the Easy Street chairlift. These new culverts would cause direct water quality impacts, both short-term and long-term. During construction, culvert installation would result in a short-term increase in localized sediment mobilization and turbidity. Over the long-term, the presence of the culvert in the streams could result in increased potential for sediment mobilization and turbidity in the respective drainages. Implementation of Management Requirements MR3, MR9, MR10, as well as Other Management Provision OMP9 (see Table 2.4-2) would minimize the effect of sediment delivery and increased turbidity on the downstream waters.

The construction of two new bridges under Alternative 2 would result in direct short-term water quality impacts. One bridge would be installed where Trail 55B crosses Stream A. Another bridge would be built where Trail 71 crosses Hyak Creek. The construction of these bridges would likely result in a short-term increase in sediment delivery and turbidity to the streams caused by the clearing and grading within the stream channel. This effect would likely be immediate because both of these drainages are perennial. Implementation of Management Requirements MR9 and MR10, as well as Other Management Provision

OMP10 (see Table 2.4-2) would minimize the effect of sediment delivery and increased turbidity on the downstream waters.

The construction of 13 utility crossings in surface waters within the U. Yakima Watershed would result in direct, short-term impacts to water quality. Construction of utility crossings would increase sediment delivery and turbidity in streams due to vegetation removal and channel excavation. This effect would be immediate in flowing channels, while the effect would be delayed in dry channels until periods of flow. Upon completion of the utility installation, the site of disturbance from the utility crossing would be revegetated, thus stabilizing the impact area from a water quality perspective. Proper implementation of BMPs and Other Management Provisions such as OMP9, OMP14, OMP2, and Management Requirement MR27 (see Table 2.4-2) would help maintain turbidity levels below SWQS and reduce the probability of potential exceedences.

Indirect Impacts

Under Alternative 2, construction of lift terminals and lift towers, including concrete tower bases, would occur within the Riparian Buffers of all 7th field drainages in the U. Yakima Watershed. Pouring of concrete structures near streams during construction would increase the pH of receiving waters, resulting from concrete or concrete washings reaching surface waters. Management Requirements MR15, MR16, and MR36 (see Table 2.4-2) would reduce the probability of high pH runoff entering the streams. These measures would help to maintain current pH levels, which meet SWQS, within streams in the U. Yakima Watershed. Should equipment working in or adjacent to streams experiences fuel leaks or hydraulic system failures, construction activities within Riparian Buffers could introduce petroleum contaminants to surface waters. Results of current water quality monitoring data reveal petroleum products to be just above detection limits in streams. These findings suggest that despite efforts at containment and clean-up of diesel fuel, oil, and hydraulic fluid spills on roads and in the vehicle maintenance area, these contaminants are sometimes introduced to streams. Under Alternative 2, construction activities for all stream crossing structures could potentially increase pollutant (e.g., fuel) and sediment delivery. Development of a SWPPP and the implementation of Management Requirements such as MR14 and MR16, as well as Other Management Provisions OMP13, OMP15, and OMP17 (see Table 2.4-2) would reduce the potential for any short-term, indirect delivery of pollutants to streams in the U. Yakima Watershed.

Implementation of the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan) would limit sediment delivery to streams from sources such as road sanding. Implementation of the Stormwater Management Plan would include paving of the Silver Fir Parking Lot 1 and Summit West Parking Lot 2. In addition, new surface water controls for each lot would filter sediment and petroleum products. Likewise, snow management would be practiced, and MgCl de-icer/ice-inhibitor would be applied instead of sand for each lot. With implementation of the Stormwater

Management Plan, the water quality of adjacent and nearby streams would improve due to decreases in sediment delivery and oil and grease contents.

The findings of the Upper South Fork Snoqualmie River and Coal Creek Watershed Condition Assessment (Jones & Stokes 2001) indicate that management objectives for water quality are currently being met for all parameters in the U. Yakima Watershed, except for turbidity levels in some streams. The temperature and dissolved oxygen data collected for this assessment suggest that the U. Yakima Watershed within the Study Area is also impaired for temperature and dissolved oxygen. Although several streams within the Study Area exceed SWQS for turbidity, temperature, and dissolved oxygen, none of these streams are included on the 1998 303d list (WSDOE 2000a). Water quality within the U. Yakima Watershed portion of the Study Area supports all recreation classes of beneficial use. No violations of water quality standards for fecal coliform are expected under Alternative 2. Temperature and dissolved oxygen would likely continue to be a concern within the U. Yakima Watershed. Existing conditions show that exceedences of the temperature standard occur in Tunnel Creek, Beaver Lake Creek, and Stream A, most likely because of historic development at Snoqualmie Pass. Under Alternative 2, water quality in Coal Creek would likely continue to exceed the 7-DADMax during summer base flow events due to its proximity to I-90. The effects of water quality on the summer rearing window for Char are described further in Section 4.4 - Fisheries.

Under Alternative 2, the dissolved oxygen standards in Beaver Lake Creek, Tunnel Creek, and Stream A would continue to be exceeded, especially at summer base flow. Dissolved oxygen is partly dependent on water temperature, with colder temperatures enabling higher dissolved oxygen concentrations. Under Alternative 2, the dissolved oxygen is not expected to increase significantly and any impacts on fish would be negligible (see Section 4.4 - Fisheries).

Proposed activities just outside stream channels but within the Riparian Buffers may result in indirect sediment production and transfer of sediment to streams via transport mechanisms such as water, wind, or gravity. Examples of these proposed activities indirectly impacting water quality are construction of roads, parking lots, and buildings within Riparian Buffers; the clearing and grading of soils for ski trails in Riparian Buffers; trenching for the burial of utility lines; and the construction and/or paving of both existing and new parking lots within the Riparian Buffers. Under Alternative 2, 16 acres of mature and immature forests would be cleared and graded in Riparian Buffers along with utility trenching that would occur in Riparian Buffers, all of which would result in an increased potential for indirect sediment impacts to streams due to these proposed activities. Any sediment impacts from the construction activities listed above would increase the turbidity in streams usually in the short-term and in the long-term, these turbidity impacts would likely be reduced to background levels following successful implementation of Management Requirements such as MR2 and MR14, as well as Other Management Provisions OMP12, OMP13, and OMP15 (see Table 2.4-2) which would minimize turbidity impacts to streams.

Sediment is also exposed during typical ski area maintenance and operations such as ski trail brushing, ditch cleaning, various other maintenance activities, and where revegetation efforts are slow or unsuccessful. However, with the proper application of BMPs, Measures in Table 2.4-2, and monitoring, sediment yield from maintenance and revegetation activities to streams would be minimal.

Land cover changes in the Riparian Buffers due to activities proposed under Alternative 2 could also indirectly affect the temperature of the streams. When streambanks that are currently forested are converted to developed land due to proposed activities, elevated temperatures through direct solar heating increase due to the decrease of riparian cover along streambanks. Thermal effects to streams have the potential to occur during construction activities in Riparian Reserves. The water temperature at the outlet of a stream is a cumulative result of the temperatures and flow volumes of its contributing sources. Temperatures typically become higher as the water flows downstream. For most stream reaches within the Study Area, stream temperatures would remain the same as existing conditions. In drainages, such as Stream A, Stream B, and Tunnel Creek, where small areas of trees would be removed from alongside the streambank, it is possible that temperatures would increase slightly due to decreased shading. However, any such temperature increase is likely to be immeasurable due to the small area of proposed activities. Since water temperature and dissolved oxygen are highly correlated, Alternative 2 would also likely maintain the existing stream dissolved oxygen concentrations for all streams within the U. Yakima Watershed portion of the Study Area.

Increased pollutant concentrations in stormwater (e.g., oil and grease, BOD) resulting from the development of 3.72 acres of impervious surfaces could result in long-term indirect impacts to water quality. However, under Alternative 2, The Summit-at-Snoqualmie would implement the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan). This plan calls for the paving of Silver Fir Parking Lot 1 and Summit West Parking Lot 2. In addition, a new treatment train would improve water quality by treating runoff, collecting oil and grease, and retaining sediment from these newly paved surfaces. Sediment traps would reduce concentrations of suspended solids and petroleum hydrocarbons. Traps would reduce net sediment delivered to nearby streams, resulting in lower turbidity measurements. Implementation of the Stormwater Management Plan under Alternative 2 would reduce long-term detrimental impacts to water quality caused by sand, oil, and grease introduced by continuous stormwater runoff from parking lots.

Through implementation of the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and other specific Measures (see Table 2.4-2), there would be several beneficial impacts to water quality within the U. Yakima Watershed under Alternative 2. The effects of revegetation, tree island creation, channel restoration, wetland restoration, and road decommissioning are all indirectly beneficial impacts to water quality. Under Alternative 2, approximately 0.58 mile of roads would be decommissioned in the U. Yakima Watershed and the 3 culverts that streams passed under one of these roads would be removed. There would be some

short-term detrimental impacts to the water quality in these streams due to exposed and unstabilized soil, however, once the appropriate BMPs are in place and impacted areas are stabilized, this road decommissioning would be a beneficial long-term impact. Also under Alternative 2, tree islands are proposed at Summit East, Summit Central, and Summit West, and once these tree islands are healthy and established, they would help stabilize the soils in these areas, which would be beneficial for the water quality in nearby streams over the long-term because of the reduced sediment loading. Under Alternative 2, the only the stream channel next to the tubing area would be restored would be one, as described further in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). Wetlands restoration and revegetation to be performed under Alternative 2 would decrease several DPC parameters for some drainages, but would only reduce one to below the threshold: modified channel length in the Beaver drainage (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan and Table 4.3.3-2).

Riparian Buffers

Summary

Under Alternative 2, the total area of impervious surfaces within Riparian Buffers would increase by 3.72 acres in the U. Yakima Watershed portion of the Study Area. Under Alternative 2, impervious surfaces would represent approximately 4 percent of the total Study Area Riparian Buffers. Approximately 1.90 miles of streams in the U. Yakima Watershed portion of the Study Area would be confined in culverts under Alternative 2, including the 74 culverted road crossings. Under Alternative 2, approximately 0.08 mile of new road would be built within Riparian Buffers and 16 acres of mature and immature forested Riparian Buffers would be converted into other vegetation community types. 3.12 miles of streambank would be converted from natural conditions to modified and developed conditions. Through implementation of the Stormwater Management Plan, sediment yield to streams within the U. Yakima Watershed would decrease under Alternative 2.

Table 4.3.3-6A:
MDP Study Area Riparian Buffer Land Cover Specifications within the Upper Yakima River Watershed

Parameter	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Study Area (acres)[a]	2,510.31	2,509.08	2,509.08	2,509.08	2,509.08
Riparian Buffer Area (acres)	429.15	430.32	423.68	430.32	423.68
Land Cover Types within Riparian Buffers (acres)[b]					
Forested – Mature	204.20	185.45	191.22	198.56	187.92
Forested – Immature	37.00	34.26	34.12	35.08	34.22
Forested – Sapling	2.76	7.10	15.38	7.05	8.88
Naturally Non-forested[c]	19.73	18.35	20.15	19.57	19.94
Modified	149.84	165.81	143.99	151.53	153.63
Developed	15.62	19.34	18.81	18.53	19.10
Land Cover Along Stream Length (miles)[b]					
Forested – Mature	6.37	5.84	5.92	6.18	5.90
Forested – Immature	1.23	1.13	1.11	1.14	1.12
Forested – Sapling	0.41	0.58	0.66	0.59	0.64
Naturally Non-forested[c]	0.84	0.74	0.80	0.82	0.78
Modified	3.99	4.44	4.28	4.06	4.30
Developed	0.20	0.24	0.22	0.20	0.24
Total Length (miles)[d]	**13.03**	**12.99**	**12.99**	**12.99**	**12.99**
Road Length within Riparian Buffers (miles)					
Native	3.98	3.59	4.16	3.50	4.16
Paved	0.41	0.41	0.41	0.41	0.41
Total (miles)	**4.39**	**4.00**	**4.57**	**3.91**	**4.57**

[a] The Study Area total acreage differs between Alternative 1 and the Action Alternatives due to small rounding errors within the summation of many-record GIS data files.
[b] Includes wetland landcover types
[c] Includes lake landcover type
[d] Includes jurisdictional streams (except culverted streams)
Note: This table does not include the Mill Creek portion of the Study Area.

Table 4.3.3-6B:
Mill Creek Riparian Buffer Land Cover Specifications within the Upper Yakima River Watershed

Parameter	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Study Area (acres)[a]	389.05	389.05	389.05	389.05	389.05
Riparian Buffer Area (acres)	94.34	94.34	182.46[1]	94.34	182.46[1]
Land Cover Types within Riparian Buffers (acres)[b]					
Forested – Mature	7.09	7.09	23.54	7.09	23.54
Forested – Immature	0.00	0.00	0.00	0.00	0.00
Forested – Sapling	70.29	70.29	128.69	70.29	128.69
Naturally Non-forested[c]	0.00	0.00	0.00	0.00	0.00
Modified	15.38	15.38	27.59	15.38	27.59
Developed	1.58	1.58	2.64	1.58	2.64
Land Cover Along Stream Length (miles)[d]					
Forested – Mature	0.73	0.73	0.73	0.73	0.73
Forested – Immature	0.13	0.13	0.13	0.13	0.13
Forested – Sapling	2.70	2.70	2.70	2.70	2.70
Naturally Non-forested[c]	0.01	0.01	0.01	0.01	0.01
Modified	0.71	0.71	0.71	0.71	0.71
Developed	0.05	0.05	0.05	0.05	0.05
Total Length (miles)[d]	**4.33**	**4.33**	**4.33**	**4.33**	**4.33**
Road Length within Riparian Buffers (miles)					
Native	0.81	0.81	0.81	0.81	0.81
Paved	0.00	0.00	0.00	0.00	0.00
Total	**0.81**	**0.81**	**0.81**	**0.81**	**0.81**

[a] Additional Riparian Buffer Area under Alternative 3 and Modified Alternative 5 is due to the wider buffer width appropriate for Riparian Reserves brought under management by the USFS as applied to the donated land parcel.
[b] Includes wetland landcover types
[c] Includes lake landcover type
[d] Includes jurisdictional streams (except culverted streams)
Note: This table includes only the Mill Creek portion of the Study Area.

Table 4.3.3-6C:
MDP Study Area and Mill Creek Riparian Buffer Land Cover Specifications within the Upper Yakima River Watershed

Parameter	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Study Area (acres)[a]	2,899.36	2,898.13	2,898.13	2,898.13	2,898.13
Riparian Buffer Area (acres)	523.49	524.66	606.14	524.66	606.14
Land Cover Types within Riparian Buffers (acres)[b]					
Forested – Mature	211.29	192.54	214.76	205.65	211.46
Forested – Immature	37.00	34.26	34.12	35.08	34.22
Forested – Sapling	73.05	77.39	144.07	77.34	137.57
Naturally Non-forested[c]	19.73	18.35	20.15	19.57	19.94
Modified	165.22	181.19	171.58	166.91	181.22
Developed	17.20	20.92	21.45	20.11	21.74
Land Cover Along Stream Length (miles)[b]					
Forested – Mature	7.10	6.57	6.65	6.91	6.63
Forested – Immature	1.36	1.26	1.24	1.27	1.25
Forested – Sapling	3.11	3.28	3.36	3.29	3.34
Naturally Non-forested[c]	0.85	0.75	0.81	0.83	0.79
Modified	4.70	5.15	4.99	4.77	5.01
Developed	0.25	0.29	0.27	0.25	0.29
Total Length (miles)[d]	**17.36**	**17.32**	**17.32**	**17.32**	**17.32**
Road Length within Riparian Buffers (miles)					
Native	4.79	4.40	4.97	4.31	4.97
Paved	0.41	0.41	0.41	0.41	0.41
Total	**5.20**	**4.81**	**5.38**	**4.72**	**5.38**

[a] The Study Area total acreage differs between Alternative 1 and the Action Alternatives due to small rounding errors within the summation of many-record GIS data files.
[b] Includes wetland landcover types
[c] Includes lake landcover type
[d] Includes jurisdictional streams (except culverted streams)
Note: This table includes the Mill Creek portion of the Study Area.

Direct Impacts

The largest impact to Riparian Buffers in the U. Yakima Watershed portion of the Study Area would be the complete removal of riparian function via the creation of impervious surfaces (roads, buildings, and parking lots) and the installation of stream culverts. As displayed in Table 4.3.3-6, the increase in developed impervious surface area within Riparian Buffers would be 3.7 acres in the U. Yakima Watershed portion of the Study Area. This increase represents approximately 4 percent of the total Study Area Riparian Buffers within the U. Yakima Watershed. Although the roads, buildings, and parking lots would typically be located within either the upland forest portion or previously modified portion of the Riparian Buffers, the primary direct impact to the Riparian Buffers would occur at the 74 culverted stream crossings. Culverts constrain streams, providing sites of increased sediment recruitment and erosion concerns, and also eliminate most riparian functions. Approximately 1.8 miles of streams in the U.

Yakima Watershed portion of the Study Area do not have functioning Riparian Buffers because they have been placed in culverts, including the 74 culverted stream crossings.

Another direct impact to Riparian Buffers would be the removal of riparian forest vegetation for the construction of projects proposed under Alternative 2 that include clearing and grading activities. Under Alternative 2, 21.5 acres of mature and immature forested Riparian Buffers would be lost due to construction of ski trails, lift terminals, buildings, roads, and parking lots (see Table 4.3.3-6). Mature forest is considered to have full potential for production of trees that could become natural LWD in streams. Immature forest has moderate potential for LWD recruitment which increases through time. Changes to mature and immature forests within Riparian Buffers would immediately reduce shade and litter input that the trees currently provide to the streams. Grading in the Riparian Buffers would also reduce the level of riparian function for wildlife habitat, sediment filtration, floodwater storage, nutrient input to streams, stream channel shade, and stabilizing stream banks via root structure. The development of lift terminals, buildings, roads, and parking lots would have a long-term direct impact to all of the riparian functions of the vegetation communities in Riparian Buffers by eliminating riparian vegetation and creating impervious surfaces. Proposed clearing and grading for the creation of ski trails and utility trenching would result in short-term direct impacts to Riparian Buffers that would be mitigated by the restoration and replacement of topsoil and revegetation with native species. Following construction, these areas would typically be maintained as ski trails with shrubs and herbaceous vegetation, after the topsoil is replaced and native species are used for revegetation. Although there would be a long-term direct impact to some riparian functions, other functions such as ground cover to filter sediment, floodwater storage, and stream bank stabilization would not be affected over the long-term. Clearing and grading activities within Riparian Buffers would be minimized through implementation of Management Requirements MR2 and MR14, as well as Other Management Provisions OMP12, OMP13, and OMP14 (see Table 2.4-2).

Of the 17.32 linear miles of streambanks under Alternative 2 (two sides to 8.66 miles of streams), 7.83 miles (45 percent) would remain under natural mature and immature forest cover, 0.75 mile (4.3 percent) would remain in natural nonforest cover, 5.15 miles (29.7 percent) would adjoin ski trails and other modified vegetation, and 0.29 mile (1.7 percent) would be adjacent to developed areas. The 5.44 miles of streambanks with human caused management concerns along their stream reaches would cause indirect impacts to the physical condition and function of these streams over the long-term. Direct impacts to Riparian Buffers would include the reduction of bank stability, the increase of erosion, the reduction of mature riparian vegetation, changes to nutrient inputs, and elimination of LWD inputs. Implementation of Management Requirements MR2 and MR14 as well as Other Management Provisions OMP12, OMP13, OMP15, and OMP26 (see Table 2.4-2) would avoid and/or minimize impacts to Riparian Buffers and their associated stream functions. These measures would reduce the loss of stream shade, keep nutrient and LWD inputs occurring, and control soil erosion and sediment yield to streams. Additional Other Management Practices, such as OMP31, OMP32, and OMP33 (see Table 2.4-2) would help quickly

reestablish vegetative cover along stream channels and keep sediment delivery to streams to minimal levels.

The restoration projects listed and described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would have some beneficial direct impacts to Riparian Buffers. These benefits within Riparian Buffers would beneficially indirectly impact streams and wetlands with human caused management concerns in the Study Area. The restoration projects would result in decreases to stream length with management concerns and decreases in modified channel length parameters, which, for the Beaver drainage would reduce the parameter to below threshold (see Table 4.3.3-2). Successful implementation of Management Requirements such as, MR2 and MR14 as well as Other Management Provisions OMP12, OMP13, OMP15, and OMP26, which are listed in Table 2.4-2, would improve several functions of Riparian Buffers such as stream shading, nutrient and litter input, streambank stabilization, and LWD recruitment in the long-term. However, short-term detrimental impacts to Riparian Buffers, streams, and wetlands may occur during the construction and implementation of these restoration projects.

Indirect Impacts

Under Alternative 2, the Stormwater Management Plan would be implemented. Thus, parking lots Silver Fir 1 and Summit West 2 would be paved. Stormwater routing would be designed to reduce the transport of fine grained sediments and petroleum products off-site into Riparian Buffers, streams, and wetlands (see Appendix G – Conceptual Stormwater Management Plan). With the use of a de-icer/ice-inhibitor (MgCl), parking lot sanding would decrease. Therefore, sediment delivered to Riparian Buffers, streams, and wetlands near these parking lots would be reduced and riparian functions such as nutrient and litter input and would eventually return to a more natural condition.

The removal of 21.49 acres mature and immature forests within Riparian Buffers under Alternative 2 would indirectly impact the adjacent undisturbed Riparian Buffers by increasing the windthrow potential. However, the trail clearing prescription treatments proposed under Alternative 2, which include forest edge feathering and scalloping (see Section 2.3.1.3 - Construction), would help mitigate the windthrow potential. Due to these specialized trail clearing treatments, the amount of windthrow in Riparian Buffers is expected to remain similar to background levels.

0.58 mile of new permanent roads would be constructed under Alternative 2, increasing the possibility of the transport and establishment of noxious weeds into Riparian Buffers. The areas with the greatest potential of an increase in noxious weeds would be the existing and proposed crossings of streams. The construction of ski trails through and adjacent to Riparian Buffers may increase the potential for noxious weed establishment at locations within the Study Area. The use of BMPs and implementation of Management Requirement MR24 (see Table 2.4-2) would reduce potential indirect impacts to Riparian Buffers from noxious weeds.

Under Alternative 2, the areas with the greatest potential for mass wasting and severe erosion are the top portions of Summit East, Summit Central, and Summit West where there are proposed project activities and these areas currently exhibit a bare soil ground cover. Implementation of the MDP Implementation Plan, including some of the proposed restoration projects, would include revegetation and stabilization of Riparian Buffers. As a result, sediment production and loading to streams and wetlands in the Study Area from these areas would likely be similar to existing conditions.

4.3.3.2 South Fork Snoqualmie River Watershed

Streams

Summary

Within the S.F. Snoqualmie Watershed under Alternative 2, there would be one additional stream crossing (culverts, bridges, and/or fords). In addition, totals would reach 0.22 mile of culverted channels, and 1.7 miles of ditches conveying streamflow. Finally, there would be four new utilidor crossings, and six new trenched utility crossings. All of these items would directly impact stream channels. Indirect impacts to streams under Alternative 2 would include the removal of 6.45 acres of mature and immature forest within Riparian Buffers. Clearing and grading activities and the construction of 0.02 acre of impervious surfaces within Riparian Buffers could modify the flow paths of runoff and erosion patterns. Beneficial impacts include the application of MgCl to paved parking lots, which would reduce the amount of sediment transported to streams and reduce the filling of pools in streams.

Table 4.3.3-7:
Impacts to Streams in the South Fork Snoqualmie River Watershed

Disturbance Source	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Road Density (miles/square mile)	1.96	1.99	1.99	1.97	1.99
Number of Stream Crossings (all channel types) by Crossing Structure[a]					
Culvert	12	13	13	13	13
Bridge	2	2	2	2	2
Ford[b]	2	2	2	2	2
Total Number of Stream Crossings	**16**	**17**	**17**	**17**	**17**
Length of Altered or Channelized Channel Types[a]					
Long Culverted Channels (miles)	0.22	0.29	0.29	0.29	0.29
Ditches Conveying Natural Streamflow (miles)	1.70	0.99	0.99	0.99	0.99
Number of Culverted Segments	10	11	11	11	11

[a] Includes Jurisdictional streams
[b] Does not include temporary crossings

Drainages of Particular Concern Analysis

Under Alternative 2, there would be two new threshold exceedences within the S.F. Snoqualmie Watershed portion of the Study Area, located in the following drainages:

- Northside (Stream length with management concerns – 83.13 percent)
- Upper Alpental (Riparian Buffers in a non-natural condition – 31.96 percent)

Table 4.3.3-8:
Summary of DPC Analysis of Watershed Conditions for Alternative 2 in the South Fork Snoqualmie River Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Northside	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)	**N/A**	**49.02**	**72.08**	**270.07**	**89.34**	**318.62**	**214.58**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.13	94.17	43.72	31.96	40.33	11.36
Change from Alternative 1 (% of total)		1.66	10.27	2.60	4.74	1.36	0.05
Stream Length w/ Management Concerns (% of total)	10	58.79	75.40	4.44	3.89	23.19	3.99
Change from Alternative 1 (% of total)		58.79	25.65	2.00	0.00	1.79	0.01
Road Density (miles/square mile)	3	5.48	7.02	0.50	0.68	1.70	2.35
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.00	0.00	0.00
Road Crossing Density (number/square mile)	6	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Impervious Cover (% of total)	8	1.89	18.18	0.26	2.36	1.95	2.68
Change from Alternative 1 (% of total)		0.25	3.92	0.05	2.13	0.03	0.00
Modified Channel Length (% of total)	8	0.00	76.25	1.96	0.00	22.20	5.50
Change from Alternative 1 (% of total)		0.00	-12.18	0.00	0.00	-2.97	0.01
Culverted Channel Length (% of total)	8	0.00	23.75	0.00	0.00	3.97	0.36
Change from Alternative 1 (% of total)		0.00	12.18	0.00	0.00	0.13	0.00
Parameters over Threshold		**3**	**7**	**1**	**2**	**4**	**1**
Change from Alternative 1		1	0	0	1	0	0

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Under Alternative 2, the watershed conditions of many of the 7th field drainages within the Study Area would change as a result of proposed forest clearing, road and parking lot building, construction of

facilities, and implementation of restoration projects. All of the drainages in the S.F. Snoqualmie Watershed would be affected by the Proposed Action to varying degrees (see Table 4.3.3-8). A majority of the seven parameters relevant to watershed resources would continue to exceed thresholds in the Summit North and Nacrinomical drainages Proposed development in these two drainages would increase parameter scores for Riparian Buffers in a non-natural condition, stream length with management concerns, and impervious cover (see Table 4.3.3-8). As a result of proposed changes to the drainage network at SW Lot 1 and Alp Lot 6 for the Stormwater Management Plan, the length of modified channels would decrease, while the length of culverted channels would increase in the Summit North and Nacrinomical drainages. Even though parameter scores for these two drainages increase and decrease as a result of proposed development and restoration, there would be no new parameter exceedences (see Table 4.3.3-8).

The number of parameters that are over threshold in the Northside drainage would increase from two to three due to a new exceedence in the stream length with management concerns parameter (see Table 4.3.3-8). The number of parameters that are over threshold would also increase in the Upper Alpental drainage from one to two due to increased Riparian Buffers in a non-natural condition from proposed trail and parking lot construction. The parameter scores for the International and Other drainages would increase as a result of the Proposed Action, but none of the increases in these drainages would be sufficient to create new threshold exceedences.

Under Alternative 2, The Summit-at-Snoqualmie would implement the MDP Implementation Plan, Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, which includes restoration projects such as slope stabilization, road deactivation, revegetation, and stream and wetland restoration. These restoration projects would help to address areas of concern identified in the DPC analysis, and would result in some decreases in the DPC parameters scores, but would not decrease any parameter below the threshold (see Table 4.3.3-8). These restorations, outlined in Section 5.0 - Restoration of Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, incorporate the concepts of creation, enhancement, revegetation, and road deactivation activities as means to achieve restoration. Table 5-1 in Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, outlines and describes the restoration projects that would be implemented by The Summit-at-Snoqualmie under Alternative 2.

Direct Impacts

Direct impacts to stream channels within the S.F. Snoqualmie Watershed under Alternative 2 would occur during the construction or removal of crossing structures (culverts, bridges, and fords) at road and ski trail crossings of streams. Properly designed and installed stream crossing structures help protect development investments and downstream infrastructural resources, and they are not detrimental in themselves, apart

from the loss of natural stream structure. Ski and/or road crossings and their associated structures create sediment sources, increase streambank erosion potential, and add to the road maintenance requirements.

The only new culvert under Alternative 2 within the S.F. Snoqualmie Watershed would be installed where a tributary crosses under the proposed realignment of Alpental Parking Lot 7. This new culvert would be sized to pass water from 100-year storm events with considerations for sediment and debris likely to be encountered. As previously described in Section 4.3.3.1 – Upper Yakima River Watershed, constructing a culvert installation would result in adverse impacts on stream channels. Management Requirements MR2, MR8, MR9, MR10, as well as Other Management Provision OMP9 (see Table 2.4-2) would be implemented during culvert installation to reduce channel down-cutting and sediment delivery to streams in tandem with the MDP Implementation Plan, which outlines the sequence of events that are to occur before, during, and after implementation of the MDP. Under Alternative 2, there would be no culvert removal within the S.F. Snoqualmie Watershed, however, there would be one ditch that conveys flows, approximately 0.7 mile in length, that would be removed.

Under Alternative 2, no new bridges or fords are proposed within the S.F. Snoqualmie Watershed portion of the Study Area, but existing bridges and fords would undergo regular maintenance as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

In addition to the one new culvert, Alternative 2 would require the channelization of stream segments via the placement of long culverts (greater than about 100 feet - CV channels) in two places within the S.F. Snoqualmie Watershed. Both CV channels would be created to convey stream segments under Summit West Parking Lot 1. The total impacted stream length for both of these CV channels would be about 0.07 mile. Like culverts, these CV channels would be sized to pass water from 100-year storm events with considerations for sediment and debris likely to be encountered (Management Requirement MR8, see Table 2.4-2). Section 4.3.3.1 – Upper Yakima River Watershed describes in more detail how CV channels directly affect stream channels.

The trenching of utilities would directly impact streams under Alternative 2, although it would only be over a short-time period. Within the S.F. Snoqualmie Watershed there would be 6 crossing of streams by utility trenching. These new utility crossings would directly impact streams as described in Section 4.3.3.1 – Upper Yakima River Watershed. Utility trenching impacts would be short-term because Management Requirements such as MR27 and Other Management Provisions such as OMP2, OMP9, and OMP14 (see Table 2.4-2) would be implemented and the streambank would be stabilized as outlined in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). Under Alternative 2, an above ground utilidor would be built within the S.F. Snoqualmie Watershed. No direct impacts to stream channels are expected from construction of the utilidor at Alpental.

Under Alternative 2, there would be no direct impact to streams within the S.F. Snoqualmie Watershed as a result of stream restoration.

Drainages of Particular Concern Analysis

Indirect Impacts

The paving of Parking Lots 3, 4, 5, 6, and 7 at Alpental, and Summit West Parking Lot 1 under Alternative 2 would indirectly impact streams within the S.F. Snoqualmie Watershed. The creation of impervious surfaces would alter flow paths and the rate of drainage runoff. As described in the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan), each of these parking lots would have its own surface water control system that would filter out sediment and petroleum products. The Stormwater Management Plan would incorporate paving, BMPs, and adaptive management to control sediment; remove and store plowed snow; and monitor other sediment sources.

As described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), other indirect impacts to streams in the S.F. Snoqualmie Watershed under Alternative 2 would result from operation and maintenance activities such as road and ski trail maintenance. These activities would include control of potential erosion problems, maintaining the drainage network, ensuring that sediment or debris does not obstruct the water pathways, and ascertaining proper function of stream crossing structures (bridges, culverts, and fords). Performed on a routine basis, the results of operation and maintenance activities would be beneficial to streams. Without routine maintenance, further erosion and sediment impacts to stream channels could result.

In the S.F. Snoqualmie Watershed under Alternative 2, there would be 0.01 mile of new road built, so the road density would barely increase to 1.99 mile/mile^2 (see Table 4.3.3-8). Although unlikely, the 0.01 mile of new road could indirectly impact stream channels over the long-term via potential sediment delivery from any mobilized sediment off of the new road segment. Potential sediment yields from this segment of newly constructed road that reach streams would be minimized through the implementation of the Stormwater Management Plan as well as Management Requirements MR15, MR24, and MR36, as well as Other Management Provisions OMP2, OMP3, OMP4, and OMP5 (see Table 2.4-2). Any existing indirect sediment and flow regime impacts from already existing road crossings within the S.F. Snoqualmie Watershed would be reduced under Alternative 2 because ski area maintenance activities, as outlined in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), would repair degraded channels at road crossings.

The impacts of sediment delivery on stream channel conditions (e.g., bank erosion, pool filling, cobble embeddedness, etc.) in the S.F. Snoqualmie Watershed are expected to decline with the implementation the Stormwater Management Plan. The Stormwater Management Plan includes application of the ice

inhibitor MgCl to melt snow in parking lots instead of using sand for traction. Because of the use of MgCl, under Alternative 2, the yield of sand to streams would be reduced from existing conditions. Consequently sediment delivery and channel stability impacts on streams within the U. Yakima Watershed under Alternative 2 would be reduced in the long-term, which would benefit the condition of stream channels.

Other off-channel construction activities could impact channels indirectly if large quantities of sediment or other contaminants are transported to streams. This could occur under Alternative 2 at Summit West and Alpental during the grading and paving of the parking lots. This action would reduce or remove most riparian functions of nearby stream channels. With time, stream channels within the Summit North and Nacrinomical 7th field drainages could reflect these changes via increased instability and a reduction in the quantity and quality of aquatic habitat. These indirect stream channel impacts would be reduced by implementation of Management Requirement MR15 as well as Other Management Provisions OMP2, OMP4, OMP7, and OMP11 (see Table 2.4-2) as well as the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Under Alternative 2, other indirect impacts could occur due to the proposed changes in vegetation communities within Riparian Buffers. Within the S.F. Snoqualmie Watershed, Alternative 2 would increase ski trails and modified vegetation within Riparian Buffers by 1.59 acres. An additional 3.04 acres would be developed into base area and other support facilities (see Table 4.3.3-12). Approximately 0.43 mile of streambanks that are currently either naturally forested or naturally non-forested would be converted to 0.24 mile of modified vegetation and 0.03 mile of developed areas (see Table 4.3.3-12). As described in Section 4.3.3.1 – Upper Yakima River Watershed, changes in land cover within Riparian Buffers and along streambanks can indirectly impact the physical condition and ecological functions of streams over the long-term. With appropriate Mitigation Measures, Management Requirements, and Other Management Provisions in Table 2.4-2, revegetation, and monitoring, the potential for indirect impacts to stream channels would be reduced. Indirect impacts would be less likely due to the limited disturbance area and prompt stabilization of the site.

Wetlands

Summary

Under Alternative 2, there would be 18 wetlands impacted within the S.F. Snoqualmie Watershed under the proposed actions, which would include 0.86 acre of clearing and 0.88 acre of grading (see Table 4.3.3-9). Direct impacts from clearing and grading within wetlands would result from construction of lift terminals and towers, buildings, culvert installation, utility trenching, and the construction of ski trails. Actions that would indirectly impact wetlands within the S.F. Snoqualmie Watershed at The Summit-at-Snoqualmie include application of the MgCl de-icer/ice-inhibitor on I-90 and in Summit West Parking Lot 1 and Alpental Parking Lots 3, 4, 5, 6, and 7, various operation and maintenance activities occurring during the summer, revegetation and stabilization measures, and construction activities on adjacent lands.

Most of the activities described above would be considered long-term impacts to wetlands with the exception of utility trenching and stabilization measures, which would only impact wetlands for a short period of time.

Table 4.3.3-9:
Summary of Wetlands within the South Fork Snoqualmie River Watershed

Parameter	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Total Number of Wetlands Impacted	0	18	13	18	18
Clearing Impacts (acres)					
PEM	0.00	0.68	0.67	0.68	0.68
PFO	0.00	0.00	0.00	0.00	0.00
PSS	0.00	0.18	0.18	0.18	0.18
Total	**0.00**	**0.86**	**0.84**	**0.86**	**0.86**
Grading Impacts (acres)					
PEM	0.00	0.81	0.80	0.81	0.81
PFO	0.00	0.00	0.00	0.00	0.00
PSS	0.00	0.07	0.07	0.07	0.07
Total	**0.00**	**0.88**	**0.87**	**0.88**	**0.88**
Total Clearing and Grading Impacts (acres)	0.00	1.74	1.71	1.74	1.74
Total Natural Wetlands (acres)	1.47	1.46	1.46	1.46	1.46
Total Modified Wetlands (acres)	7.76	7.16	7.18	7.16	7.16
Total Wetlands (acres)	**9.23**	**8.62**	**8.64**	**8.62**	**8.62**

Direct Impacts

Under Alternative 2, approximately 1.74 acres of wetlands would be directly impacted by construction activities that require grading, which displaces wetland area and removes all wetlands functionality through the placement of fill material and/or soil excavation in wetlands. The impacts of grading on wetlands are described in Section 4.3.3.1 – Upper Yakima River Watershed. Grading impacts in wetlands in the S.F. Snoqualmie Watershed would occur at several locations, including the upper terminal of the realigned St. Bernard chairlift at Alpental, the lower terminal of Julie's Chair and the two proposed surface lifts near Summit West Parking Lot 1 at Summit West. Approximately 0.28 acre of these grading impacts to wetlands could be avoided by flagging and surveying wetlands in the proposed impact areas. The resultant information would be used in detailed construction plans that facilitate project design, allowing avoidance and minimization of unnecessary impacts to wetlands. As a result, there would be less actual impact during implementation than is currently identified and disclosed through GIS analysis alone.

Other proposed construction activities only require the removal of vegetation in wetlands, which includes the removal of trees and shrubs in wetlands for new ski trails. Vegetation removal only eliminates some wetland functions. All clearing impacts are considered long-term impacts because the alteration of the plant communities in wetlands can change the wetland functions, such as shading and nutrient and organic carbon cycling. Clearing impacts to wetlands would occur at several locations such as the proposed chairlift corridors for the St. Bernard chairlift at Alpental and Julie's Chair chairlift at Summit West. No clearing impacts to wetlands within the S.F. Snoqualmie Watershed could be minimized or avoided by field project design during implementation.

Under Alternative 2, no wetland restoration projects are proposed in the S.F. Snoqualmie Watershed.

Under Alternative 2, some of the wetlands in the S.F. Snoqualmie Watershed would be impacted by utility trenching, which is a short-term direct impact as described in more detail in Section 4.3.3.1 – Upper Yakima River Watershed. Places where utility trenching impacts to wetlands within the S.F. Snoqualmie Watershed would occur are the proposed chairlift corridors for the realigned chairlifts at Summit West and Alpental. Trenching impacts to wetlands may be avoided by trenching around wetlands where possible. The use of Management Requirement MR24 as well as Other Management Provisions such as OMP7, OMP14, and OMP16 (see Table 2.4-2) would also minimize the potential impacts to wetland functions from utility trenching.

Indirect Impacts

Operational and maintenance activities that indirectly impact wetlands would be mostly limited to wetlands on existing and proposed ski trails (mainly modified PEM and PSS wetlands) under Alternative 2. These activities include mowing vegetation, the maintenance of contour ditch lines, and snow management, which are all described in further detail in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). Potential impacts to wetlands from operation and maintenance activities can indirectly impact wetlands both beneficially and adversely. Regular maintenance activities can reduce the potential for adverse impacts, such as sediment delivery and the growth of noxious weeds in wetlands. Nonetheless, some adverse effects to wetlands do occur and are usually long-term in nature because they can cause wetlands to lose natural functions. Beneficial impacts to wetlands from operation and maintenance activities include the prevention of erosional impacts such as sediment delivery to wetlands, which enhances the viability of wetlands. Implementation of Other Management Provision OMP16 (see Table 2.4-2) would help prevent substantial impacts to wetlands within ski trails during maintenance activities. Wetlands within the Study Area that are in natural settings in the forest or open meadows would not be affected by the maintenance of ski area facilities.

Development activities in the uplands adjacent to wetlands can indirectly affect wetland functions. The degree and type of impact to wetland function is dictated by the type and location of the proposed development activity in relationship to the wetland. Primary indirect impacts to wetlands occur from

changes in hydrology and sediment sources. Under Alternative 2, grading would take place in the Riparian Buffers of several wetlands in all of the 7th field drainages within the S.F. Snoqualmie Watershed. Proper implementation of BMPs, and Other Management Provisions such as OMP7, OMP14, and OMP16 (see Table 2.4-2) would mitigate the potential for increased sediment delivery to wetlands during construction. Increases in sediment delivery would be mitigated via measures in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), which would minimize the potential for additional indirect impacts. The introduction of new disturbance in Riparian Reserves, such as areas of grading activities and proposed roads (temporary and permanent), as well as ski trail clearing and utility trenching would result in increased potential for the introduction of noxious species into wetlands. However, with the implementation of Management Requirements from Table 2.4-2 such as MR24, the potential introduction of noxious species to wetlands at The Summit-at-Snoqualmie would be limited.

The proposed paving and application of sand/de-icer/ice-inhibitor mix to Summit West Parking Lot 1 and Alpental Parking Lots 3, 4, 5, 6, and 7 could potentially indirectly impact the wetland complexes and individual wetlands in these areas. The use of MgCl on these parking lots could disrupt the ecology of the wetland by enhancing the growth potential of some wetland plants, or by creating more saline soils that could foster a favorable environment for salt-tolerant noxious weeds. Implementation of Management Requirement MR24 (see Table 2.4-2) would minimize the risk of the introduction of noxious species into wetlands. Indirect impacts on roadside vegetation could occur if the applications exceed recommended application rates. Based on applications of magnesium chloride at other Washington ski areas, use of chemical de-icer/ice-inhibitors has not elevated chloride concentrations in soil or water beyond state water quality standards or vegetation thresholds (SE GROUP 2002). Studies have shown that magnesium chloride can have adverse environmental effects, particularly to vegetation along roadsides (D'Itri 1992; Lewis 1999). However, as mentioned above, monitoring of other sites in Washington has not detected water quality standards or soil thresholds have been exceeded. However, the reduction of the use of sand on parking lots would also be beneficial because the amount of sand potentially impacting wetlands adjacent to the parking lots would be reduced.

Consultation with the USACE and other appropriate agencies regarding federal and state wetland permitting requirements would be required for this project. The permits that are required for implementation of the MDP are listed in Table 1.7-1. As engineering plans are developed for any approved project, permit applications would be transmitted to the USACE as appropriate to ensure compliance with the federal wetland permit process. Compliance includes identifying mitigation ratios and developing a conceptual mitigation plan, as well as identifying sites for enhancement, restoration, or creation.

Water Quantity

Summary

Under Alternative 2, no snowmaking is proposed, there would be no new groundwater or surface water withdrawals. Diversions would be subject to the same requirements as currently exist under SNOPAC (no change in water rights). The wastewater disposal technique would continue to be via sewer under SPUD, and represents the primary groundwater-related operational impact that would occur under Alternative 2, however, no new impacts to groundwater are expected from the Proposed Action.

As described in Section 4.3.3.1 – Upper Yakima River Watershed, differences in land cover between the No Action Alternative and Alternative 2 may locally affect snow accumulation and snowmelt, and could affect the runoff patterns of the Watershed. In Alternative 2, the main change in land use at Summit West would be in the Summit North 7th field drainages, where land would be re-graded in order to replace the Little Thunder chairlift and for the paving of Summit West Parking Lot 1. Also at Summit West, tree islands would be planted to separate of ski trails. At Alpental, land would be re-graded in the Nacrinomical 7th field drainage for the paving of Alpental Parking Lots 3, 4, 5, 6, and 7. New buildings within the S.F. Snoqualmie Watershed include the Slide Inn Lodge at Summit West and the mountain-top restaurant, Visitor Services Building, and a maintenance building at Alpental.

Table 4.3.3-10:
Hydrologic Landcover in the South Fork Snoqualmie River Watershed

Parameter	Alt. 1 (acres)	Alt. 2 (acres)	Alt. 3 (acres)	Alt. 4 (acres)	Mod. Alt. 5 (acres)
Study Area[a]	1,014.15	1,013.72	1,013.72	1,013.72	1,013.72
Land Cover Types (Hydrologic Maturity) within the Study Area[b]					
Forested – Mature (Mature)	478.86	473.28	475.09	475.84	473.28
Forested – Immature (Intermediate)	23.36	17.10	17.10	17.10	17.10
Forested – Sapling (Immature)	0.00	3.10	3.10	6.18	3.10
Naturally Non-forested (Immature)[3]	308.20	301.47	304.56	306.72	301.47
Modified (Immature)	179.97	189.94	187.33	180.07	190.22
Developed[c]	23.76	28.81	26.53	27.81	28.54

[a] The Study Area total acreage differs between Alternative 1 and the Action Alternatives due to small rounding errors within the summation of many-record GIS data files.
[b] Includes wetland cover type
[c] Includes 1.34 acres of lake landcover type

Indirect Impacts

Land use changes within the S.F. Snoqualmie Watershed initiated during construction under Alternative 2 would continue to indirectly influence the surface water quantity at The Summit-at-Snoqualmie for the

life of the MDP. Approximately 47 percent of the Study Area within the S.F. Snoqualmie Watershed (473 acres of land cover) would remain as hydrologically mature forest under Alternative 2, which is approximately 0.5 percent less than under Alternative 1. Land under some cover types, such as mature forest, generally retains more of the precipitation delivered to it and then releases the water slowly. Other land under cover types such as herbaceous vegetation and partially developed facilities release more water to runoff at more rapid rates. These land cover types are considered hydrologically immature. Because of proposed development and restoration, 6.34 acres of land cover would be converted to hydrologically immature land. Hydrologically immature land cover types include naturally non-forested areas, young saplings planted for restoration, and ski trails (both new and existing) that consist of modified shrubs and herbaceous vegetation (see Table 4.3.3-10). The creation of ski trails and other development clearing would therefore increase the amount of immature land cover in the S.F. Snoqualmie Watershed by 0.6 percent. Under Alternative 2, 5.05 acres of land would be converted to developed condition by the construction of the Slide Inn Lodge, the mountain-top restaurant, Visitor Services Building, and the maintenance building. The resultant creation of impervious surfaces would result in the loss of all hydrologic properties. Land conversions (ski trails and impervious areas) would likely generate a slight net export of water from the S.F. Snoqualmie Watershed. Differences in land cover between Alternative 1 and Alternative 2 may indirectly affect local snow accumulation and snowmelt, which could change the runoff patterns of the 7th field drainages in the watershed.

Construction techniques, including the embedding of coarse woody debris within the ground surface, along with Other Management Provisions OMP25, OMP26, and OMP33 (see Table 2.4-2) would minimize localized increases in sheet flow on construction sites during and after construction. Under current maintenance practices at The Summit-at-Snoqualmie, modified vegetation would continue to be maintained in a hydrologically immature condition to support ski area management; water from these areas generally runs off quickly to streams. Considering that several streams within the S.F. Snoqualmie Watershed portion of the Study Area are typically ephemeral or intermittent at this elevation, and given that source protection measures are included in the construction techniques and Measures from Table 2.4-2, the effects of lift and trail construction are unlikely to result in any measurable increase in flow in the S.F. Snoqualmie River. Therefore, no water quantity impacts are expected within the S.F. Snoqualmie Watershed.

Flow Model

The flow model described in Section 4.3.3.1 – Upper Yakima River Watershed was also run for the 7th field drainages within the S.F. Snoqualmie Watershed for each alternative and the results are displayed in Table 4.3.3-11.

Alternative 1 portrays the percentage of flow increase over baseline conditions for each 7th field drainage. In comparison to Alternative 1, Alternative 2 would result in increases in flows, caused by areas of tree clearing and areas of new impervious surface in various of the 7th field drainages within the S.F.

Snoqualmie Watershed. The flow model analysis for the S.F. Snoqualmie Watershed was performed using proposed land cover changes for Alternative 2 in all the 7th field drainages. The results show the resultant percentage of flow over natural conditions. As described in Section 3.3.1.3 – Upper Yakima River Watershed, the equations presented in Illustrations 3.3.1-1, 3.3.1-2, and 3.3.1-3 were used to calculate the potential change in flow for three analysis parameters: the low flow; mean annual flow, and the two-year peak flow, as a function of the acreage of forest clearing and the acreage of new impervious surfaces proposed under Alternative 2 (see Table 4.3.3-10). For example, for Alternative 2, the model predicts that the annual low flow of the International Watershed would increase by 1.3 percent, the average annual flow would increase by 0.4 percent, and the two-year peak flow would increase by 0.3 percent over Alternative 1 conditions (see Table 4.3.3-11).

Table 4.3.3-11:
Projected Changes in Flow of the 7th Field Drainages in the South Fork Snoqualmie River Watershed

Watershed Name	Alt. 1 Change in Flow (%)	Alt. 2 Change in Flow (%)	Alt. 3 Change in Flow (%)	Alt. 4 Change in Flow (%)	Mod. Alt. 5 Change in Flow (%)
International (271.06 acres)					
Low Flow	17.0%	1.3%	0.9%	1.3%	1.3%
Mean Annual Flow	5.4%	0.4%	0.3%	0.4%	0.4%
Two-Year Peak Flow	4.0%	0.3%	0.2%	0.3%	0.3%
Nacrinomical (323.15 acres)					
Low Flow	15.4%	0.8%	0.8%	0.8%	0.8%
Mean Annual Flow	4.9%	0.3%	0.3%	0.3%	0.3%
Two-Year Peak Flow	3.6%	0.2%	0.2%	0.2%	0.2%
Northside (85.38 acres)					
Low Flow	48.9%	0.3%	0.3%	0.3%	0.3%
Mean Annual Flow	15.6%	0.1%	0.1%	0.1%	0.1%
Two-Year Peak Flow	11.6%	0.1%	0.1%	0.1%	0.1%
Summit North (94.24 acres)					
Low Flow	77.8%	6.2%	6.2%	6.2%	6.2%
Mean Annual Flow	24.8%	2.0%	2.0%	2.0%	2.0%
Two-Year Peak Flow	18.5%	1.5%	1.5%	1.5%	1.5%
Upper Alpental (157.66 acres)					
Low Flow	5.9%	1.0%	0.0%	1.0%	1.0%
Mean Annual Flow	1.9%	0.3%	0.0%	0.3%	0.3%
Two-Year Peak Flow	1.4%	0.2%	0.0%	0.2%	0.2%

As shown in Table 4.3.3-11, the 7th field drainages whose streamflow would be most impacted by forest clearing and creation of new impervious surfaces under Alternative 2 would be International and Summit North. Meanwhile, there would be little or no impact to the Northside 7th field drainage.

As described in Section 4.3.3.1 – Upper Yakima River Watershed, the comparatively small streamflow increases are typical of the types of streams in the 7th field drainages. In addition, any local increase in streamflow in the S.F. Snoqualmie Watershed from the 5.05 acres of new impervious surfaces is expected to be mitigated through BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Water Quality

Summary

Under Alternative 2, sediment delivery to streams within the S.F. Snoqualmie Watershed would occur at 17 stream crossings (culverts, bridges, fords) and 6 utility crossings that would exist after project construction. This could result in increased turbidity. Temperature and dissolved oxygen could increase due to the 0.27 mile of mature and immature forest removal along streambanks. The pH of streams could increase under Alternative 2 due to the construction of 3.04 acres of impervious surfaces within Riparian Buffers. Other water pollution, such as oil and grease, is expected to decrease under Alternative 2 due to the implementation of the Stormwater Management Plan. After implementation of all projects in Alternative 2, water quality levels would likely remain close to current conditions. Proper implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 would reduce the possibility of water quality exceedences.

Direct Impacts

The major water quality impact associated with project construction under Alternative 2 in the S.F. Snoqualmie Watershed would be the result of sediment delivery to streams. Stream crossing (culvert) installation and utility trenching across streams would result in direct sediment loading to streams and subsequent turbidity increases. Most of these turbidity impacts would be short-term, and where projects would directly impact stream channels, BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, along with implementation of a SWPPP, would typically limit the increases in turbidity to a few hours duration during installation. Increases in fine sediment could increase turbidity of the streamflow, affect aquatic organisms, and reduce aesthetic appeal.

Under Alternative 2, there would be one new culvert installed within the S.F. Snoqualmie Watershed: an unnamed stream would be culverted under Alpental Parking Lot 7. The installation of this culvert would likely result in direct impacts, both short-term and long-term, to water quality. During construction, the installation of this culvert would likely result in a short-term increase in localized sediment mobilization and turbidity. Over the long-term, the presence of the culvert could result in increased potential for sediment mobilization and turbidity in the S.F. Snoqualmie River. Implementation of BMPs and

Management Requirements such as MR3, MR9, and MR10 as well as Other Management Provisions OMP9 (see Table 2.4-2) would reduce water quality impacts to streams associated with this culvert installation.

The construction of 6 utility crossings in surface waters within the S.F. Snoqualmie Watershed would result in short-term, direct impacts to water quality. Impacts due to the construction of utility crossings are described in Section 4.3.3.1 – Upper Yakima River Watershed. Implementation of BMPs and Management Requirements such as MR27 as well as Other Management Provisions OMP2, OMP9, OMP14 (see Table 2.4-2) would minimize the effect of sediment delivery and increased turbidity on the downstream waters. Under implementation of Alternative 2, turbidity levels would likely remain below SWQS. Proper installation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2 would minimize the probability of SWQS exceedences.

Under Alternative 2, construction of lift terminals, lift towers, and tower concrete bases, would occur within the Riparian Reserves of all the 7th field drainages in the S.F. Snoqualmie Watershed. Runoff from concrete structures or concrete washings could increase the pH impacts of affected waters in the S.F. Snoqualmie Watershed as described in Section 4.3.3.1 – Upper Yakima River Watershed. Implementation of BMPs and Management Requirements such as MR15, MR16, and MR36 (see Table 2.4-2) would decrease the chance of high pH runoff entering the streams. Thus, current pH levels, which meet SWQS, would be maintained within streams in the S.F. Snoqualmie Watershed. Other potential water quality impacts that could occur during construction activities within Riparian Buffers include the contamination of surface water by petroleum products should equipment working in or adjacent to streams experience fuel leaks or hydraulic system failures. Current data shows that petroleum products are just above detection limits in streams within the S.F. Snoqualmie Watershed. This suggests that despite the containment and clean-up of diesel fuel, oil, and hydraulic fluid spills in the vehicle maintenance area or on roads these contaminants still sometimes reach streams. Existing avalanche control activities may result in detectable oil and grease levels in the S.F. Snoqualmie River from diesel fuel contained in the explosives used for avalanche control at Alpental (see Section 3.2.3.4 - Surface Water Quality). This trend would continue under Alternative 2, and but would not increase because no new avalanche control activities are proposed. Under Alternative 2, all stream crossing structure locations have the potential for increased pollutant (e.g., fuel) and sediment delivery during construction activities. Development of a SWPPP and the implementation of BMPs and Management Requirements MR14 and MR16 as well as Other Management Provisions such as OMP13, OMP15, and OMP17 (see Table 2.4-2) would minimize the potential for any short-term, indirect delivery of pollutants to streams that could affect the water quality in the S.F. Snoqualmie Watershed.

The implementation of the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan) would limit sediment delivery to streams from sources such as road sanding. Under the Stormwater Management Plan, Summit West Parking Lot 1 and Alpental Parking Lots 3, 4, 5, 6, and 7

would be paved, surface water controls for each lot would be built to filter out sediment and petroleum products, snow management would be practiced in each lot, and a MgCl de-icer/ice-inhibitor would be applied instead of sand for each lot. Under implementation of the Stormwater Management Plan, the water quality of adjacent and nearby streams would improve because less sediment and oil and grease contents would be delivered to streams. Indirect impacts on water quality could occur if the applications exceed recommended application rates. Based on applications of magnesium chloride at other Washington ski areas, use of chemical de-icer/ice-inhibitors has not elevated chloride concentrations in soil or water beyond state water quality standards or vegetation thresholds (SE GROUP 2002).

The Upper South Fork Snoqualmie River and Coal Creek Watershed Condition Assessment (Jones & Stokes 2001) suggests that management objectives for water quality are currently being met under ski area operations for all parameters in the S.F. Snoqualmie Watershed. Water quality within the S.F. Snoqualmie Watershed portion of the Study Area supports beneficial uses for all recreation classes. No exceedences of water quality standards for fecal coliform are expected under Alternative 2. Temperature and dissolved oxygen are not currently a concern within the S.F. Snoqualmie Watershed.

Under Alternative 2, the dissolved oxygen standards would continue to be met within the S.F. Snoqualmie Watershed. Dissolved oxygen is partly dependent on water temperature, with colder temperatures enabling higher dissolved oxygen concentrations. Under Alternative 2, the dissolved oxygen is not expected to decrease significantly and any impacts on fish would be negligible (see Section 4.4 - Fisheries).

Indirect Impacts

Proposed activities just outside stream channels but within the Riparian Buffers in the S.F. Snoqualmie Watershed may result in indirect sediment production and transfer of sediment to streams when accompanied by a transport mechanism such as water, wind, or gravity. Examples of these proposed activities include: construction of roads, parking lots, and buildings within Riparian Buffers; the clearing and grading of soils for ski trails in Riparian Buffers; trenching for the burial of utility lines; and the construction and/or paving of both existing and new parking lots within the Riparian Buffers. Under Alternative 2, 6.45 acres of mature and immature forests would be cleared and graded within Riparian Buffers. This includes the utility trenching that would occur in Riparian Buffers. All of these proposed activities would result in an increased potential for indirect sediment impacts to streams. Any sediment impacts from the construction activities listed above would increase the turbidity in streams in the short-term. Over the long-term, turbidity impacts would likely be reduced to background levels following successful implementation of BMPs and Management Requirements such as MR2 and MR14 as well as Other Management Provisions OMP12, OMP13, and OMP15 (see Table 2.4-2) which would minimize turbidity impacts to streams.

Sediment is also exposed during typical ski area maintenance and operations such as ski trail brushing, ditch cleaning, various other maintenance activities, and where revegetation efforts are slow or

unsuccessful. However, with the proper application of BMPs, Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, and monitoring, sediment yield from maintenance and revegetation activities to streams would be minimal.

Land cover changes in the Riparian Buffers of the S.F. Snoqualmie Watershed due to activities proposed under Alternative 2 could also indirectly affect the temperature of the streams. When currently forested streambanks are converted to developed land by proposed activities, temperatures are elevated by an increase in direct solar heating. This increase is caused by the reduction of riparian cover shading along streambanks. Thermal effects to streams have the potential to occur during construction activities in Riparian Reserves. Since water temperature in a stream is a cumulative function of the temperatures of its inputs, temperature typically becomes higher as the water flows downstream. Existing conditions exhibit limited canopy coverage along streams. Due to the limited areas of vegetation removal associated with MDP Implementation, the current stream temperatures within the Study Area would likely remain the same as existing conditions or increase slightly for all streams. Alternative 2 would likely maintain the existing stream dissolved oxygen concentrations for all streams within the S.F. Snoqualmie Watershed portion of the Study Area, since levels of dissolved oxygen are a function of water temperature, and temperatures would be likely to remain the same.

The development of 3.04 acres of impervious surfaces could result in long-term indirect impacts to water quality caused by increased pollutant concentrations in stormwater (e.g., oil and grease, BOD). However, under Alternative 2, The Summit-at-Snoqualmie would implement the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan). This plan calls for the paving of Summit West Parking Lot 1, Alpental Parking Lots 3, 4, 5, 6, and 7, and the portion of Alpental Road along these parking lots. In addition, a new treatment train would treat water flowing off the parking lots to collect oil and grease, and retain sediment, thereby improving the water quality of stormwater runoff. Concentrations of TSS and petroleum hydrocarbons would be reduced by sediment traps, which would decrease sediment delivery to nearby streams. Decreases in sediment delivery would correlate to lower turbidity. With implementation of the Stormwater Management Plan, long-term detrimental impacts to water quality from sand, oil, and grease from continuously polluted stormwater runoff parking lots would be reduced under Alternative 2.

Implementation of the MDP Implementation Plan and other specific Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, would result in beneficial impacts to water quality within the S.F. Snoqualmie Watershed under Alternative 2. The effects of revegetation and tree island creation at Summit West would indirectly benefit water quality. Once these tree islands are healthy and established, they would help stabilize the soils in these areas, improving water quality in nearby streams over the long-term by reducing sediment loading. All revegetation to be conducted under Alternative 2 is described in the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Riparian Buffers

Summary

A total of 3.04 acres of impervious surfaces have been developed within Riparian Buffers in the portion of the Study Area within the S.F. Snoqualmie Watershed, which represents approximately 1.1 percent of the total Riparian Buffer area. Approximately 0.29 mile of streams in the S.F. Snoqualmie Watershed portion of the Study Area have been placed in culverts, including the 13 culverted stream crossings. Under Alternative 2, 0.01 mile of new road would be built within Riparian Buffers and 6.45 acres of mature and immature forested Riparian Buffers would be converted into other vegetation community types. 0.07 mile of streambank would be converted from natural conditions to modified and developed conditions. Through implementation of the Stormwater Management Plan, sediment yield to streams within the S.F. Snoqualmie Watershed would decrease under Alternative 2.

Table 4.3.3-12:
Riparian Buffer Land Cover Specifications
within the South Fork Snoqualmie River Watershed

Parameter	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Study Area (acres)[a]	1,014.15	1,013.72	1,013.72	1,013.72	1,013.72
Riparian Buffer Area (acres)	277.35	274.18	274.18	274.18	274.18
Land Cover Types within Riparian Buffers (acres)[b]					
Forested – Mature	108.28	105.52	106.24	105.79	105.52
Forested – Immature	6.24	2.55	2.55	2.55	2.55
Forested – Sapling	0.00	0.97	0.97	3.84	0.97
Naturally Non-forested[c]	52.02	49.68	50.27	50.96	49.68
Modified	97.64	99.23	99.02	95.72	99.28
Developed	13.18	16.22	15.12	15.31	16.17
Land Cover Along Stream Length (miles)[d]					
Forested – Mature	4.0	3.9	3.9	3.9	3.9
Forested – Immature	0.3	0.1	0.1	0.1	0.1
Forested – Sapling		0.0	0.0	0.1	0.0
Naturally Non-forested[c]	2.7	2.7	2.7	2.7	2.7
Modified	3.0	2.9	2.9	2.9	2.9
Developed	0.3	0.4	0.4	0.4	0.4
Total Length (miles)[d]	10.3	10.0	10.0	10.0	10.0
Road Length within Riparian Buffers (miles)					
Native	1.55	1.21	1.21	1.21	1.21
Paved	0.32	0.64	0.64	0.51	0.64
Total	1.87	1.85	1.85	1.73	1.85

[a] The Study Area total acreage differs between Alternative 1 and the Action Alternatives due to small rounding errors within the summation of many-record GIS data files.
[b] Includes wetland landcover types
[c] Includes lake landcover type
[d] Includes jurisdictional streams (except culverted streams)

Direct Impacts

The largest impact to Riparian Buffers in the S.F. Snoqualmie Watershed portion of the Study Area would be the complete removal of riparian function through the creation of impervious surfaces (roads, buildings, and parking lots) and also by the installation of stream culverts. As displayed in Table 4.3.3-12, 3.04 acres of impervious surfaces have been developed within Riparian Buffers in the S.F. Snoqualmie Watershed portion of the Study Area, which represents approximately 1.1 percent of the total Riparian Buffer area. As described previously, the most common areas of impact to the Riparian Buffers occurs at the 13 culverted stream crossings. Approximately 0.29 mile of streams in the S.F. Snoqualmie Watershed portion of the Study Area do not have functioning Riparian Buffers because they have be placed in culverts, including the 13 culverted stream crossings.

Under Alternative 2, 6.45 acres of mature and immature forested Riparian Buffers in the S.F. Snoqualmie Watershed would be lost due to construction of ski trails, lift terminals, buildings, roads, and parking lots (see Table 4.3.3-12). As described previously, clearing and grading impacts to mature and immature forests within Riparian Buffers would immediately reduce shade and litter input that the trees currently provide to the streams. The development of lift terminals, buildings, roads, and parking lots would have a long-term direct impact on all of the riparian functions of the vegetation communities in Riparian Buffers. Long-term impacts would result from the elimination of riparian vegetation and the creation of impervious surfaces. New ski trails and utility trenching would be restored through replacement of topsoil and revegetation with native species, which limit impacts to Riparian Buffers to the short-term. Although there would be a long-term direct impact to some riparian functions, others described previously would not be affected over the long-term. Clearing and grading activities within Riparian Buffers would be minimized through implementation of Management Requirements MR2 and MR14 as well as Other Management Provisions OMP12, OMP13, and OMP15 (see Table 2.4-2).

Of the 9.72 linear miles of streambanks within the S.F. Snoqualmie Watershed under Alternative 2 (two banks, each along 4.86 miles of streams):

- 3.99 miles (41 percent) would remain under natural mature and immature forest cover,
- 2.64 miles (27 percent) would remain in natural nonforest cover,
- 2.81 miles (29 percent) would adjoin ski trails and other modified vegetation, and
- 0.24 mile (2.5 percent) would be adjacent to developed areas.

The 3.05 miles of streambanks with human caused management concerns along their stream reaches would directly and indirectly affect streams over the long-term. The proposed project activities within Riparian Buffers could result in hydrological effects such as the reduction of bank stability, an increase in erosion, reduction of mature riparian vegetation, alteration of nutrient inputs, and elimination of LWD inputs. These impacts to Riparian Buffers and their associated stream functions would be avoided and or minimized through implementation of Mitigation Measures, Management Requirements, and Other

Management Provisions outlined in Table 2.4-2. These measures, in combination with implementation of the Stormwater Management Plan would reduce the loss of stream shade, preserve nutrient and LWD inputs, and control soil erosion and sediment yield to streams. Other Management Provisions, such as OMP31 – OMP33 (see Table 2.4-2), would help quickly reestablish vegetative cover along stream channels and maintain sediment delivery to streams at minimal levels.

The restoration projects within the S.F. Snoqualmie Watershed that are listed and described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would have some beneficial direct impacts Riparian Buffers, but could indirectly impact streams and wetlands in the Study Area. Short-term detrimental impacts to Riparian Buffers, streams, and wetlands would likely occur during the construction and implementation of these restoration projects. However, the net result of successful implementation of restoration projects and BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2, would help restore several functions of Riparian Buffers such as stream shading, nutrient and litter input, streambank stabilization, and LWD recruitment, in the long-term. Although they provide several benefits, the restoration projects would not result in any decreases in the DPC parameter scores, and would not reduce any parameters below the threshold (see Table 4.3.3-8).

Indirect Impacts

Under Alternative 2, implementation of the Stormwater Management Plan would include paving of the access road to the Alpental parking lots, Alpental Parking Lots 3, 4, 5, 6, 7, and Summit West 1. Design criteria would reduce the transport of fine grained sediments and petroleum products off-site into Riparian Buffers, streams, and wetlands (see Appendix G – Conceptual Stormwater Management Plan). With the use of a de-icer/ice-inhibitor (MgCl), sediment delivered to Riparian Buffers, streams, and wetlands near this road and the parking lots would be reduced and riparian functions such as nutrient and litter input and would eventually return to a more natural condition.

The removal of 6.45 acres mature and immature forests within Riparian Buffers in the S.F. Snoqualmie Watershed under Alternative 2 could increase the windthrow potential by indirectly impacting the adjacent undisturbed Riparian Buffers. Any windthrow potential within Riparian Buffers would be reduced by the trail clearing prescription treatments proposed under Alternative 2, which include forest edge feathering and scalloping (see Section 2.3.1.3 - Construction). The amount of windthrow in Riparian Buffers is expected to remain similar to background levels due to these specialized trail clearing treatments.

0.01 mile of new permanent roads would be constructed within the S.F. Snoqualmie Watershed under Alternative 2, increasing the possibility of the transport and establishment of noxious weeds into Riparian Buffers. The areas with the greatest potential for an increase in noxious weeds would be at the existing and proposed crossings of streams. The construction of ski trails through and adjacent to Riparian Buffers may increase the potential for noxious weed establishment at locations within the Study Area. The use of

BMPs and implementation of Management Requirement MR24 (see Table 2.4-2) would reduce potential indirect impacts to Riparian Buffers from noxious weeds.

Under Alternative 2, the areas with the greatest potential for mass wasting and severe erosion are the upper mountaintop areas at Alpental and Summit West due to proposed actions that would occur within areas of bare soils. Through the application of the MDP Implementation Plan, including some of the proposed restoration projects, once Riparian Buffers are revegetated and stabilized, sediment production and loading to streams and wetlands in the Study Area from these areas would likely be below existing conditions.

4.3.4 Impacts – Alternative 3

See Figures 2.3.4-1, Alternative 3 Proposed Conditions – The Summit and 2.3.4-2, Alternative 3 Proposed Conditions - Alpental for the proposed conditions under Alternative 3 at both The Summit and Alpental.

4.3.4.1 Upper Yakima River Watershed

Streams

Summary

Under Alternative 3, there would be 89 stream crossings (culverts, bridges, and/or fords), 1.90 miles of culverted channels, 0.83 mile of ditches conveying streamflow, and 13 new trenched utility crossings, all of which would directly impact stream channels within the U. Yakima Watershed. Indirect impacts to streams under Alternative 3 include the addition of 0.6 acre of mature and immature forest within Riparian Buffers due to clearing and grading activities,[60] and construction of 4.25 acres of impervious surfaces within Riparian Buffers. Under Alternative 3, application of MgCl to I-90 and SR 906 would continue, and MgCl would be applied to Silver Fir Parking Lot 1 and the Summit West Parking Lot 2. In addition, both of these lots would be paved, reducing the amount of sediment transported to streams.

Drainages of Particular Concern Analysis

Under Alternative 3, there would be one new threshold exceedence within the U. Yakima Watershed portion of the Study Area:

- Summit South (Stream length with management concerns – 13.50 percent)

[60]In Alternative 3, the proposed Mill Creek land donation would occur, resulting in the transition to land management under the Northwest Forest Plan. Riparian areas currently managed according to county regulations would transition to Riparian Reserves, which carry greater buffer widths.

Table 4.3.4-1:
Summary of DPC Analysis of Watershed Conditions for Alternative 3 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	L. Mill Creek	U. Mill Creek	Creek Run	Summit South	Hyak	Tunnel	Ski Acres	Beaver	Other
Area (acres)	**N/A**	**395.50**	**33.21**	**220.15**	**223.79**	**192.61**	**134.35**	**357.93**	**171.30**	**155.56**
Riparian Buffers in a Non-Natural Condition (% of total)	30	80.34	99.86	20.81	66.88	27.79	51.26	55.29	59.34	44.52
Change from Alternative 1 (% of total)		-2.83	-0.14	1.94	21.82	0.43	9.27	2.51	2.96	0.00
Stream Length w/ Management Concerns (% of total)	10	8.37	18.33	1.40	13.50	6.45	37.77	45.19	27.98	32.40
Change from Alternative 1 (% of total)		0.59	0.00	-0.49	6.91	0.64	10.54	0.72	-20.65	0.00
Road Density (miles/square mile)	3	7.47	2.90	2.25	5.61	2.78	11.77	8.80	7.68	1.66
Change from Alternative 1 (miles/square mile)		0.05	0.00	-0.27	-0.05	0.00	-0.57	-0.48	-0.97	0.00
Road Crossing Density (number/square mile)	6	29.13	0.00	20.35	11.44	13.29	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	0.01	-2.85	3.33	4.80	0.02	-3.72	0.00
Impervious Cover (% of total)	8	2.27	0.88	0.70	4.34	1.32	7.92	9.35	4.34	1.16
Change from Alternative 1 (% of total)		0.02	0.00	-0.06	0.01	0.04	0.89	1.19	0.05	0.01
Modified Channel Length (% of total)	8	0.00	0.00	0.00	1.69	0.00	5.61	12.65	5.48	0.00
Change from Alternative 1 (% of total)		0.00	0.00	0.00	0.00	0.00	0.01	-0.03	-4.97	0.00
Culverted Channel Length (% of total)	8	1.56	0.00	0.00	0.00	5.76	26.82	17.16	15.70	38.46
Change from Alternative 1 (% of total)		1.56	0.00	0.00	0.00	0.00	0.75	1.07	-6.26	0.00
Parameters over Threshold		**3**	**2**	**1**	**4**	**1**	**5**	**7**	**5**	**3**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**0**	**0**	**-1**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Similar to Alternative 2, the watershed conditions of many of the 7th field drainages within the Study Area would change under Alternative 3 as a result of proposed tree clearing, road and parking lot building, construction of facilities, and implementation of restoration projects. Most of the drainages in the U. Yakima Watershed would be affected by Alternative 3, while the Other drainage would not have any impacts affecting the parameters that relate to watershed conditions (see Table 4.3.4-1). The impacts to the Ski Acres and Beaver drainages under Alternative 3 would be the same as described for Alternative 2. The Ski Acres and Beaver drainages would continue to have a majority of the seven parameters relevant to watershed resources exceeding thresholds. However, the Beaver drainage would have one parameter that has been improved to below threshold, as compared to Alternative 1. The number of parameters that are over threshold in the Tunnel drainage would be the same as existing conditions. Alternative 3 increases in impervious cover would be less than under Alternative 2 and would not be enough to cause a threshold exceedence (see Table 4.3.4-1).

For Alternative 3, the Riparian Buffers in a non-natural condition and stream length with management concerns parameters would be lower than under Alternative 2 in the Creek Run, Summit South, and Hyak drainages. The reduction in impacts under Alternative 3 would not be sufficient to prevent a new threshold exceedence in the stream length with management concerns parameter, which would still occur in the Summit South drainage (see Table 4.3.4-1). The reductions in impacts under Alternative 3 would be the most significant in the Creek Run drainage, where the impacts to the Riparian Buffers parameter would be reduced from 28 percent in Alternative 2 to 21 percent in Alternative 3. Similarly, the impacts to stream length with management concerns in the Creek Run drainage under Alternative 3 would be 3.5 percent less than under Alternative 2 (see Table 4.3.4-1). Finally, the percentage of Riparian Buffers in a non-natural condition in the Upper and Lower Mill Creek drainages would decrease as a result of the land donation because the Riparian Buffers would increase in width as a result of a change from Kittitas County jurisdiction to USFS jurisdiction. The increase in the width of the Riparian Buffers in the Mill Creek drainages would result in the inclusions of larger areas of undisturbed forests in the buffers (see Table 4.3.4-1).

Under Alternative 3, The Summit-at-Snoqualmie would implement the MDP Implementation Plan, Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, which includes restoration projects such as slope stabilization, road deactivation, revegetation, and stream and wetland restoration. These restoration projects would help to address areas of concern identified in the DPC analysis. These restorations, outlined in Section 5.0 - Restoration of Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, incorporate the concepts of creation, enhancement, revegetation, and road deactivation activities as means to achieve restoration. For example, the restoration project to daylight Beaver Lake Creek would result in a decrease in the modified channel length parameter to below threshold in the Beaver drainage. Tables 5-1 and 5-2 in Appendix F - The Summit-at-Snoqualmie MDP – Implementation,

Operations, Restoration and Monitoring Plan, outline and describe the restoration projects that would be required by the USFS and implemented by The Summit-at-Snoqualmie under Alternative 3.

Direct Impacts

Alternative 3 would be similar to Alternative 2 because the three new culverts would be installed in the exact same locations. These culverts would be sized to pass water from 100-year storm events with considerations for sediment and debris likely to be encountered. Management Requirements MR3, MR9, and MR10 as well as Other Management Provision OMP9 (see Table 2.4-2) would be implemented during culvert installation. These measures, in tandem with the MDP Implementation Plan (which outlines the sequence of events that are to occur before, during, and after implementation of the MDP) would reduce channel down-cutting and sediment delivery to streams. Also like Alternative 2, four culverts would be removed under Alternative 3: three because of the decommissioning of road M-5 and one because of the daylighting of Beaver Lake Creek. The removal of culverts during these projects would result in long-term beneficial impacts to stream channels, including a decrease in the modified channel length parameter to below threshold, but would impact streams negatively in the short-term through instream disturbance and temporary sediment impacts.

Exactly as in Alternative 2, there are two new bridges proposed within the U. Yakima Watershed portion of the Study Area under Alternative 3. Bridge footings for both sites would be located outside of the floodprone areas of these streams and would not constrict or otherwise impact the channel. Management Requirements MR3, MR9, and MR10 as well as Other Management Provision OMP9 (see Table 2.4-2) would be implemented in tandem with the MDP Implementation Plan during culvert installation to reduce channel down-cutting and sediment delivery to streams.

Under Alternative 3, no new fords would be built, but the existing fords would receive maintenance, as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Alternative 3 would require the same amount (0.06 mile) of stream segment channelization within culverts, occurring in two places within the U. Yakima Watershed. Just like Alternative 2, one CV channel would be created near the bottom terminal of the proposed Mill Creek chairlift on the backside of Summit East and the other CV channel would be built upslope from the upper terminal of the realigned Little Thunder chairlift at Summit West.

The number of utility trenches crossing streams under Alternative 3 would be the same as under Alternative 2. Impacts to stream channels from utility trenching would be short-term because Management Requirement MR27 as well as Other Management Provisions OMP2, OMP9, and OMP14 (see Table 2.4-2) would be followed and the streambank would be stabilized as outlined in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Another direct impact to streams under Alternative 3 is the restoration of streams within the U. Yakima Watershed as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). Even though restoration projects are intended to improve stream and riparian vegetation zone functions, these restoration projects would result in temporary, direct impacts to stream channels from increased sediment delivery potential during project implementation. However in the long-term, these restoration projects would be beneficial to streams because their natural functions would be improved. Parameters would be reduced in several drainages due to the restoration projects, and one parameter would be decreased to below threshold in the Beaver drainage: modified channel length.

Indirect Impacts

The paving of Silver Fir Parking Lot 1 and Summit West Parking Lot 2 in Alternative 3 would indirectly impact streams within the U. Yakima Watershed by creating impervious surfaces that alter flow paths and the rate of drainage runoff as described in Section 4.3.3.1 – Upper Yakima River Watershed. The Stormwater Management Plan would incorporate paving, BMPs, and adaptive management to control sediment; removal/storage of plowed snow and monitoring of other sediment sources. These management activities would indirectly benefit stream channels by reducing sediment delivery.

As described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), other indirect impacts to streams in the U. Yakima Watershed under Alternative 3 would result from operation and maintenance activities that are described in Section 4.3.3.1 – Upper Yakima River Watershed. Routine operation and maintenance activities would benefit streams by reducing the potential for further erosion and sediment impacts to stream channels.

The slope stabilization projects within the U. Yakima Watershed, as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would result in beneficial long-term indirect impacts to stream channels because of the reduced sediment yield to nearby streams, and would result in reductions of DPC parameters for several drainages, but would not result in any decreases to below threshold for any parameter.

In the U. Yakima Watershed under Alternative 3, there would be 0.19 mile of new road built, while 0.37 mile of road would be restored to natural conditions, resulting in a road density of 4.71 mile/mile^2 (see Table 4.3.3-2), exactly the same as Alternative 2. The new road would indirectly impact stream channels over the long-term through increased potential for sediment delivery to streams from new road segments at stream crossings (bridges, culverts, and fords). These crossings could alter stream functions and the flow regime of the streams within the Summit South 7th field drainage. Like Alternative 2, any potential sediment yields from newly constructed roads that reach streams under Alternative 3 would be minimized through the implementation of Management Provisions MR15, MR24, and MR36 as well as Other

Management Provisions OMP2 through OMP5 (see Table 2.4-2). Restored road segments would indirectly adversely affect stream channels within the Summit South and Creek Run 7th field drainages over a short-term until the re-claimed road bed is completely revegetated and stabilized. The road decommissioning restoration projects would result in reductions in road density and road crossing density in several drainages, but would not result in decreases to below threshold.

As described in Alternative 2, the effects of sediment delivery on stream channel condition (e.g., bank erosion, pool filling, cobble embeddedness, etc.) within the U. Yakima Watershed are expected to decline with the implementation of ice inhibitor application (reducing road sanding), parking lot paving, and snow management in the base area under Alternative 3. Consequently, the management effects on sediment delivery and channel stability would be similar to those in Alternative 2, and long-term improvements in the condition of stream channels would be expected.

Other off-channel construction activities under Alternative 3 could impact channels indirectly if large quantities of sediment or other contaminants are transported to streams. These effects would be the same as Alternative 2 except that the Creek Run pod in Section 16 would not be built. Therefore, unlike Alternative 2, stream channels within the Creek Run 7th field drainage would not be impacted, and there would be less instability or reduction in the quantity and quality of aquatic habitat in the U. Yakima Watershed under Alternative 3. Indirect stream channel impacts would be reduced through Management Requirement MR15 as well as Other Management Provisions such as OMP2, OMP4, OMP7, and OMP11 (see Table 2.4-2) as well as the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Under Alternative 3, the proposed changes in vegetation communities within Riparian Buffers would increase ski trails and modified vegetation within Riparian Buffers by 6.36 acres from existing conditions. Meanwhile, 4.25 acres would be developed into base area and other support facilities (see Table 4.3.3-6). Approximately 0.63 mile of streambanks that are currently either naturally forested or naturally non-forested would be converted to streambanks with modified vegetation or developed areas under Alternative 3. These actions would indirectly impact the physical condition and ecological functions of streams over the long-term.

Wetlands

Summary

Alternative 3 project activities would impact 36 wetlands within the U. Yakima Watershed at The Summit-at-Snoqualmie. These actions would include 1.70 acres of clearing and 1.87 acres of grading (see Table 4.3.3-3), for a total of 3.57 acres of impacted wetlands. These totals contrast to the 2.19 acres of clearing and 1.90 acres of grading proposed under Alternative 2, which total 4.09 acres of impacted wetlands. These direct impacts would be a result of construction of lift terminals and towers, buildings, utility trenching, and the clearing and grading of land for ski trails. Indirect impacts to wetlands within the

U. Yakima Watershed at The Summit-at-Snoqualmie under Alternative 3 include application of the MgCl de-icer/ice-inhibitor, operation and maintenance activities, revegetation and stabilization measures, and construction activities on adjacent lands. All activities described above would result in long-term impacts to wetlands except for utility trenching and stabilization measures, which would be short-term impacts.

Direct Impacts

Implementation of Alternative 3 would result in similar impacts to 36 wetlands in the U. Yakima Watershed portion of the Study Area. In contrast to the 1.90 acres of grading in wetlands for Alternative 2, approximately 1.87 acres of wetlands would be directly impacted by grading activities, because there would be no development of the Creek Run chairlift. Approximately 1.06 acres of these grading impacts to wetlands could be avoided by flagging and surveying wetlands in the proposed impact areas. This information could be used in detailed construction plans that would facilitate the project design to avoid and minimize all unnecessary impacts to wetlands. As a result, there would be less actual impact during project implementation than is currently identified and disclosed through GIS analysis alone.

Under Alternative 3, activities that require the clearing of vegetation without grading are similar to Alternative 2 except that the Creek Run chairlift and corresponding runs would not be built. Therefore there would be only 1.70 acres of clearing, which is less clearing in wetlands than the 2.19 acres of clearing proposed under Alternative 2. Under Alternative 3, approximately 0.89 acre of these clearing impacts to wetlands could be avoided by flagging and surveying wetlands in the proposed impact areas. This information would be used in detailed construction plans that would facilitate the project design to avoid and minimize all unnecessary impacts to wetlands. Thus, there would be less actual impact during project implementation than is currently identified and disclosed through GIS analysis alone.

Under Alternative 3, the same area of wetlands would be impacted by utility trenching as under Alternative 2. There would be no long-term loss of wetland acreage or wetland function due to utility trenching because the wetland area would be restored immediately after installation of the utility line. Trenching impacts to wetlands may be avoided by trenching around wetlands where possible. The use of Management Requirement MR24 and Other Management Provisions such as OMP7, OMP14, and OMP16 (see Table 2.4-2) would also minimize the potential impacts to wetland functions from utility trenching.

In Alternative 3, the restoration of Wetland #207 and Wetland #142, would be performed in conjunction with tree island revegetation at Summit West and Summit Central respectively. These actions would have a beneficial direct impact by restoring wetland functions such as the hydrologic regime, shading, and nutrient and carbon cycling to more natural conditions. The wetland restoration projects would decrease the Riparian Buffers in non-natural condition parameter, but not to below the threshold.

Indirect Impacts

Operational and maintenance activities that could impact wetlands under Alternative 3 are the same as those described under Alternative 2.

The potential for sediment delivery to wetlands would be increased during construction in the Riparian Buffers of wetlands. Implementation of Management Requirement MR24 and Other Management Provisions such as OMP7, OMP14, and OMP16 (see Table 2.4-2), and the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would mitigate this increase, and would minimize the potential for indirect impacts such as sediment delivery from Riparian Buffers to wetlands.

Application of MgCl as well as paving the parking lots under Alternative 3 could potentially indirectly impact the large wetland complexes and individual wetlands in these areas in both beneficial and negative ways, as described in Alternative 2.

Water Quantity

Summary

Under Alternative 3, no snowmaking is proposed, and there would be no new groundwater or surface water withdrawals. Therefore, no change in water rights would take place. The wastewater disposal technique remains via sewer under SPUD. This would be the primary groundwater-related operational impact that would occur under Alternative 3.

In Alternative 3, the main change in land use patterns from Alternative 2 would be in Section 16 where land would be cleared and graded in order to install Rampart chairlift and its respective pod. Unlike Alternative 2, there would be no Creek Run chairlift. Several of the existing ski trails at Summit East in Section 16 would be revegetated with saplings.

Indirect Impacts

Approximately 550.37 acres of the Study Area within the U. Yakima Watershed (29 percent of land cover) would remain as hydrologically mature forest under Alternative 3. Because of proposed development and restoration, 34.2 acres of land cover would be converted to hydrologically immature land, which includes naturally non-forested areas, young saplings planted for restoration, and ski trails (both new and existing) consisting of modified shrubs and herbaceous vegetation (see Table 4.3.3-4). The creation of ski trails and other development clearing would therefore increase the amount of immature land cover in the U. Yakima Watershed portion of the Study Area by 2.6 percent. Land conversions (ski trails, impervious areas) would likely generate a slight net export of water from the U. Yakima Watershed. Differences in land cover between Alternative 1 and Alternative 3 may indirectly affect snow accumulation and snowmelt locally, which could affect the runoff patterns of the Watershed.

Construction techniques, including the embedding of coarse woody debris within the ground surface, along with Other Management Provisions OMP25, OMP26, and OMP33 would minimize any localized increase in sheet flow on construction sites during and after construction (see Table 2.4-2). Under current maintenance practices at The Summit-at-Snoqualmie, modified vegetation would continue to be maintained in a hydrologically immature condition to support ski area management. Water from these areas generally runs off quickly to streams. Several streams within the U. Yakima Watershed portion of the Study Area are typically ephemeral or intermittent at this elevation, and given that source protection measures are included in the construction techniques and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, the effects of lift and trail construction would not result in any measurable increase in flow in either Coal Creek or Mill Creek. Therefore, no water quantity impacts are expected within the U. Yakima Watershed.

Flow Model

The results of the flow model are displayed in Table 4.3.3-5. As shown, the streamflow characteristics of the 7th field drainages would differ from Alternative 2, because of differences in forest clearing and creation of impervious surfaces as proposed under Alternative 3. Differences would occur in the Creek Run, Hyak, and Summit South drainages. There would be no difference in predicted streamflow between Alternatives 2 and 3 for the Beaver Lake, Lower Mill Creek, Ski Acres, Tunnel, and Upper Mill Creek 7th field drainages.

As described in Section 4.3.3.1 – Upper Yakima River Watershed, these small streamflow increases are typical of the types of streams in the 7th field drainages. In addition, any local increase in streamflow in the U. Yakima Watershed from the 5.58 acres of new impervious surfaces is expected to be mitigated through BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Water Quality

Summary

Under Alternative 3, sediment delivery to streams would occur at 89 stream crossings (culverts, bridges, fords) and 13 utility crossings that would exist after project construction, which could result in increased turbidity. Temperature and dissolved oxygen could increase due to the mature and immature forest removed along streambanks. The pH of streams could increase under Alternative 3 due to the construction of 4.25 acres of impervious surfaces within Riparian Buffers. Other water pollution constituents, such as oil and grease, are expected to decrease under Alternative 3 due to the implementation of the Stormwater Management Plan. After implementation of all projects in Alternative 3, water quality levels would likely remain close to current conditions. Proper installation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 would reduce the probability of water quality exceedences.

Direct Impacts

Under Alternative 3, there would be three new culverts installed in streams within the U. Yakima Watershed: one in the Lower Mill Creek drainage near the bottom terminal of the Mill Creek chairlift, one in the Summit South drainage near the bottom terminal of the Rampart chairlift, and one in the Tunnel Creek drainage near the bottom terminal of the Easy Street chairlift. The installation of two new bridges in Alternative 3 would also result in direct impacts, both short-term and long-term, to water quality. One bridge would be installed where Trail 55B crosses Stream A and the other bridge would be built where Trail 71 crosses Hyak Creek. The construction of culverts and bridges would likely result in a short-term increase of sediment delivery and turbidity in the streams due to construction within the stream channel. Over the long-term, the presence of bridges and culverts in streams could result in increased potential for sediment mobilization and turbidity in the respective drainages. Implementation of BMPs and Management Requirements MR3, MR9, MR10 as well as Other Management Provisions such as OMP9, and OMP10 (see Table 2.4-2) would minimize the effect of sediment delivery and increased turbidity on the downstream waters.

Under Alternative 3, the construction of 13 utility crossings in surface waters within the U. Yakima Watershed would result in short-term, direct impacts to water quality. The impacts to water quality in the U. Yakima Watershed that are incurred during the construction of utility crossings are described under Alternative 2. The implementation of BMPs such as mulching, installation of erosion and sediment control devices, and re-establishment of ground cover and shrub vegetation would minimize the effect of sediment delivery and increased turbidity on the downstream waters. Under project build-out in Alternative 3, turbidity levels would likely remain below SWQS. Proper installation of BMPs, Management Requirement MR27 as well as Other Management Provisions OMP2, OMP9, OMP14 (see Table 2.4-2) would further reduce the possibility of exceedences.

Under Alternative 3, construction of lift terminals and the lift towers, which include their concrete bases, would occur within the Riparian Buffers of all the 7th field drainages of the U. Yakima Watershed except for the Creek Run drainage. The pH of streams within these drainages could be affected as described under Alternative 2. Because the potential for the change in pH of surface waters would increase, the use of Management Requirements MR15, MR16, and MR36 (see Table 2.4-2) would minimize the chance of high pH runoff entering the streams, and thereby maintain the current pH levels within streams in the U. Yakima Watershed. Another potential water quality impact that could occur during construction activities within Riparian Buffers under Alternative 3 would be the contamination of surface water by petroleum products if equipment working in or adjacent to streams experiences fuel leaks or hydraulic system failures. All stream crossing structure locations have the potential for increased pollutant (e.g., fuel) and sediment delivery during construction activities under Alternative3, however, development of a SWPPP and the implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 would minimize the potential for any short-term, indirect delivery of pollutants to streams.

Beneficial impacts to surface water quality would result from the implementation of the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan). Implementation would limit sediment delivery to streams from sources such as road sanding as described in Alternative 2. Under implementation of the Stormwater Management Plan, the water quality of adjacent and nearby streams would improve because of decreases in sediment delivery and oil and grease contents.

As reported in Alternative 2, the Upper South Fork Snoqualmie River and Coal Creek Watershed Condition Assessment (Jones & Stokes 2001) suggests that management objectives for water quality are currently being met under ski area operations for all parameters in the S.F. Snoqualmie and U. Yakima Watersheds, with the following exceptions: temperature, dissolved oxygen, and turbidity in some streams within drainages in the U. Yakima Watershed. Under Alternative 3, impacts to these water quality parameters would likely be less than as described in Alternative 2 because the Creek Run pod would not be constructed in Section 16.

Indirect Impacts

Under Alternative 3, the acreage of mature and immature forests in Riparian Buffers would increase by 0.59 acre because of the Mill Creek land donation and the widening of Riparian Buffers in this parcel to NWFP specifications. Utility trenching would occur in Riparian Buffers, which would result in an increased potential for indirect sediment impacts to streams caused by proposed activities. Sediment impacts from construction activities would increase the turbidity in streams in the short-term. In the long-term, these turbidity impacts would likely be reduced to background levels as a result of successful implementation of BMPs and Management Requirements MR2, MR14 as well as Other Management Provisions OMP12, OMP13, and OMP15 (see Table 2.4-2) which would minimize turbidity impacts to streams.

Land cover changes in the Riparian Buffers due to activities proposed under Alternative 3 could also indirectly affect the temperature of the streams as described in Alternative 2. The current stream temperatures within the reaches in the Study Area would likely remain the same as existing conditions or increase slightly for all streams under Alternative 3. In drainages, such as Stream B and Tunnel Creek, where small areas of trees would be removed from alongside the streambank, no temperature increase is likely due to the small area of proposed activities. Since water temperature and dissolved oxygen are directly correlated, Alternative 3 would also likely maintain the existing stream dissolved oxygen concentrations for all streams within the U. Yakima Watershed portion of the Study Area.

Under Alternative 3 The Summit-at-Snoqualmie would implement the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan), which is described in Alternative 2. With Alternative 3's implementation of the Stormwater Management Plan, long-term detrimental impacts to water quality from sand, oil, and grease from polluted stormwater runoff parking lots would be reduced from existing conditions.

With implementation of the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and other specific Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 under Alternative 3, there would be several beneficial impacts to water quality within the U. Yakima Watershed, as described in Alternative 2. Under Alternative 3, 0.37 mile of road would be decommissioned and the three culverts under this road in would be removed, reducing culverted stream length. Also under Alternative 3, tree islands are proposed at Summit East, Summit Central, and Summit West. Once these tree islands are healthy and established, they would help stabilize the soils in these areas. Under Alternative 3, in addition to the restoration project to daylight Beaver Lake Creek, a second stream channel would be restored next to the tubing area, as described further in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). These restoration projects would result in a decrease in DPC parameters, including modified channel length, culverted channel length and stream length with management concerns in the Beaver drainage. One parameter, modified channel length, would be reduced to below threshold in the Beaver drainage due to the daylighting of Beaver Lake Creek and stream channel restoration near the tubing area (see Table 4.3.4-1). Wetlands restoration and all revegetation proposed under Alternative 3 are also described in the MDP Implementation Plan.

Riparian Buffers

Summary

Under Alternative 3, the total area of developed impervious surfaces within Riparian Buffers in the U. Yakima Watershed portion of the Study Area would increase by 4.25 acres. This represents approximately 0.7 percent of the total Study Area Riparian Buffer acreage within the U. Yakima Watershed. Under Alternative 3, the total Study Area culverted stream mileage would reach approximately 1.9 miles of streams in the U. Yakima Watershed portion of the Study Area, an increase of 0.06 mile. This includes the 74 culverted stream crossings. Under Alternative 3, 0.19 mile of new road would be built within Riparian Buffers. Meanwhile, 0.35 mile of streambank would be converted from natural conditions to modified and developed conditions. Through implementation of the Stormwater Management Plan, sediment yield to streams within the U. Yakima Watershed would decrease under Alternative 3.

Direct Impacts

Direct impacts to Riparian Buffers under Alternative 3 would be less than in Alternative 2 because of there is no development of ski trails or lifts in the Creek Run pod. As displayed in Table 4.3.3-6, 4.25 acres of impervious surfaces would be developed under Alternative 3 within Riparian Buffers in the U. Yakima Watershed portion of the Study Area. This represents approximately 0.7 percent of the total Riparian Buffer area within that portion of the Study Area within the U. Yakima Watershed. 74 culverted stream crossings would directly impact the Riparian Buffers under Alternative 3, by constraining streams, providing sites of increased sediment recruitment and erosion concerns, and eliminating most riparian functions. In Alternative 3, approximately 1.90 miles of streams in the U. Yakima Watershed portion of

the Study Area do not have functioning Riparian Buffers because they have been placed in culverts, including the 74 culverted stream crossings. Clearing and grading activities within Riparian Buffers would be minimized through implementation of Management Requirements MR2, MR14, as well as Other Management Provisions OMP12, OMP13, and OMP15 (see Table 2.4-2).

Of the 17.32 linear miles of streambanks under Alternative 3 (two sides to 8.66 miles of streams), 7.89 miles (45 percent) would remain under natural mature and immature forest cover, 0.81 mile (5 percent) would remain in natural nonforest cover, 4.99 miles (29 percent) would adjoin ski trails and other modified vegetation, and 0.27 mile (2 percent) would be adjacent to developed areas. These impacts to Riparian Buffers and their associated stream functions would be less than under Alternative 2 after implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Indirect Impacts

Under Alternative 3, the short-term detrimental and long-term beneficial impacts from the restoration projects listed and described in the MDP Implementation (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and the Stormwater Management Plan would be the same as described under Alternative 2. This includes the reduction of the modified channel length parameter to below threshold in the Beaver drainage (see Table 4.3.4-1).

Indirect impacts to Riparian Buffers such as windthrow potential, noxious weed establishment, and mass wasting potential under Alternative 3 would be similar to conditions described in Alternative 2.

4.3.4.2 South Fork Snoqualmie River Watershed

Streams

Summary

Within the S.F. Snoqualmie Watershed under Alternative 3, there would be 17 stream crossings (culverts, bridges, and/or fords), 0.29 mile of culverted channels, 0.99 mile of ditches conveying streamflow, 4 new utilidor crossings, and 6 new trenched utility crossings, all of which would directly impact stream channels, mostly in the long-term. However, some short-term effects would also occur. Indirect impacts to streams under Alternative 3 include the removal of 6.45 acres of mature and immature forest within Riparian Buffers due to clearing and grading activities and the construction of 1.94 acres of impervious surfaces within Riparian Buffers that could modify the flow paths of runoff and erosion patterns. Beneficial impacts include the application of MgCl to paved parking lots. Use of MgCl would reduce the need for sanding, thereby decreasing the amount of sediment transported to streams and reducing the fill of pools in streams.

Drainages of Particular Concern Analysis

Under Alternative 3, there would be one new threshold exceedence within the S.F. Snoqualmie Watershed portion of the Study Area, in comparison to Alternative 1:

- Northside (Stream length with management concerns – 83.13 percent [see Table 4.3.4-2]

Table 4.3.4-2:
Summary of DPC Analysis of Watershed Conditions for Alternative 3 in the South Fork Snoqualmie River Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	North-side	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)	**N/A**	**49.02**	**72.08**	**270.07**	**89.34**	**318.62**	**214.58**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.13	94.17	43.31	27.26	40.19	11.36
Change from Alternative 1 (% of total)		1.66	10.27	2.19	0.04	1.22	0.05
Stream Length w/ Management Concerns (% of total)	10	33.68	75.50	3.75	3.89	23.19	3.99
Change from Alternative 1 (% of total)		33.68	25.74	1.30	0.00	1.79	0.01
Road Density (miles/square mile)	3	5.48	7.02	0.50	0.68	1.70	2.35
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.00	0.00	0.00
Road Crossing Density (number/square mile)	6	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Impervious Cover (% of total)	8	1.89	17.73	0.24	0.23	1.95	2.68
Change from Alternative 1 (% of total)		0.25	3.47	0.03	0.00	0.03	0.00
Modified Channel Length (% of total)	8	0.00	76.34	1.96	0.00	22.20	5.50
Change from Alternative 1 (% of total)		0.00	-12.08	0.00	0.00	-2.97	0.01
Culverted Channel Length (% of total)	8	0.00	23.66	0.00	0.00	3.97	0.36
Change from Alternative 1 (% of total)		0.00	12.08	0.00	0.00	0.13	0.00
Parameters over Threshold		**3**	**7**	**1**	**1**	**4**	**1**
Change from Alternative 1		**1**	**0**	**0**	**0**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

In general, the impacts to drainages in the S.F. Snoqualmie Watershed under Alternative 3 would be very similar to those described for Alternative 2. The impacts to the Northside, Summit North, and the other drainages would be exactly the same as described under Alternative 2 (see Table 4.3.4-2). For the Riparian Buffers in a non-natural condition and stream length with management concerns parameters, the proposed impacts in the International drainage would be slightly less than those proposed under Alternative 2. In comparison to the Proposed Action, there would be a reduction in clearing and grading, because the *Pulse Gondola* would not be constructed (see Table 4.3.4-2). The impacts to Riparian Buffers would also be reduced under Alternative 3 in the Upper Alpental drainage. As a result, the exceedence of this parameter that would occur under Alternative 2 would *not* occur under Alternative 3. Finally, the impacts to Riparian Buffer in the Nacrinomical drainage would be reduced as compared to Alternative 2. However, this threshold is exceeded in all alternatives including the No Action Alternative (see Table 4.3.4-2).

Under Alternative 3, The Summit-at-Snoqualmie would implement the MDP Implementation Plan, Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, which includes restoration projects such as slope stabilization, road deactivation, revegetation, and stream and wetland restoration. These restoration projects would help to address areas of concern identified in the DPC analysis. These restoration projects would result in decreases to several DPC parameters, including modified channel length, stream length with management concerns, and Riparian Buffers in a non-natural condition, for several drainages. However, the restoration projects would not result in any parameter decreases to below threshold in any drainage (see Table 4.3.4-2). These restorations, outlined in Section 5.0 - Restoration of Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, incorporate the concepts of creation, enhancement, revegetation, and road deactivation activities as means to achieve restoration. Tables 5-1 and 5-2 in Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, outline and describe the restoration projects that would be required by the USFS and implemented by The Summit-at-Snoqualmie under Alternative 3.

Direct Impacts

Direct impacts to stream channels within the S.F. Snoqualmie Watershed under Alternative 3 would be exactly the same as described under Alternative 2. Management Requirements MR2, MR8, MR9, MR10 as well as Other Management Provision OMP9 (see Table 2.4-2), in tandem with the MDP Implementation Plan, would be implemented during culvert installation to reduce channel down-cutting and sediment delivery to streams. Under Alternative 3, there would be no culvert removal within the S.F. Snoqualmie Watershed. No new bridges or fords are proposed within the S.F. Snoqualmie Watershed portion of the Study Area either. However, existing bridges and fords would undergo regular maintenance as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Alternative 3 would also require the channelization of stream segments, resulting in a CV channel class, via the placement of culverts in two places within the S.F. Snoqualmie Watershed. Both CV channels would be created to convey 0.07 mile of stream segments under Summit West Parking Lot 1. Management Requirement MR8 from Table 2.4-2 would be implemented during culvert installation to reduce channel down-cutting and sediment delivery to streams in tandem with the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), which outlines the sequence of events to occur before, during, and after implementation of the MDP.

Just as in Alternative 2, the trenching of utilities would directly impact streams under Alternative 3, although it would only be over a short-time period. Within the S.F. Snoqualmie Watershed there would be six crossings of streams by utility trenching. These new utility crossings would directly impact streams as described in Section 4.3.3.1 – Upper Yakima River Watershed. Impacts to stream channels from utility trenching would be short-term because Management Requirement MR27 as well as Other Management Provisions such as OMP2, OMP9, and OMP14 (see Table 2.4-2) would be followed and the streambank would be stabilized as outlined in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Under Alternative 3, there would be no direct impact to streams within the S.F. Snoqualmie Watershed as a result of stream restoration. While several DPC parameters would be improved, no parameter would be reduced to below threshold in any drainage (see Table 4.3.4-2).

Indirect Impacts

The paving of Parking Lots 3, 4, 5, 6, and 7 at Alpental, and Parking Lot 1 at Summit West under Alternative 3 would have the same indirect impacts to streams within the S.F. Snoqualmie Watershed as described in Alternative 2.

As described in further details in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), other indirect impacts to streams in the S.F. Snoqualmie Watershed under Alternative 3 would occur from operation and maintenance activities that are described in Section 4.3.3.1 – Upper Yakima River Watershed. The results of operation and maintenance activities would be beneficial to streams if performed on a routine basis, reducing the potential for further erosion and sediment impacts to stream channels.

In the S.F. Snoqualmie Watershed under Alternative 3, there would be 0.01 mile of new road built. At 1.99 mile/mile^2, the road density would be the same as Alternative 2 (see Table 4.3.3-8). The indirect impacts to stream channels and the Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 used to prevent these impacts would be exactly the same as described in Section 4.3.3.2 - Trails.

The impacts of sediment delivery on stream channel conditions are expected to decline under Alternative 3 due to the use of the ice inhibitor MgCl as described in Alternative 2. Consequently sediment delivery and channel stability impacts on streams within the S.F. Snoqualmie Watershed under Alternative 3 would be reduced in the long-term, which would benefit the condition of stream channels.

Other off-channel construction activities could impact channels indirectly if large quantities of sediment or other contaminants are transported to streams. This would also occur under Alternative 3 at Summit West and Alpental during the grading and paving of parking lots as described in Alternative 2. These indirect stream channel impacts would be reduced through Management Requirements MR15, Other Management Provisions OMP2, OMP4, OMP7, and OMP11 (see Table 2.4-2) as well as the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Within the S.F. Snoqualmie Watershed, Alternative 3 would increase ski trails and modified vegetation within Riparian Buffers by 1.38 acres, and an additional 1.94 acres would be developed into base areas and other support facilities (see Table 4.3.3-12), the same as described under Alternative 2.

Wetlands

Summary

Under Alternative 3, there would be 13 wetlands impacted within the S.F. Snoqualmie Watershed, which would include 0.84 acre of clearing and 0.87 acre of grading (see Table 4.3.3-9), for a total of 1.71 acres of impacted wetlands. This contrasts with 0.86 acre of clearing and 0.88 acre of grading, for a total of 1.74 acres of impacted wetlands under Alternative 2. Direct impacts would be a result of construction of lift terminals and towers, buildings, utility trenching, and the clearing and grading of land for ski trails. Indirect impacts to wetlands within the S.F. Snoqualmie Watershed at The Summit-at-Snoqualmie under Alternative 3 include application of the MgCl de-icer/ice-inhibitor, operation and maintenance activities, revegetation and stabilization measures, and construction activities on adjacent lands. All activities described above would result in long-term impacts to wetlands. The exception would be for utility trenching and stabilization measures, which would be short-term impacts.

Direct Impacts

Implementation of Alternative 3 would result in 0.03 acre less of impacts to wetlands in the S.F. Snoqualmie Watershed portion of the Study Area than Alternative 2 because the gondola and mountain-top restaurant and accompanying utility lines to the top of Alpental would not be constructed. Approximately 0.31 acre of the 0.87 acre grading impacts to wetlands could be avoided by flagging and surveying wetlands in the proposed impact areas. This information could be used in detailed construction plans that would facilitate the project design to avoid and minimize unnecessary impacts to wetlands. Consequently, there would be less actual impacts during implementation than are currently identified and disclosed through GIS analysis alone.

Activities that involve clearing of vegetation but no grading under Alternative 3 would result in 0.02 acre less impact to wetlands than Alternative 2 since the gondola and utility corridor to the top of Alpental would not be built. None of the 0.84 acre of clearing impacts to wetlands under Alternative 3 could be avoided or minimized during field planning for project implementation.

Under Alternative 3, the gondola and mountain-top restaurant would not be constructed, therefore no utility trenching would occur. No utilidor would be routed to the top of Alpental. Thus, the acreage of wetlands impacted due to utility trenching would be less than Alternative 2. There would be no long-term loss of wetland acreage or wetland function due to utility trenching because the wetland area would be restored immediately after installation of the utility line. Trenching impacts to wetlands would be avoided by trenching around wetlands where possible. The use of Management Requirement MR24 as well as Other Management Provisions such as OMP7, OMP14, and OMP16 (see Table 2.4-2) would also minimize the potential impacts to wetland functions from utility trenching.

Indirect Impacts

Operational and maintenance activities that could impact wetlands under Alternative 3 are the same as those described under Alternative 2.

Under Alternative 3, grading would take place in Riparian Buffers of wetlands in the same places as Alternative 2 except that no grading would occur for the gondola or utilidor. The potential for sediment delivery to wetlands would be increased during construction. However, implementation of BMPs, Management Requirement MR23 as well as Other Management Provisions OMP7, OMP14, and OMP16 (see Table 2.4-2), and the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would minimize the potential for these indirect impacts.

Application of MgCl as well as paving the parking lots under Alternative 3 could potentially indirectly impact the large wetland complexes and individual wetlands in these areas both beneficially and negatively as described in Alternative 2.

Water Quantity

Summary

Under Alternative 3, no snowmaking is proposed. Therefore there would be no new groundwater or surface water withdrawals, and no change in water rights would take place. The wastewater disposal technique would remain via sewer under SPUD, and represents the primary groundwater-related operational impact that would occur under Alternative 3.

Indirect Impacts

Approximately 475 acres of the Study Area within the S.F. Snoqualmie Watershed (47 percent of land cover) would remain as hydrologically mature forest under Alternative 3. Because of proposed

development and restoration, 6.82 acres of land cover would be converted to hydrologically immature land, which includes naturally non-forested areas, young saplings planted for restoration, and ski trails (both new and existing) consisting of modified shrubs and herbaceous vegetation (see Table 4.3.3-10). The creation of ski trails and other development vegetation removal would therefore increase the amount of immature land cover in the S.F. Snoqualmie Watershed portion of the Study Area by 0.6 percent. Land conversions (ski trails, impervious areas) would likely generate a slight net export of water from the S.F. Snoqualmie Watershed. Differences in land cover between Alternative 1 and Alternative 3 may indirectly affect snow accumulation and snowmelt locally, which could affect the runoff patterns of the Watershed.

Construction techniques, including the embedding of coarse woody debris within the ground surface, along with Other Management Provisions OMP25, OMP26, and OMP33 would minimize localized increases in sheet flow on construction sites during and after construction (see Table 2.4-2). Under current maintenance practices at The Summit-at-Snoqualmie, modified vegetation would continue to be maintained in a hydrologically immature condition to support ski area management. Water from these areas generally runs off quickly to streams. Considering that several streams within the S.F. Snoqualmie Watershed portion of the Study Area are typically ephemeral or intermittent at this elevation, and given that source protection measures are included in the construction techniques and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, the effects of lift and trail construction would not result in any measurable increase in flow in the S.F. Snoqualmie River. Thus, no water quantity impacts are expected within the S.F. Snoqualmie Watershed.

Flow Model

The results 7of the flow model are displayed in Table 4.3.3-11. As shown, International and Upper Alpental are the 7th field drainages whose streamflow would change because of forest clearing and creation of new impervious surfaces under Alternative 3 as compared to Alternative 2. Meanwhile, there would be no change the streamflow between Alternatives 2 and 3 in the Nacrinomical, Northside, and Summit North 7th field drainages.

As described in Section 4.3.3.1 – Upper Yakima River Watershed, these small amounts of streamflow increases are typical of the types of streams in the 7th field drainages. In addition, local increases in streamflow in the S.F. Snoqualmie Watershed from the 2.77 acres of new impervious surfaces are expected to be mitigated through BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Water Quality

Summary

Under Alternative 3, sediment delivery to streams within the S.F. Snoqualmie Watershed would occur at 17 stream crossings (culverts, bridges, fords) and six utility crossings. Incidents of sediment delivery could result in increased turbidity. Temperature and dissolved oxygen could increase due to the 0.57 mile

of mature and immature forest removed along streambanks. The pH of streams could increase under Alternative 3 due to the construction of 1.94 acres of impervious surfaces within Riparian Buffers. Other water pollution constituents, such as oil and grease, are expected to decrease under Alternative 3 due to the implementation of the Stormwater Management Plan. After implementation of all projects in Alternative 3, water quality levels would likely remain close to current conditions. Implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 would reduce the probability of potential water quality exceedences.

Direct Impacts

Under Alternative 3, there would be one new culvert installed within the U. Yakima Watershed; an unnamed stream that would be culverted under Alpental Parking Lot 7. Impacts to the S.F. Snoqualmie Watershed from this culvert are described in Alternative 2. Implementation of BMPs and Management Requirements such as MR3, MR9, and MR10 as well as Other Management Provision OMP9 (see Table 2.4-2) would reduce water quality impacts to streams as a result of this culvert installation.

The construction of six utility crossings in surface waters within the S.F. Snoqualmie Watershed would result in short-term, direct impacts to water quality. Impacts due to the construction of utility crossings are described in Section 4.3.3.1 – Upper Yakima River Watershed. Implementation of BMPs such as mulching, installation of erosion and sediment control devices, and re-establishing ground cover and shrub vegetation would minimize the effect of sediment delivery and increased turbidity on the downstream waters. Under implementation of Alternative 3, turbidity levels would likely remain below SWQS. Proper implementation of BMPs and Management Requirement MR27 as well as Other Management Provisions OMP2, OMP9, and OMP14 (see Table 2.4-2) would reduce the possibility of exceedences.

The impacts of increased pH and petroleum products to the S.F. Snoqualmie Watershed in Alternative 3 are exactly the same as described under Alternative 2. Implementation of a required SWPPP, to be developed, and the implementation of BMPs and Management Requirements MR14, MR15, MR16, and MR36 as well as Other Management Provisions OMP13, OMP15, and OMP17 (see Table 2.4-2) would minimize the potential for any short-term, indirect delivery of pollutants to streams that would affect the water quality in the S.F. Snoqualmie Watershed under Alternative 3.

Implementation of the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan), which is described in more detail under Alternative 2, would carry various beneficial impacts to surface water quality.

No exceedences of water quality standards for fecal coliform are expected under Alternative 3. Temperature and dissolved oxygen are not currently a concern within the S.F. Snoqualmie Watershed.

Under Alternative 3, the dissolved oxygen standards would continue to be met within the S.F. Snoqualmie Watershed. Dissolved oxygen is partly dependent on water temperature, with colder temperatures enabling higher dissolved oxygen concentrations. Under Alternative 3, the dissolved oxygen is not expected to decrease significantly and any impacts on fish would be negligible (see Section 4.4 - Fisheries).

Indirect Impacts

Under Alternative 3, 6.45 acres of mature and immature forests would be cleared and graded in Riparian Buffers, including utility trenching. All of these activities would result in an increased potential for indirect sediment impacts to streams. Sediment impacts from the construction activities listed above would increase the turbidity in streams usually in the short-term. Over the long-term, turbidity would likely be reduced to background levels following successful implementation of BMPs and Management Requirements MR2 and MR14 as well as Other Management Provisions such as OMP12, OMP13, and OMP15 (see Table 2.4-2) which would minimize delivery of sediment to streams.

Water temperature in streams cumulatively reflects the temperature inputs of tributary waters. Therefore, temperature typically becomes higher as the water flows downstream. Existing conditions exhibit limited canopy coverage along streams. Due to the limited areas of vegetation removal associated with MDP Implementation, the current stream temperatures within the Study Area would likely remain the same as existing conditions or increase slightly for all streams. Alternative 3 would likely maintain the existing stream dissolved oxygen concentrations for all streams within the S.F. Snoqualmie Watershed portion of the Study Area, since levels of dissolved oxygen are a function of water temperature, and temperatures would be likely to remain the same.

Under Alternative 3, The Summit-at-Snoqualmie would implement the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan). This plan calls for the paving of Summit West Parking Lot 1, Alpental Parking Lots 3, 4, 5, 6, and 7, and the portion of Alpental Road along these parking lots. In addition, a new treatment train for water flowing off the parking lots would improve water quality by collecting oil and grease, and retaining sediment. With implementation of the Stormwater Management Plan, long-term detrimental impacts to water quality from sand, oil, and grease from polluted stormwater runoff from parking lots would be reduced under Alternative 3.

Implementation of the MDP Implementation Plan and other specific Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, there would result in several beneficial impacts to water quality within the S.F. Snoqualmie Watershed under Alternative 3. These are described in more detail under Alternative 2.

Riparian Buffers

Summary

In Alternative 3, 1.94 acres of impervious surfaces would be developed within Riparian Buffers in the S.F. Snoqualmie Watershed. This represents approximately 0.7 percent of the total Riparian Buffer area within the Study Area. Approximately 0.29 mile of streams in the S.F. Snoqualmie Watershed portion of the Study Area would be placed in culverts, including the 17 culverted road crossings. Under Alternative 3, 0.01 mile of new road would be built within Riparian Buffers and 6.45 acres of mature and immature forested Riparian Buffers would be converted into other vegetation community types. 0.06 mile of streambank would be converted from natural conditions to modified and developed conditions. Through implementation of the Stormwater Management Plan, sediment yield to streams within the S.F. Snoqualmie Watershed would decrease under Alternative 3.

Direct Impacts

Direct impacts to Riparian Buffers under Alternative 3 would be the same as described in Alternative 2 with one exception: the gondola at Alpental would not be built, eliminating associated impacts within Riparian Buffers. As displayed in Table 4.3.3-12, 1.94 acres of impervious surfaces would be developed under Alternative 3 within Riparian Buffers in the S.F. Snoqualmie Watershed portion of the Study Area. This represents approximately 0.7 percent of the total Riparian Buffer area within that portion of the Study Area in the S.F. Snoqualmie Watershed. Seventeen culverted stream crossings would directly impact the Riparian Buffers, constraining streams, providing sites of increased sediment recruitment and erosion concerns, and eliminating most riparian functions. In Alternative 3, approximately 0.29 mile of streams in the S.F. Snoqualmie Watershed portion of the Study Area would not have functioning Riparian Buffers because they have been placed in culverts, including the 13 culverted stream crossings. Under Alternative 3, 6.45 acres of mature and immature forested Riparian Buffers would be lost due to construction of ski trails, lift terminals, buildings, roads, and parking lots (see Table 4.3.3-12). Clearing and grading activities within Riparian Buffers would be minimized through implementation of Management Requirements MR2, MR14 as well as Other Management Provisions OMP12, OMP13, and OMP15 (see Table 2.4-2).

Of the linear 9.87 miles of streambanks within the S.F. Snoqualmie Watershed (two sides to 4.94 miles of streams), under Alternative 3, approximately 4 miles (41 percent) would remain under natural mature and immature forest cover, 2.78 miles (28 percent) would remain in natural nonforest cover, 2.81 miles (28 percent) would adjoin ski trails and other modified vegetation, and 0.25 mile (2.5 percent) would be adjacent to developed areas. These impacts to Riparian Buffers and their associated stream functions would be less than under Alternative 2 after implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Indirect Impacts

Under Alternative 3, the long-term beneficial and short-term detrimental impacts from the restoration projects listed and described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and the Stormwater Management Plan would the same as described under Alternative 2. However, the restoration project would only result in reductions in DPC parameters for several drainages, but would not reduce parameters to below threshold for any drainage (see Table 4.3.4-2).

Indirect impacts to Riparian Buffers such as windthrow potential, noxious weed establishment, and mass wasting potential under Alternative 3 would be similar to conditions described in Alternative 2.

4.3.5 Impacts – Alternative 4

See Figures 2.3.5-1, Alternative 4 Proposed Conditions – The Summit and 2.3.5-2, Alternative 4 Proposed Conditions - Alpental for the proposed conditions under Alternative 4 at both The Summit and Alpental.

4.3.5.1 Upper Yakima River Watershed

Streams

Summary

Under Alternative 4, there would be 86 stream crossings (culverts, bridges, and/or fords), 1.90 miles of culverted channels, 0.83 mile of ditches conveying streamflow, and 11 new trenched utility crossings, all of which would directly impact stream channels within the U. Yakima Watershed. Indirect impacts to streams under Alternative 4 include the removal of 7.56 acres of mature and immature forest within Riparian Buffers due to clearing and grading activities, and construction of 2.91 acres of impervious surfaces within Riparian Buffers. Under Alternative 4, application of MgCl to I-90 and SR 906 would continue, and MgCl would also applied to parking lots Silver Fir 1, 2, 3, and 4 as well as Summit West 2 and 3. All of these parking lots would be paved, reducing the amount of sediment delivered to streams.

Drainages of Particular Concern Analysis

Under Alternative 4, there would be no new threshold exceedences, in comparison to Alternative 1 conditions.

Table 4.3.5-1:
Summary of DPC Analysis of Watershed Conditions for Alternative 4 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Thre-shold	Lower Mill Creek	Upper Mill Creek	Creek Run	Sum-mit South	Hyak	Tun-nel	Ski Acres	Beaver	Other
Area (acres)	**N/A**	**395.50**	**33.21**	**220.15**	**223.79**	**192.61**	**134.35**	**357.93**	**171.30**	**155.56**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.76	100.00	18.87	45.09	27.37	50.71	55.21	59.34	44.52
Change from Alternative 1 (% of total)		0.59	0.00	0.00	0.03	0.00	8.71	2.43	2.96	0.00
Stream Length w/ Management Concerns (% of total)	10	7.34	18.33	1.73	5.78	5.81	37.32	45.19	27.98	32.40
Change from Alternative 1 (% of total)		-0.44	0.00	-0.16	-0.81	0.00	10.09	0.72	-20.65	0.00
Road Density (miles/square mile)	3	7.43	2.90	2.25	5.08	2.78	11.77	8.80	7.68	1.66
Change from Alternative 1 (miles/square mile)		0.00	0.00	-0.27	-0.58	0.00	-0.57	-0.48	-0.97	0.00
Road Crossing Density (number/ square mile)	6	29.13	0.00	17.44	8.58	9.97	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	-2.90	-5.71	0.00	4.80	0.02	-3.72	0.00
Impervious Cover (% of total)	8	2.26	0.88	0.68	4.16	1.30	7.92	9.33	4.35	1.16
Change from Alternative 1 (% of total)		0.01	0.00	-0.08	-0.17	0.02	0.89	1.17	0.06	0.01
Modified Channel Length (% of total)	8	0.00	0.00	0.00	1.69	0.00	5.61	12.65	5.48	0.00
Change from Alternative 1 (% of total)		0.00	0.00	0.00	0.00	0.00	0.01	-0.03	-4.97	0.00
Culverted Channel Length (% of total)	8	1.56	0.00	0.00	0.00	5.76	26.82	17.16	15.70	38.46
Change from Alternative 1 (% of total)		1.56	0.00	0.00	0.00	0.00	0.75	1.07	-6.26	0.00
Parameters over Threshold		**3**	**2**	**1**	**3**	**1**	**5**	**7**	**5**	**3**
Change from Alternative 1		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-1**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Under Alternative 4, road crossing density would be increased in Lower Mill Creek and Tunnel as a result of new culverts and bridges proposed under Alternative 4. Road crossing density would be reduced in Creek Run, Summit South and Beaver as a result of proposed restoration. In the Beaver drainage, the

restoration projects would result in a decrease in the modified channel length parameter to below threshold (see Table 4.3.5-1). Meanwhile, impervious surfaces would increase slightly in Hyak, Tunnel, Ski Acres and Beaver as a result of activities proposed under Alternative 4. Impervious surfaces would decrease in Creek Run and Summit South as a result of proposed restoration activities, resulting in reductions in road density, road crossing density and impervious cover parameters, but not reducing any DPC parameter to below threshold (see Table 4.3.5-1).

Under Alternative 4, The Summit-at-Snoqualmie would implement the MDP Implementation Plan, Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, which includes restoration projects such as slope stabilization, road deactivation, revegetation, and stream and wetland restoration. These restoration projects would help to address areas of concern identified in the DPC analysis. These restoration projects would result in decreases in several DPC parameters, including stream length with management concerns, road density, road crossing density, impervious cover and culverted channel length, in several drainages. In the Beaver drainage, the modified channel length parameter would be reduced to below threshold because of the restoration projects (see Table 4.3.5-1). These restorations, outlined in Section 5.0 - Restoration of Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, incorporate the concepts of creation, enhancement, revegetation, and road deactivation activities as means to achieve restoration. Tables 5-1 and 5-2 in Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, outline and describe the restoration projects that would be required by the USFS and implemented by The Summit-at-Snoqualmie under Alternative 4.

Direct Impacts

Alternative 4 would differ from Alternative 2 because only two new culverts would be installed; one in the Lower Mill Creek drainage where ski trail 52D crosses a stream and one in the Tunnel Creek drainage where the new Silver Fir Base Lodge would be built. Both culverts would be sized to pass water from 100-year storm events with considerations for sediment and debris likely to be encountered. Management Requirements MR3, MR8, MR9, MR10 as well as Other Management Provision OMP9 (see Table 2.4-2) in tandem with the MDP Implementation Plan, would be implemented during culvert installation to reduce channel down-cutting and sediment delivery to streams. Under Alternative 4, four culverts would be removed; three via the decommissioning of road M-5 and one via the daylighting of Beaver Lake Creek. The removal of culverts during these projects would result in long-term beneficial impacts to stream channels, but would impact streams negatively in the short-term through instream disturbance and temporary sediment impacts. The restoration project to daylight Beaver Lake Creek would result in a decrease in the modified channel length parameter to below threshold in the Beaver drainage (see Table 4.3.5-1).

Under Alternative 4, no new bridges are proposed within the U. Yakima Watershed portion of the Study Area, which means that there would be less impact to stream channels than under Alternative 2.

Under Alternative 4, no new fords would be built, but the existing fords would receive maintenance, as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Alternative 4 would require 1.90 miles of channelization of stream segments, creating CV channel types in two places within the U. Yakima Watershed. Just like Alternative 2, one CV channel would be created near the bottom terminal of the proposed Mill Creek chairlift on the backside of Summit East and the other CV channel would be built upslope from the upper terminal of the realigned Little Thunder chairlift at Summit West.

The number of utility trenches crossing streams under Alternative 4 would be 11, which is two less than under Alternative 2 because there would be no development of the Creek Run or Rampart chairlifts. Thus, impacts to stream channels from utility trenching would be less. Impacts to stream channels from utility trenching would be primarily short-term because Management Requirement MR27 as well as Other Management Provisions such as OMP2, OMP9, and OMP14 (see Table 2.4-2) would be implemented and the streambank would be stabilized as outlined in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Another direct impact to streams under Alternative 4 would occur from restoration of streams within the U. Yakima Watershed as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). Even though restoration projects are intended to improve stream and riparian vegetation zone functions, these restoration projects would result in temporary, direct impacts to stream channels from increased sediment delivery during project implementation. However, in the long-term, these restoration projects would be beneficial to these streams because their natural functions would be restored. The restoration project would result in several decreases in DPC parameters, including stream length with management concerns, road density, road crossing density, impervious cover, and culverted channel length, for several drainages. In the Beaver drainage, the modified channel length parameter would be reduced to below threshold due to the restoration projects (see Table 4.3.5-1).

Indirect Impacts

The paving of Silver Fir Parking Lot 1 and Summit West Parking Lot 2 in Alternative 4 would indirectly impact streams within the U. Yakima Watershed by creating impervious surfaces that alter flow paths and the rate of drainage runoff as described in Section 4.3.3.1 – Upper Yakima River Watershed. The Stormwater Management Plan would incorporate paving, BMPs, and adaptive management to control sediment; removal/storage of plowed snow; and monitoring of other sediment sources, which would indirectly benefit stream channels through reduction of sediment delivery from the current road and parking lot sanding.

As described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), other indirect impacts to streams in the U. Yakima Watershed under Alternative 4 would result from operation and maintenance activities as described in Section 4.3.3.1 – Upper Yakima River Watershed. Operation and maintenance activities would be beneficial to streams if performed on a routine basis, reducing the potential for further erosion and sediment impacts to stream channels.

The slope stabilization projects within the U. Yakima Watershed, as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would result in beneficial long-term indirect impacts to stream channels because of the reduced sediment yield to nearby streams. The slope stabilization projects would result in several decreases in DPC parameters, including stream length with management concerns, for several drainages, but would not directly result in any decreases to below threshold (see Table 4.3.5-1).

In the U. Yakima Watershed under Alternative 4, there would be no new roads built since the Creek Run and Rampart chairlifts would not be constructed, while 0.37 mile of road would be restored to natural conditions (same as Alternative 2). As a result, road density would be 6.23 mile/mile^2, which is less than Alternative 2 (see Table 4.3.3-2). The 0.37 mile of road to be restored would indirectly affect stream channels within the Summit South and Creek Run 7th field drainages over a short-term until the former road bed is completely re-vegetated and stabilized.

As described in Alternative 2, the effects of sediment delivery on stream channel condition (e.g., bank erosion, pool filling, cobble embeddedness, etc.) are expected to decline with the implementation of ice inhibitor application, parking lot paving, and snow management in the base area. Consequently, the management effects of Alternative 4 on sediment delivery and channel stability would be similar to those in Alternative 2, and long-term improvements in the condition of stream channels would be expected.

Other off-channel construction activities under Alternative 4 could impact channels indirectly if large quantities of sediment or other contaminants are transported to streams. However, such impacts would be less than Alternative 2 because neither the Rampart pod nor the Creek Run pod would be constructed. Therefore, unlike Alternative 2, stream channels within the Summit South and Creek Run 7th field drainages would not be impacted. There would be no increased instability or reduction in the quantity and quality of aquatic habitat since no new roads would be built. Off-channel construction activities under Alternative 4 that could impact stream channels indirectly would be reduced through Management Requirement MR15 as well as Other Management Provisions such as OMP2, OMP4, OMP7, and OMP11 (see Table 2.4-2) as well as the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Under Alternative 4, indirect impacts would occur due to the proposed changes in vegetation communities within Riparian Buffers. These effects would result from the increase in the area of ski trails and modified

vegetation within Riparian Buffers by 1.69 acres from existing conditions. Meanwhile, 2.91 acres would be developed into base area and other support facilities (see Table 4.3.3-6), which is less than in Alternative 2. Approximately 0.28 mile of streambanks that are currently either naturally forested or naturally non-forested would be converted to modified vegetation or developed areas (see Table 4.3.3-6) under Alternative 4. This would indirectly impact the physical condition and ecological functions of streams over the long-term, but to a lesser degree than Alternative 2.

Wetlands

Summary

Under Alternative 4, there would be 31 wetlands impacted within the U. Yakima Watershed at The Summit-at-Snoqualmie under the proposed actions. These wetland impacts would include 1.10 acres of clearing and 1.77 acres of grading (see Table 4.3.3-3), for a total of 2.87 acres of wetlands impacts. This compares to 2.19 acres of clearing and 1.90 acres of grading totaling 4.09 acres of wetlands impacts proposed for Alternative 2. The total of 2.87 acres of wetlands impacts proposed under Alternative 4 represents the lowest amount of wetlands impacts within the U. Yakima Watershed of any of the alternatives. These direct impacts would be a result of construction of lift terminals and towers, buildings, utility trenching, and the clearing and grading of land for ski trails. Indirect impacts to wetlands within the U. Yakima Watershed at The Summit-at-Snoqualmie under Alternative 4 include application of the MgCl de-icer/ice-inhibitor, operation and maintenance activities, revegetation and stabilization measures, and construction activities on adjacent lands. All activities described above would result in long-term impacts to wetlands except for utility trenching and stabilization measures, which would cause short-term impacts.

Direct Impacts

Alternative 4 would be similar to Alternative 2 except that approximately 1.10 acres of wetlands in the U. Yakima Watershed would be directly impacted by grading activities because there would be no development of either the Creek Run or Rampart chairlifts. Approximately 1.08 acres of these grading impacts to wetlands can be avoided by flagging and surveying wetlands in the proposed impact areas and using this information in detailed construction plans that would facilitate the project design to avoid and minimize all unnecessary impacts to wetlands so that there would be less actual impacts than there is currently identified through GIS analysis.

Activities that require the clearing of vegetation, but no grading, under Alternative 4 are similar to Alternative 2. However, the Creek Run and Rampart chairlifts and corresponding runs would not be built, so there would be only 1.10 acres of clearing. Under Alternative 4, no clearing impacts to wetlands in the U. Yakima Watershed could be minimized or avoided by field planning prior to implementation.

Under Alternative 4, wetlands affected by utility trenching would not result in the long-term loss of wetland acreage or wetland function because the wetland area would be restored immediately after installation of the utility line. The locations of utility trenching impacts under Alternative 4 would be the

same as Alternative 2 except that there would be no trenching within Section 16. Trenching impacts to wetlands would be avoided by trenching around wetlands where possible and the use of Management Requirement MR24 as well as Other Management Provisions OMP7, OMP14, and OMP16 (see Table 2.4-2) would also minimize the potential impacts to wetland functions from utility trenching.

In Alternative 4, the restoration of Wetland #207 and Wetland #142, would be performed in conjunction with tree island revegetation at Summit West and Summit Central respectively. These would result in a beneficial direct impact because wetland functions such as the hydrologic regime, shading, and nutrient and carbon cycling would be restored to more natural like conditions. The wetland restoration projects would result in improvements to DPC parameters, but would not result in any reductions to below threshold for any drainage (see Table 4.3.5-1).

Indirect Impacts

Operations and maintenance activities that could impact wetlands under Alternative 4 are the same as those described under Alternative 2.

The potential for increased sediment delivery to wetlands would be increased during construction in the Riparian Buffers of wetlands unless BMPs, Management Requirement MR24 as well as Other Management Provisions OMP7, OMP14, and OMP16 (see Table 2.4-2) were applied, and the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) was followed. These actions would minimize the potential for indirect impacts such as sediment delivery from Riparian Buffers to wetlands.

Application of MgCl as well as paving the parking lots under Alternative 4 could potentially indirectly impact the large wetland complexes and individual wetlands in these areas as described in Alternative 2.

Water Quantity

Summary

Under Alternative 4, no snowmaking is proposed, there would be no new groundwater or surface water withdrawals, and no change in water rights would take place. The wastewater disposal technique would remain via sewer under SPUD, and represents the primary groundwater-related operational impact that would occur under Alternative 4.

In Alternative 4, no development in Section 16 is proposed, in contrast to Alternative 2. Section 16 land cover would remain as it currently exists. Therefore Alternative 4 would result in a lesser impact to water quantity than Alternative 2.

Indirect Impacts

Approximately 562.2 acres of the Study Area within the U. Yakima Watershed (30 percent of land cover) would remain as hydrologically mature forest under Alternative 4. Because of proposed development and

restoration, 19.39 acres of land cover would be converted to hydrologically immature land, which includes naturally non-forested areas, young saplings planted for restoration, and ski trails (both new and existing) consisting of modified shrubs and herbaceous vegetation (see Table 4.3.3-4). The creation of ski trails and other development clearing would therefore increase the area of immature land cover in the U. Yakima Watershed portion of the Study Area by 1 percent. Land conversions (ski trails, impervious areas) would likely generate a slight net export of water from the U. Yakima Watershed. Differences in land cover between Alternative 1 and Alternative 4 may indirectly affect snow accumulation and snowmelt locally, which could affect the runoff patterns of the watershed.

Construction techniques, including the embedding of coarse woody debris within the ground surface, along with Other Management Provisions OMP25, OMP26, and OMP33 would minimize localized increases in sheet flow on construction sites during and after construction (see Table 2.4-2). Under current maintenance practices at The Summit-at-Snoqualmie, modified vegetation would continue to be maintained in a hydrologically immature condition to support ski area management. Water from these areas generally runs off quickly to streams. Considering that several streams within the U. Yakima Watershed portion of the Study Area are typically ephemeral or intermittent at this elevation, and given that source protection measures are included in the construction techniques and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, the effects of lift and trail construction would not result in any measurable increase in flow in either Coal Creek or Mill Creek. Thus, no water quantity impacts are expected within the U. Yakima Watershed.

Flow Model

The results of the flow model for Alternative 4 are displayed in Table 4.3.3-5. As shown, Creek Run, Hyak, and Summit South are the 7th field drainages whose streamflow would change because of forest clearing and creation of new impervious surfaces under Alternative 4 in relationship to Alternative 2. Meanwhile, there would be no change the streamflow between Alternatives 2 and 4 in the Beaver Lake, Lower Mill Creek, Ski Acres, Tunnel, and Upper Mill Creek 7th field drainages.

As described in Section 4.3.3.1 – Upper Yakima River Watershed, the forecasted small amounts of streamflow increases are typical of the types of streams in the 7th field drainages. In addition, local increases in streamflow in the U. Yakima Watershed from the 5.01 acres of new impervious surfaces would be mitigated through BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Water Quality

Summary

Under Alternative 4, sediment delivery to streams would occur at 89 total stream crossings (culverts, bridges, fords) and 11 utility crossings, which could result in increased turbidity. Temperature and dissolved oxygen could increase due to the removal of 0.28 mile of mature and immature forest along

streambanks. The pH of streams could increase under Alternative 4 due to the construction of 2.91 acres of impervious surfaces within Riparian Buffers. Other water pollution constituents, such as oil and grease, are expected to decrease under Alternative 4 due to the implementation of the Stormwater Management Plan. After implementation of all projects in Alternative 4, water quality levels would likely remain close to current conditions. BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 would reduce the probability of water quality exceedences.

Direct Impacts

Under Alternative 4, there would be two new culverts installed in streams within the U. Yakima Watershed; one in the Lower Mill Creek drainage near the bottom terminal of the Mill Creek chairlift and one in the Tunnel Creek drainage near the bottom terminal of the Easy Street chairlift. In Alternative 4 no new bridges would be installed. The construction of culverts would likely result in short-term increased sediment delivery and turbidity in the streams due to construction within the stream channel. Over the long-term, the presence of culverts in streams could result in increased potential for sediment mobilization and turbidity in the respective drainages. Implementation of BMPs and Management Requirements MR3, MR9, MR10, as well as Other Management Provisions such as OMP9 (see Table 2.4-2) would minimize the effect of sediment delivery and increased turbidity on the downstream waters.

Under Alternative 4, the construction of 11 utility crossings in surface waters within the U. Yakima Watershed would result in short-term, direct impacts to water quality. The impacts to water quality in the U. Yakima Watershed incurred during the construction of utility crossings are described under Alternative 2. The implementation of BMPs and Other Management Provisions such as OMP2, OMP9, OMP14, and OMP25 (see Table 2.4-2) would likely keep turbidity levels below SWQS under build-out in Alternative 4. BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions outlined in Table 2.4-2 would reduce the probability of exceedences.

Under Alternative 4, construction of lift terminals and the lift towers (including concrete foundations), would occur within the all of the 7th field drainages in the U. Yakima Watershed except for the Creek Run drainage. The pH of streams within these drainages could be affected as described under Alternative 2. Management Requirements MR15, MR16, and MR36 (see Table 2.4-2) would help minimize the chance of high pH runoff entering the streams, and thereby maintain the current pH levels within streams in the U. Yakima Watershed. Other potential water quality impacts that could occur during construction activities within Riparian Buffers under Alternative 4 include the contamination of surface water by petroleum products, should equipment working in or adjacent to streams experiences fuel leaks or hydraulic system failures. All stream crossing structure locations have the potential for increased pollutant (e.g., fuel) and sediment delivery during construction activities under Alternative 4. However, development of a SWPPP and the implementation of BMPs and Management Requirements MR14 and MR16 as well as Other Management Provisions OMP13, OMP15, and OMP17 (see Table 2.4-2) would minimize the potential for any short-term, indirect delivery of pollutants to streams.

Other impacts on surface water quality could result from the implementation of the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan), which would limit sediment delivery to streams from sources such as road sanding as described in Alternative 2. Under implementation of the Stormwater Management Plan, the water quality of adjacent and nearby streams would improve because of a decrease in sediment delivery and oil and grease contents.

As reported in Alternative 2, the Upper South Fork Snoqualmie River and Coal Creek Watershed Condition Assessment (Jones & Stokes 2001) suggests that management objectives for water quality are currently being met under current ski area operations for all parameters in the S.F. Snoqualmie and U. Yakima Watersheds, except for the temperature, dissolved oxygen, and turbidity in some streams within drainages in the U. Yakima Watershed. Under Alternative 4, impacts to these water quality parameters would likely be less than described in Alternative 2 because the Rampart pod and Creek Run pod in Section 16 would not be built.

Indirect Impacts

Under Alternative 4, 7.56 acres of mature and immature forests would be cleared and graded in Riparian Buffers, including utility trenching. All of these activities would result in an increased potential for indirect sediment impacts to streams. Sediment impacts from the construction activities listed above would increase the turbidity in streams usually in the short-term. In the long-term, turbidity impacts would likely be reduced to background levels following successful implementation of BMPs and Management Requirements MR2, and MR14 as well as Other Management Provisions OMP12, OMP13, and OMP15 (see Table 2.4-2) which would minimize delivery of sediment to streams.

Land cover changes in the Riparian Buffers due to activities proposed under Alternative 4 could also indirectly affect the temperature of the streams as described in Alternative 2. Stream temperatures within the reaches in the Study Area would likely remain the same as existing conditions or increase slightly for all streams under Alternative 4. In drainages such as Tunnel Creek, small areas of trees would be removed from alongside the streambank, however no temperature increase is likely due to the small area of proposed activities. Since water temperature and dissolved oxygen are directly correlated, Alternative 4 would also likely maintain the existing stream dissolved oxygen concentrations for all streams within the U. Yakima Watershed portion of the Study Area.

Under Alternative 4, The Summit-at-Snoqualmie would implement the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan), which is described in Alternative 2. With implementation of the Stormwater Management Plan under Alternative 4, long-term detrimental impacts to water quality from sand, oil, and grease from polluted stormwater runoff from parking lots would be reduced in comparison to existing conditions.

Via implementation of the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and other specific Mitigation

Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2), there would be several beneficial impacts to water quality within the U. Yakima Watershed under Alternative 4, similar to those described in Alternative 2. Under Alternative 4, 0.37 mile of road would be decommissioned and the three culverts that convey streams under this road would be removed. Also under Alternative 4, tree islands are proposed at Summit East, Summit Central, and Summit West. Once these tree islands are healthy and established, they would help stabilize the soils in these areas. Under Alternative 4, in addition to the restoration project to daylight Beaver Lake Creek, a second stream channel would be restored next to the tubing area, as described further in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). These stream restoration projects would result in several decreases in DPC parameters, including stream length with management concerns, modified channel length and culverted channel length, for the Beaver drainage. The modified channel length parameter would be reduced to below threshold in the Beaver drainage due to restoration of Beaver Lake Creek and the stream at the tubing area (see Table 4.3.5-1). Wetlands to be restored and all proposed revegetation under Alternative 4 are also described in Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan.

Riparian Buffers

Summary

Under Alternative 4, the total area of developed impervious surfaces within Study Area Riparian Buffers of the U. Yakima Watershed would increase by 2.91 acres. This increase represents approximately 0.6 percent of the total Study Area Riparian Buffers within the U. Yakima Watershed. Approximately 1.90 miles of streams in the U. Yakima Watershed portion of the Study Area have been placed in culverts, including the 74 culverted stream crossings. Under Alternative 4, no new roads would be built within Riparian Buffers since the Rampart and Creek Run chairlifts would not be built. Meanwhile, 7.56 acres of mature and immature forested Riparian Buffers would be converted into other vegetation community types. 0.07 mile of streambank would be converted from natural conditions to modified and developed conditions. Through implementation of the Stormwater Management Plan, sediment yield to streams within the U. Yakima Watershed would decrease under Alternative 4.

Direct Impacts

Direct impacts to Riparian Buffers under Alternative 4 would be less than Alternative 2 because of there would be no development of ski trails or lifts in the Rampart and Creek Run pods. As displayed in Table 4.3.3-6, the total area of impervious surfaces would increase by 2.91 acres within Riparian Buffers in the U. Yakima Watershed portion of the Study Area, which represents approximately 0.6 percent of the total Riparian Buffer area under Alternative 4. 74 culverted stream crossings directly impact the Riparian Buffers under Alternative 4, constraining streams, providing sites of increased sediment recruitment and erosion concerns, and eliminating most riparian functions. In Alternative 4, approximately 1.90 miles of streams in the U. Yakima Watershed portion of the Study Area remain without functioning Riparian

Buffers because they have be placed in culverts, including the 74 culverted stream crossings. Under Alternative 4, 7.56 acres of mature and immature forested Riparian Buffers would be lost due to construction of ski trails, lift terminals, buildings, roads, and parking lots (see Table 4.3.3-6). Clearing and grading activities within Riparian Buffers would be minimized through implementation of Management Requirements MR2, and MR14 as well as Other Management Provisions OMP12, OP13, and OMP15 (see Table 2.4-2).

Of the 17.32 linear miles of streambanks under Alternative 4 (two sides to 8.66 miles of streams), 8.18 miles (47 percent) would remain under natural mature and immature forest cover, 0.83 mile (5 percent) would remain in natural nonforest cover, 4.77 miles (28 percent) would adjoin ski trails and other modified vegetation, and 0.25 mile (1.5 percent) would be adjacent to developed areas. These impacts to Riparian Buffers and their associated stream functions would be less than under Alternative 2 after implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Indirect Impacts

Under Alternative 4, the long-term beneficial and short-term detrimental impacts from the restoration projects listed and described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and the Stormwater Management Plan would be the same as described under Alternative 2. The restoration projects would result in the modified channel length parameter to decrease below threshold in the Beaver drainage (see Table 4.3.5-1).

Indirect impacts to Riparian Buffers such as windthrow potential, noxious weed establishment, and mass wasting potential under Alternative 4 would be similar to conditions described in Alternative 2.

4.3.5.2 South Fork Snoqualmie River Watershed

Streams

Summary

Within the S.F. Snoqualmie Watershed under Alternative 4, there would be a total of 17 stream crossings (culverts, bridges, and/or fords), representing an increase of one crossing over Alternative 1 conditions. In addition, there would be a total of 0.29 mile of culverted channels, 0.99 mile of ditches conveying streamflow, four new utilidor crossings, and six new trenched utility crossings, all of which would directly impact stream channels, mostly in the long-term. However, some short-term effects would also be expected. Indirect impacts to streams under Alternative 4 would include the removal of 6.18 acres of mature and immature forest within Riparian Buffers due to clearing and grading activities. In addition, the construction of 2.13 acres of impervious surfaces within Riparian Buffers could modify the flow paths of runoff and erosion patterns. Beneficial impacts would include the application of MgCl to paved parking

lots. This would reduce the need for traction sanding, which would thereby decrease the amount of sediment transported to streams and reduce the filling of pools in streams.

Drainages of Particular Concern Analysis

Under Alternative 4 (as under Alternative 2), there would be one new threshold exceedence within the S.F. Snoqualmie Watershed portion of the Study Area, in comparison to Alternative 1:

- Northside (Stream length with management concerns – 83.13 percent [see Table 4.3.5-2])

Table 4.3.5-2:
Summary of DPC Analysis of Watershed Conditions for Alternative 4 in the South Fork Snoqualmie River Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Thre-shold	North-side	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)	**N/A**	**49.02**	**72.08**	**270.07**	**89.34**	**318.62**	**214.58**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.13	94.17	41.49	31.96	40.35	11.36
Change from Alternative 1 (% of total)		1.66	10.27	0.37	4.74	1.38	0.05
Stream Length w/ Management Concerns (% of total)	10	6.02	75.50	2.97	3.89	22.51	3.99
Change from Alternative 1 (% of total)		6.02	25.74	0.53	0.00	1.11	0.01
Road Density (miles/square mile)	3	5.48	7.02	0.50	0.68	1.62	2.35
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.00	-0.08	0.00
Road Crossing Density (number/square mile)	6	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Impervious Cover (% of total)	8	1.89	17.73	0.27	2.36	1.73	2.68
Change from Alternative 1 (% of total)		0.25	3.47	0.06	2.13	-0.20	0.00
Modified Channel Length (% of total)	8	0.00	76.34	1.96	0.00	22.20	5.50
Change from Alternative 1 (% of total)		0.00	-12.08	0.00	0.00	-2.97	0.01
Culverted Channel Length (% of total)	8	0.00	23.66	0.00	0.00	3.97	0.36
Change from Alternative 1 (% of total)		0.00	12.08	0.00	0.00	0.13	0.00
Parameters over Threshold		**2**	**7**	**1**	**2**	**4**	**1**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Under Alternative 4, road crossing density would increase in the Nacrinomical drainage. Impervious cover would increase in the Northside, Summit North, International and Upper Alpental drainages as a result of activities proposed under Alternative 4 (see Table 4.3.5-2). Meanwhile, a slight decrease in impervious surfaces would occur in the Nacrinomical drainage as a result of the removal of Parking Lot 7.

Under Alternative 4, The Summit-at-Snoqualmie would implement the MDP Implementation Plan, Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, which includes restoration projects such as slope stabilization, road deactivation, revegetation, and stream and wetland restoration. These restoration projects would help to address areas of concern identified in the DPC analysis, reducing parameters such as impervious cover and modified channel length, for two drainages (see Table 4.3.4-2). However, the restoration projects would not reduce any parameter in any drainage to below the threshold. These restorations, outlined in Section 5.0 - Restoration of Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, incorporate the concepts of creation, enhancement, revegetation, and road deactivation activities as means to achieve restoration. Tables 5-1 and 5-2 in Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, outlines and describes the restoration projects that would be required by the USFS and implemented by The Summit-at-Snoqualmie under Alternative 4.

Direct Impacts

Direct impacts to stream channels within the S.F. Snoqualmie Watershed under Alternative 4 would be exactly the same as described under Alternative 2. The only new culvert under Alternative 4 within the S.F. Snoqualmie Watershed would be installed where a tributary crosses under the proposed realignment of Alpental Parking Lot 6. Management Requirements MR3, MR8, MR9, and MR10 as well as Other Management Provisions OMP9 (see Table 2.4-2), in tandem with the MDP Implementation Plan, would be implemented during culvert installation to reduce channel down-cutting and sediment delivery to streams. Under Alternative 4, there would be no culvert removal within the S.F. Snoqualmie Watershed and no new bridges or fords are proposed within the S.F. Snoqualmie Watershed portion of the Study Area. However, existing bridges and fords would undergo regular maintenance as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Alternative 4 would also require the channelization of stream segments in culverts. The placement of culverts would result in two new CV class channels within the S.F. Snoqualmie Watershed. Both CV channels would be created to convey 0.07 mile of stream segments under Summit West Parking Lot 1. Management Requirement MR8 from Table 2.4-2 would be implemented during culvert installation to reduce channel down-cutting and sediment delivery to streams in tandem with the MDP Implementation Plan, which outlines the sequence of events that must occur before, during, and after implementation of the MDP.

Just as in Alternative 2, there would be six crossings of streams by utility trenching under Alternative 4 within the S.F. Snoqualmie Watershed. These new utility crossings would directly impact streams as described in Section 4.3.3.1 – Upper Yakima River Watershed. Impacts to stream channels from utility trenching would be short-term because Management Requirements MR27 as well as Other Management Provisions such as OMP2, OMP9, and OMP14 (see Table 2.4-2) would be followed and the streambank would be stabilized as outlined in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). Under Alternative 4, an above ground utilidor would be constructed within the S.F. Snoqualmie Watershed, in order to provide utility services such as sewer and water to the mountain-top restaurant at Alpental.

Under Alternative 4, there would be no direct impact to streams within the S.F. Snoqualmie Watershed as a result of stream restoration. The modified channel length parameter would be reduced in two drainages, however, no parameter would be reduced to below threshold due to the stream restoration projects outlined in Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan (see Table 4.3.5-2).

Indirect Impacts

The paving of Alpental Parking Lots 3, 4, 5, and 6 as well as Summit West Parking Lot 1 under Alternative 4 would have similar indirect impacts to streams within the S.F. Snoqualmie Watershed as described in Alternative 2. However, the magnitude of impacts would be less because Alpental Parking Lot 7 would not be built, Finally, the re-location of the Alpental road, where it parallels Alpental lots 4, 5, and 6, to a location outside the Riparian Buffer would result in beneficial indirect impacts to stream channels. These beneficial impacts would result from improved filtering of runoff from the road's surface, and reduced sediment delivery.

As described in further detail in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), other indirect impacts to streams in the S.F. Snoqualmie Watershed under Alternative 4 would result from operation and maintenance activities (as described in Section 4.3.3.1 – Upper Yakima River Watershed). The routine performance of operation and maintenance activities would be beneficial to streams. Routine maintenance would help reduce the possibility of further erosion and sediment impacts to stream channels.

Under Alternative 4, there would be less than 0.01 mile of new road built in the S.F. Snoqualmie Watershed. At 1.97 mile/mile^2, the resultant road density would be less than under Alternative 2 (see Table 4.3.3-8). Impacts to stream channels above existing conditions would be negligible because of the very slight change and implementation of Management Requirements MR15, MR24, and MR36 as well as Other Management Provisions OMP2, OMP3, OMP4, and OMP5 (see Table 2.4-2).

The impacts of sediment delivery on stream channel conditions are expected to decline under Alternative 4 due to the use of the ice inhibitor MgCl as described in Alternative 2. Consequently sediment delivery

and channel stability impacts on streams within the S.F. Snoqualmie Watershed under Alternative 4 would be reduced in the long-term, which would benefit the condition of stream channels. In addition, re-location of the Alpental road, where it parallels Alpental Parking Lots 4, 5, and 6, to a location outside the Riparian Buffer, along with re-habilitation of the Riparian Buffer vegetation, would reduce the delivery of sediment from road sanding to the stream channel.

Other off-channel construction activities could impact channels indirectly if large quantities of sediment or other contaminants are transported to streams. This could occur under Alternative 4 at Summit West and Alpental during the grading and paving of the parking lots, as described in Alternative 2. Under Alternative 4, however, Alpental Parking Lot 7 would not be constructed and the parking area of Alpental Parking Lot 6 would be smaller than under Alternative 2. Therefore, the resultant channel impacts would be less. These indirect stream channel impacts would be reduced through Management Requirement MR15 as well as Other Management Provisions such as OMP2, OMP4, OMP7, and OMP11 (see Table 2.4-2) as well as the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Within the S.F. Snoqualmie Watershed, Alternative 4 would increase ski trails and modified vegetation within Riparian Buffers as described under Alternative 2. Additional acreage would be developed into base areas and other support facilities (see Table 4.3.3-12).

Wetlands

Summary

Under Alternative 4, there would be 18 wetlands impacted within the S.F. Snoqualmie Watershed at The Summit-at-Snoqualmie. These impacts would include 0.86 acre of clearing impacts and 0.88 acre of grading impacts (see Table 4.3.3-9), for a total of 1.74 acres of impacted wetlands. These total wetlands impacts would be identical to those outlined under Alternative 2. These direct impacts would be a result of construction of lift terminals and towers, buildings, utility trenching, and the clearing and grading of land for ski trails. Indirect impacts to wetlands within the S.F. Snoqualmie Watershed at The Summit-at-Snoqualmie under Alternative 4 include application of the MgCl de-icer/ice-inhibitor, operation and maintenance activities, revegetation and stabilization measures, and construction activities on adjacent lands. All activities described above would result in long-term impacts to wetlands. The exception would be utility trenching and stabilization measures, which would result in short-term impacts.

Direct Impacts

Implementation of Alternative 4 would result in the same impacts to wetlands in the S.F. Snoqualmie Watershed portion of the Study Area as described under Alternative 2. Approximately 0.29 acre of these grading impacts to wetlands in the S.F. Snoqualmie Watershed under Alternative 4 would be avoided by flagging and surveying wetlands in the proposed impact areas. This information would be used in detailed construction plans that would facilitate the project design to avoid and minimize unnecessary impacts to

wetlands. As a result, here would be less actual impacts during field implementation than are currently identified through GIS analysis alone.

Activities that require only the clearing of vegetation, but no grading, in wetlands under Alternative 4 are the same as Alternative 2. Under Alternative 4, none of the clearing impacts to wetlands in the S.F. Snoqualmie Watershed could be minimized or avoided during field implementation.

Under Alternative 4, the acreage of wetlands impacts due to utility trenching would be the same as Alternative 2. There would be no wetland areas would be restored immediately following installation of the utility line. Impacts to wetlands may be avoided by trenching around wetlands where possible. In addition, the use of Management Requirement MR24 as well as Other Management Provisions OMP7, OMP14, and OMP16 from Table 2.4-2 would also minimize potential utility trenching impacts to wetland functions.

Indirect Impacts

Operational and maintenance activities that could impact wetlands under Alternative 4 are the same as those described under Alternative 2.

Under Alternative 4, grading would take place in Riparian Buffers of wetlands in the same places as Alternative 2. The potential for sediment delivery to wetlands would be increased during construction. Implementation of BMPs, Management Requirement MR24 as well as Other Management Provisions OMP7, OMP14, and OMP16 from Table 2.4-2 and application of the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), would minimize the potential for these indirect impacts.

Application of MgCl as well as paving the parking lots under Alternative 4 could potentially indirectly impact the large wetland complexes and individual wetlands in these areas. The impacts of these activities would have both beneficial and detrimental consequences for wetland functions, as described in Alternative 2.

Water Quantity

Summary

Under Alternative 4, no snowmaking is proposed. There would be no new groundwater or surface water withdrawals, and therefore no change in water rights would take place. The wastewater disposal technique would remain via sewer under SPUD, and represents the primary groundwater-related operational impact that would occur under Alternative 4.

In Alternative 4 there would be no land use changes that would differ from those described under Alternative 2.

Indirect Impacts

Approximately 476 acres of the Study Area within the S.F. Snoqualmie Watershed (47 percent of land cover) would remain as hydrologically mature forest under Alternative 4. Because of proposed development and restoration, 6.62 acres of land cover would be converted to hydrologically immature land, which includes naturally non-forested areas, young saplings planted for restoration, and ski trails (both new and existing) consisting of modified shrubs and herbaceous vegetation (see Table 4.3.3-10). The creation of ski trails and other development clearing would therefore increase the area of immature land cover in the S.F. Snoqualmie Watershed portion of the Study Area by 0.7 percent. Land conversions (ski trails, impervious areas) would likely generate a slight net export of water from the S.F. Snoqualmie Watershed. Differences in land cover between Alternative 1 and Alternative 4 may indirectly affect snow accumulation and snowmelt locally, which could affect the runoff patterns of the watershed.

Construction techniques, including the embedding of coarse woody debris within the ground surface, along with Other Management Provisions OMP25, OMP26, and OMP33 would minimize localized increases in sheet flow on construction sites during and after construction (see Table 2.4-2). Under current maintenance practices at The Summit-at-Snoqualmie, modified vegetation would continue to be maintained in a hydrologically immature condition to support ski area management. Water from these areas generally runs off quickly to streams. Considering that several streams within the S.F. Snoqualmie Watershed portion of the Study Area are typically ephemeral or intermittent at this elevation, and given that source protection measures are included in the construction techniques and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, the effects of lift and trail construction would not result in any measurable increase in flow in the S.F. Snoqualmie River. Therefore no water quantity impacts are expected within the S.F. Snoqualmie Watershed.

Flow Model

The results of the flow model for Alternative 4 are displayed in Table 4.3.3-11. As shown, International and Upper Alpental are the 7th field drainages whose streamflow would change because of forest clearing and creation of new impervious surfaces under Alternative 4, as compared to Alternative 2. Meanwhile, there would be no difference in the streamflows between Alternatives 2 and 4 in the Nacrinomical, Northside, and Summit North 7th field drainages.

As described in Section 4.3.3.1 – Upper Yakima River Watershed, these small amounts of streamflow increases are typical of the types of streams in the 7th field drainages. In addition, localized increases in streamflow in the S.F. Snoqualmie Watershed from the 4.05 acres of new impervious surfaces are expected to be mitigated through BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Water Quality

Summary

Under Alternative 4, sediment delivery to streams within the S.F. Snoqualmie Watershed would occur at 17 stream crossings (culverts, bridges, fords) and six utility crossings that would exist after project construction, which could result in increased turbidity. Temperature and dissolved oxygen could increase due to the 0.28 mile of mature and immature forest removed along streambanks. The pH of streams could increase under Alternative 4 due to the construction of 2.13 acres of impervious surfaces within Riparian Buffers. Other water pollution constituents, such as oil and grease, are expected to decrease under Alternative 4 due to the implementation of the Stormwater Management Plan. After implementation of all projects in Alternative 4, water quality levels would likely remain close to current conditions. Proper implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 would reduce the possibility of future water quality exceedences.

Direct Impacts

Under Alternative 4, there would be one new culvert installed within the S.F. Snoqualmie Watershed: an unnamed stream that would be culverted under Alpental Parking Lot 6. Impacts to the S.F. Snoqualmie Watershed from this culvert are described in Alternative 2. Implementation of BMPs and Management Requirements MR3, MR9, and MR10 as well as Other Management Provisions OMP9 (see Table 2.4-2) would reduce water quality impacts to streams as a result of this culvert installation.

The construction of six utility crossings in surface waters within the S.F. Snoqualmie Watershed would result in short-term, direct impacts to water quality. Impacts due to the construction of utility crossings are described in Section 4.3.3.1 – Upper Yakima River Watershed. Implementation of BMPs and Management Requirements MR27 as well as Other Management Provisions OMP2, OMP9, and OMP14 (see Table 2.4-2) would minimize the effect of sediment delivery and increased turbidity on the downstream waters. Under implementation of Alternative 4, turbidity levels would likely remain below SWQS. Implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 would reduce the possibility of turbidity exceedences.

Under Alternative 4, the potential for increases in stream pH and possible introduction of petroleum products to the S.F. Snoqualmie Watershed are exactly the same as described under Alternative 2. Development of a SWPPP and the implementation of BMPs and Management Requirements MR14, MR15, MR16, and MR36 as well as Other Management Provisions such as OMP13, OMP15, and OMP17 (see Table 2.4-2) would minimize the potential for short-term, indirect delivery of pollutants to streams. These measures would reduce effects to water quality in the S.F. Snoqualmie Watershed under Alternative 4.

Other impacts on surface water quality could result from the implementation of the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan), which is described in more detail under Alternative 2.

No exceedences of water quality standards for fecal coliform are expected under Alternative 4. Temperature and dissolved oxygen are not currently a concern within the S.F. Snoqualmie Watershed.

Under Alternative 4, the dissolved oxygen standards would continue to be met within the S.F. Snoqualmie Watershed. Dissolved oxygen is partly dependent on water temperature, with colder temperatures enabling higher dissolved oxygen concentrations. Under Alternative 4, dissolved oxygen is not expected to decrease significantly and any impacts on fish would be negligible (see Section 4.4 - Fisheries).

Indirect Impacts

Under Alternative 4, 6.18 acres of mature and immature forests would be cleared and graded in Riparian Buffers. This total includes utility trenching that would occur in Riparian Buffers. All of these activities would result in an increased potential for indirect sediment impacts to streams. Sediment impacts from the construction activities listed above would increase the turbidity in streams, usually in the short-term. In the long-term, turbidity impacts would likely be reduced to background levels following successful implementation of BMPs and Management Requirements MR2 and MR14 as well as Other Management Provisions such as OMP12, OMP13, and OMP15 (see Table 2.4-2). These measures would minimize turbidity impacts to streams.

Under Alternative 4, Alpental Road (in the vicinity of Parking Lots 4, 5, 6, and 7) would be rerouted to a location approximately 100 feet west of its current alignment, which is within the Riparian Buffer of the South Fork of the Snoqualmie River. As a result the, existing Parking Lots 4, 5 and 6 would be reduced by approximately 0.7 acre. Parking Lot 7 would be eliminated. The resulting alignment for Alpental Road would reduce the roaded area within the Riparian Buffer of the South Fork Snoqualmie River by approximately one-third acre along this corridor. The resulting alignment, paired with re-vegetation of the Riparian Buffer, would reduce the amount of road stormwater runoff and sediment directly introduced to the stream system.

Water temperature in streams cumulatively reflects the temperature inputs of tributary waters. Therefore, temperature typically becomes higher as the water flows downstream. Existing conditions exhibit limited canopy coverage along streams. Due to the limited areas of vegetation removal associated with MDP Implementation, the current stream temperatures within the Study Area would likely remain the same as existing conditions or increase slightly for all streams. Alternative 4 would likely maintain the existing stream dissolved oxygen concentrations for all streams within the S.F. Snoqualmie Watershed portion of the Study Area, since levels of dissolved oxygen are a function of water temperature, and temperatures would be likely to remain the same.

Under Alternative 4, The Summit-at-Snoqualmie would implement the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan). This plan calls for the paving of Summit West Parking Lot 1, Alpental Parking Lots 3, 4, 5, and 6, and the portion of Alpental Road along these parking lots. In addition, a treatment train would be constructed to treat water flowing off the parking lots. The treatment train would improve water quality by collecting oil and grease, and retaining sediment. With implementation of the Stormwater Management Plan, long-term detrimental impacts to water quality from sand, oil, and grease from polluted stormwater runoff parking lots would be reduced under Alternative 4.

Implementation of the MDP Implementation Plan and other specific measures from 2.4-1, would result in several beneficial impacts to water quality within the S.F. Snoqualmie Watershed under Alternative 4. These benefits are described in more detail under Alternative 2.

Riparian Buffers

Summary

In Alternative 4, total developed impervious surface area within the S.F. Snoqualmie Watershed portion of the Study area would increase by 2.13 acres, in comparison to Alternative 1 conditions, This increase represents approximately 0.8 percent of the total Study Area Riparian Buffers within the S.F. Snoqualmie Watershed. Approximately 0.29 mile of streams in the S.F. Snoqualmie Watershed portion of the Study Area have been placed in culverts, including the 13 culverted stream crossings. Under Alternative 4, no new roads would be built within Riparian Buffers and 6.18 acres of mature and immature forested Riparian Buffers would be converted into other vegetation community types. 0.10 mile of streambank would be converted from natural conditions to modified and developed conditions. Via implementation of the Stormwater Management Plan, net sediment yield to streams within the S.F. Snoqualmie Watershed would decrease under Alternative 4.

Direct Impacts

Direct impacts to Riparian Buffers under Alternative 4 would be similar to those described in Alternative 2. The exception is that Alpental Parking Lot 7 would not be constructed and Alpental Parking Lot 6 would be smaller in area. As displayed in Table 4.3.3-12, under Alternative 4, the total area of impervious surfaces within Riparian Buffers in the S.F. Snoqualmie Watershed portion of the Study Area would increase by 2.13 acres, from a total of 13.18 acres to 15.31 acres. This total represents approximately 0.8 percent of the total Study Area Riparian Buffer area within the S.F. Snoqualmie watershed under Alternative 4. Culverted stream crossings at 13 locations directly impact the Riparian Buffers under Alternative 4. These culverted segments constrain streams, provide sites of increased sediment recruitment and erosion concerns, and eliminate most riparian functions. In Alternative 4, approximately 0.29 mile of streams in the S.F. Snoqualmie Watershed portion of the Study Area do not have functioning Riparian Buffers because they have been placed in culverts. This total includes the length of the 13 culverted stream crossings. Under Alternative 4, 6.18 acres of mature and immature forested Riparian

Buffers would be lost due to construction of ski trails, lift terminals, buildings, roads, and parking lots (see Table 4.3.3-12). Clearing and grading activities within Riparian Buffers would be minimized through implementation of Management Requirements MR2 and MR14 as well as Other Management Provisions such as OMP12, OMP13, and OMP15 (see Table 2.4-2).

Of the 9.77 linear miles of streambanks within the S.F. Snoqualmie Watershed under Alternative 4 (two sides to 4.89 miles of streams), 3.99 miles (41 percent) would remain under natural mature and immature forest cover, 2.70 miles (28 percent) would remain in natural nonforest cover, 2.79 miles (29 percent) would adjoin ski trails and other modified vegetation, and 0.23 mile (2.4 percent) would be adjacent to developed areas. These impacts to Riparian Buffers and their associated stream functions would be less than under Alternative 2 after implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Indirect Impacts

Under Alternative 4, the long-term beneficial and short-term detrimental impacts from the restoration projects listed and described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and the Stormwater Management Plan would be the same as described under Alternative 2. The restoration projects would result in a decrease in modified channel length and impervious surface, and road density in several drainages, but would not reduce any parameter to below threshold (see Table 4.3.5-2).

The re-alignment of Alpental Road under Alternative 4 would reduce the roaded area within the Riparian Buffer of the South Fork Snoqualmie River by approximately one-third acre along this corridor. The resulting alignment, paired with re-vegetation of the Riparian Buffer, would reduce the amount of road stormwater runoff and sediment directly introduced to the stream system.

Indirect impacts to Riparian Buffers such as windthrow potential, noxious weed establishment, and mass wasting potential under Alternative 4 would be similar to conditions described in Alternative 2.

4.3.6 Impacts – Modified Alternative 5

See Figures 2.3.6-1, Modified Alternative 5 Proposed Conditions – The Summit and 2.3.6-2, Modified Alternative 5 – Alpental for the proposed conditions under Modified Alternative 5 at both The Summit and Alpental.

4.3.6.1 Upper Yakima River Watershed

Streams

Summary

Under Modified Alternative 5, there would be 89 stream crossings (culverts, bridges, and/or fords), 1.90 miles of culverted channels, 0.83 mile of ditches conveying streamflow, and 13 new trenched utility

crossings. All of these activities would directly impact stream channels within the U. Yakima Watershed. Indirect impacts to streams under Modified Alternative 5 would include clearing and grading activities that would result in the removal of mature and immature forest within Riparian Buffers. In addition, construction of 4.54 acres of impervious surfaces would occur within Riparian Buffers. Under Modified Alternative 5, application of MgCl to I-90 and SR 906 would continue, and MgCl would also be applied to Parking Lots Silver Fir 1and Summit West 2. Both of these lots would also be paved. The combination of MgCl application (reducing the need for traction sanding) and paving would reduce the amount of sediment transported to streams.

Drainages of Particular Concern Analysis

Under Modified Alternative 5 (as under Alternative 2), there would be one new threshold exceedence, in comparison to Alternative 1 conditions:

- Summit South (Stream length with management concerns – 13.12 percent)

Table 4.3.6-1:
Summary of DPC Analysis of Watershed Conditions for Modified Alternative 5 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Lower Mill Creek	Upper Mill Creek	Creek Run	Sum-mit South	Hyak	Tun-nel	Ski Acres	Beaver	Other
Area (acres)	**N/A**	**395.50**	**33.21**	**220.15**	**223.79**	**192.61**	**134.35**	**357.93**	**171.30**	**155.56**
Riparian Buffers in a Non-Natural Condition (% of total)	30	80.34	99.86	25.58	63.79	28.26	51.03	55.29	59.34	44.52
Change from Alternative 1 (% of total)		-2.83	-0.14	6.71	18.73	0.89	9.03	2.51	2.96	0.00
Stream Length w/ Management Concerns (% of total)	10	8.37	18.33	3.08	13.12	5.34	34.11	45.19	27.98	32.40
Change from Alternative 1 (% of total)		0.59	0.00	1.19	6.53	-0.47	6.88	0.72	-20.65	0.00
Road Density (miles/square mile)	3	7.48	2.89	2.24	5.61	2.79	11.77	8.80	7.70	1.65
Change from Alternative 1 (miles/square mile)		0.05	-0.01	-0.28	-0.05	0.01	-0.58	-0.48	-0.95	-0.02
Road Crossing Density (number/square mile)	6	29.13	0.00	20.35	11.44	13.29	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	0.01	-2.85	3.33	4.80	0.02	-3.72	0.00
Impervious Cover (% of total)	8	2.27	0.88	0.83	4.35	1.32	7.92	9.33	4.34	1.16
Change from Alternative 1 (% of total)		0.02	0.00	0.07	0.02	0.04	0.89	1.17	0.05	0.01
Modified Channel Length (% of total)	8	0.00	0.00	0.00	1.69	0.00	5.61	12.65	5.48	0.00
Change from Alternative 1 (% of total)		0.00	0.00	0.00	0.00	0.00	0.01	-0.03	-4.97	0.00
Culverted Channel Length (% of total)	8	1.56	0.00	0.00	0.00	5.76	26.82	17.16	15.70	38.46
Change from Alternative 1 (% of total)		1.56	0.00	0.00	0.00	0.00	0.75	1.07	-6.26	0.00
Parameters over Threshold		**3**	**2**	**1**	**4**	**1**	**4**	**7**	**5**	**3**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**-1**	**0**	**-1**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

In general, Modified Alternative 5 impacts to drainages would be similar to those described under Alternative 2. Under Modified Alternative 5, The Summit-at-Snoqualmie would implement the MDP Implementation Plan, Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, which includes restoration projects such as slope stabilization, road deactivation, revegetation, and stream and wetland restoration. These restoration projects would help to address areas of concern identified in the DPC analysis. The restoration projects would result in decreases in several DPC parameters, including Riparian Buffers in a non-natural condition, stream length with management concerns, road density, modified channel length, and culverted channel length, for several drainages. The modified channel length parameter would be reduced to below threshold due to these restoration projects for the Beaver drainage (see Table 4.3.6-1). These restorations, outlined in Section 5.0 – Restoration of Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, incorporate the concepts of creation, enhancement, revegetation, and road deactivation activities as means to achieve restoration. Tables 5-1 and 5-2 in Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, outline and describe the restoration projects that would be required by the USFS and implemented by The Summit-at-Snoqualmie under Modified Alternative 5.

Direct Impacts

Culvert installation impacts under Modified Alternative 5 would be exactly the same as Alternative 2 since the three proposed new culverts would be installed in the same locations. All new culverts would be sized to pass water from 100-year storm events with considerations for sediment and debris likely to be encountered. Management Requirements MR3, MR8, MR9, and MR10 as well as Other Management Provision OMP9 (see Table 2.4-2), in tandem with the MDP Implementation Plan, would be implemented during culvert installation to reduce bank down-cutting and sediment delivery to streams. Under Modified Alternative 5, four culverts would be removed; three coinciding with the decommissioning of road M-5 and one pursuant to the daylighting of Beaver Lake Creek. The removal of culverts during these projects would result in long-term beneficial impacts to stream channels, but would impact streams negatively in the short-term through instream disturbance and temporary sediment impacts. The culvert removals would result in a decrease in the culverted channel length parameter in the Beaver drainage, but not to below threshold. The daylighting of Beaver Lake Creek, however, would result in the modified channel length parameter to decrease to below threshold in the Beaver drainage (see Table 4.3.6-1).

As in Alternative 2, two new bridges are proposed within the U. Yakima Watershed portion of the Study Area under Modified Alternative 5. Bridge footings would be located outside of the floodprone areas of these streams and would not constrict or otherwise impact the channel. Management Requirements MR3, MR9, and MR10 as well as Other Management Provision OMP9 (see Table 2.4-2), in tandem with the MDP Implementation Plan, would be implemented during culvert installation to reduce channel down-cutting and sediment delivery to streams.

Under Modified Alternative 5, no new fords would be built, but the existing fords would receive maintenance, as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Modified Alternative 5 would require the same channelization of stream segments through the placement of culverts, creating CV-class channels in two places within the U. Yakima Watershed as Alternative 2. One culvert would be constructed near the bottom terminal of the proposed Mill Creek chairlift on the backside of Summit East. The other culverted channel would be built upslope from the upper terminal of the realigned Little Thunder chairlift at Summit West. The total impacted stream length for both of these CV channels would be about 0.06 mile.

The number of utility trenches crossing streams under Modified Alternative 5 would be the same as under Alternative 2. The utility trenching impacts to stream channels would be short-term because of Management Requirement MR27 as well as Other Management Provisions OMP2, OMP9, and OMP14 (see Table 2.4-2) that would be implemented. In addition, the streambank would be stabilized as outlined in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

A beneficial direct impact to streams under Modified Alternative 5 is the restoration of streams within the U. Yakima Watershed as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). Even though the intent of restoration projects is to improve stream and riparian vegetation zone functions, restoration projects would result in temporary, direct impacts to stream channels from increased sediment delivery potential during project implementation. However, in the long-term, these restoration projects would be beneficial to these streams because their natural functions would be restored. The restoration projects would result in reductions in several DPC parameters, including Riparian Buffers in a non-natural condition, stream length with management concerns, road density, road crossing density, modified channel length and culverted channel length, for several drainages. In the Beaver drainage, the modified channel length parameter would be reduced to below threshold due to the stream restoration projects outlined in Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan (see Table 4.3.6-1).

Indirect Impacts

The paving of Silver Fir Parking Lot 1 and Summit West Parking Lot 2 in Modified Alternative 5 would indirectly impact streams within the U. Yakima Watershed. These impacts would be associated with the creation of impervious surfaces that alter flow paths and the rate of drainage runoff as described in Section 4.3.3.1 – Upper Yakima River Watershed. The Stormwater Management Plan would incorporate paving, BMPs, and adaptive management to control sediment; removal/storage of plowed snow; and monitoring of other sediment sources. These measures would indirectly benefit stream channels by reducing sediment delivery from the current road and parking lot sanding.

As described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), other indirect impacts to streams in the U. Yakima Watershed under Modified Alternative 5 would result from operation and maintenance activities as described in Section 4.3.3.1 – Upper Yakima River Watershed. Operation and maintenance activities would benefit streams when performed on a routine basis. With routine maintenance, the possibility of further erosion and sediment impacts to stream channels would be minimized.

The slope stabilization projects within the U. Yakima Watershed, as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would result in beneficial long-term indirect impacts to stream channels within the Study Area because of the reduced sediment yield. These slope stabilization projects would result in decreases in DPC parameters, such as Riparian Buffers in a non-natural condition and stream length with management concerns, but would not reduce any parameter to below threshold for any drainage (see Table 4.3.6-1).

In the U. Yakima Watershed under Modified Alternative 5, there would be 0.19 mile of new road constructed, while 0.37 mile of road would be rehabilitated, resulting in a road density of 6.29 mile/mile^2 (see Table 4.3.3-2). The 0.19 mile of new road would indirectly impact stream channels over the long-term because of the potential sediment delivery from mobilized sediments derived from the new road segments. This sediment would have the potential for delivery to streams at stream crossings (bridges, culverts, and fords), and could alter stream functions and the flow regime of the streams within the Summit South 7th field drainage. Potential sediment delivery from newly constructed roads that reach streams would be minimized through the implementation of Management Requirements MR15, MR24, and MR36 as well as Other Management Provisions OMP2 through OMP5 (see Table 2.4-2). The 0.37 mile of road to be restored would indirectly result in sediment impacts to stream channels within the Summit South and Creek Run 7th field drainages over the short-term until the former road bed is completely revegetated and stabilized.

As described in Alternative 2, the effects of sediment delivery on stream channel condition (e.g., bank erosion, pool filling, cobble embeddedness, etc.) are expected to decline with the implementation of, parking lot paving, use of ice inhibitors, and snow management in the base area. Consequently, the management effects of Modified Alternative 5 on sediment delivery and channel stability would be similar to those in Alternative 2, and long-term improvements in the condition of stream channels within the Study Area would be expected.

Other off-channel construction activities under Modified Alternative 5 could impact channels indirectly if large quantities of sediment or other contaminants are transported to streams. These potential effects would be the same as described in Alternative 2. Therefore, like Alternative 2, stream channels within both the Summit South and Creek Run 7th field drainages would be impacted by increased instability and a reduction in the quantity and quality of aquatic habitat as described under Alternative 2. These indirect

stream channel impacts would be reduced through Management Requirements MR15 as well as Other Management Provisions OMP2, OMP4, OMP7, and OMP11 (see Table 2.4-2) as well as the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Under Modified Alternative 5, indirect impacts occurring due to the proposed changes in vegetation communities within Riparian Buffers would increase ski trails and modified vegetation within Riparian Buffers by 16 acres from existing conditions, and 4.54 acres would be developed into base area and other support facilities (see Table 4.3.3-6). Similar to Alternative 2, approximately 0.58 mile of streambanks that are currently either naturally forested or naturally non-forested would be converted to modified vegetation and/or developed areas (see Table 4.3.3-6) under Modified Alternative 5. Changes in land cover within Riparian Buffers can indirectly impact the physical condition and ecological functions of streams over the long-term. These changes would reduce the current shade and litter input that the trees currently provide to the streams, change the water quality (turbidity, temperature, and dissolved oxygen), and affect the channel conditions via the potential sediment delivery to streams. Sediment introduced to the stream would be transported to depositional areas, where it can fill pools, reduce channel capacity, create unstable stream segments, and degrade aquatic habitat. Implementation of appropriate BMPs, Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, revegetation, prompt site stabilization and monitoring would minimize indirect impacts to stream channels.

Wetlands

Summary

Under Modified Alternative 5, there would be 42 wetlands impacted within the U. Yakima Watershed at The Summit-at-Snoqualmie. Under Modified Alternative 5, these impacts would include 2.27 acres of clearing and 1.87 acres of grading (see Table 4.3.3-3), for a total of 4.14 acres of wetlands impacts. This compares to 2.19 acres of clearing and 1.90 acres of grading proposed for 39 wetlands zones under Alternative 2, for a total of 4.09 acres of wetlands impacts. The acreage and number of wetlands impacted under Modified Alternative 5 would be greater than any of the alternatives, including Alternative 2. Direct impacts would be a result of construction of lift terminals and towers, buildings, utility trenching, and the clearing and grading of land for ski trails. Indirect impacts to wetlands within the U. Yakima Watershed at The Summit-at-Snoqualmie under Modified Alternative 5 include application of the MgCl de-icer/ice-inhibitor, operation and maintenance activities, revegetation and stabilization measures, and construction activities on adjacent lands. All activities described above would cause long-term impacts to wetlands. The exception would be utility trenching and stabilization measures, which would be short-term impacts.

Direct Impacts

Direct impacts under Modified Alternative 5 would be similar to Alternative 2. Approximately 1.87 acres of wetlands would be directly impacted by grading activities, similar to the 1.90 acres of grading wetlands

impacts under Alternative 2. Approximately 1.08 acres of these grading impacts to wetlands in the U. Yakima Watershed under Modified Alternative 5 could be avoided by flagging and surveying wetlands in the proposed impact areas. This information may be used in detailed construction plans that would facilitate the project design to avoid and minimize unnecessary impacts to wetlands. Thus, there would be less actual impact during field implementation than currently identified and disclosed through GIS analysis alone.

Under Modified Alternative 5, activities that require just the clearing of vegetation, but no grading, are similar to those described in Alternative 2. Under Modified Alternative 5, there would be 2.27 acres of clearing. Under Modified Alternative 5, approximately 1.30 acres of clearing-only impacts to wetlands can be avoided by flagging and surveying wetlands in the proposed impact areas. This information would be used in detailed construction plans that would facilitate the project design to avoid and all unnecessary impacts to wetlands. Therefore, there would be less actual impact during field implementation than currently identified through GIS analysis alone.

Under Modified Alternative 5, wetlands impacts due to utility trenching would not affect the long-term loss of wetland acreage or wetland function because the wetland areas would be restored immediately after installation of utility lines. The locations of utility trenching impacts under Modified Alternative 5 would be the same as Alternative 2. Trenching impacts to wetlands may be avoided by trenching around wetlands where possible. The use of Management Requirements MR24 as well as Other Management Provisions OMP7, OMP14, and OMP16 (see Table 2.4-2) would also minimize the potential impacts to wetland functions from utility trenching.

Under Modified Alternative 5, the restoration of Wetland #207 and Wetland #142, would be performed in conjunction with tree island revegetation at Summit West and Summit Central, respectively. These projects would be considered to have a beneficial direct impact because wetland functions such as the hydrologic regime, shading, and nutrient and carbon cycling would be restored to more natural conditions.

Indirect Impacts

Operational and maintenance activities that could impact wetlands under Modified Alternative 5 would be the same as those described under Alternative 2.

Under Modified Alternative 5, grading occurring in Riparian Reserves of wetlands would increase the potential for sediment delivery to wetlands during construction. Implementation of BMPs, Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 such as MR24, OMP7, OMP14, and OMP16 and application of the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), would minimize the potential for these indirect impacts.

Application of MgCl as well as paving the parking lots under Modified Alternative 5 could potentially indirectly impact the large wetland complexes and individual wetlands in these areas as described in Alternative 2.

Water Quantity

Summary

Under Modified Alternative 5, no snowmaking is proposed, and there would be no new groundwater or surface water withdrawals. Therefore, no change in water rights would occur. The wastewater disposal technique would remain via sewer under SPUD, and represents the primary groundwater-related operational impact that would occur under Modified Alternative 5.

Under Modified Alternative 5, the land use patterns would almost be identical to Alternative 2, except that the gladed trails of the Creek Run pod would require less clearing along their centerlines. Also, the clearing and grading polygons for the Rampart and Creek Run chairlifts would be slightly different.

Indirect Impacts

Approximately 535.5 acres of the Study Area within the U. Yakima Watershed (28 percent of land cover) would remain as hydrologically mature forest under Modified Alternative 5. Because of proposed development and restoration, 50 acres of land cover would be converted to a hydrologically immature status. This includes naturally non-forested areas, young saplings planted for restoration, and ski trails (both new and existing) consisting of modified shrubs and herbaceous vegetation (see Table 4.3.3-4). The creation of ski trails and other development clearing would therefore increase the immaturity of land cover in the U. Yakima Watershed portion of the Study Area by 2.6 percent. Land conversions (ski trails, impervious areas) would likely generate a slight net export of water from the U. Yakima Watershed. Differences in land cover between Alternative 1 and Modified Alternative 5 may indirectly affect snow accumulation and snowmelt locally, which could affect the runoff patterns of the Watershed.

Construction techniques, including the embedding of coarse woody debris within the ground surface, along with Other Management Provisions OMP25, OMP26, and OMP33 would minimize localized increases in sheet flow on construction sites both during and after construction (see Table 2.4-2). Under current maintenance practices at The Summit-at-Snoqualmie, modified vegetation would continue to be maintained in a hydrologically immature condition to support ski area management. Water from these areas generally runs off quickly to streams. Considering that several streams within the U. Yakima Watershed portion of the Study Area are typically ephemeral or intermittent at this elevation, and given that source protection measures are included in the construction techniques and Measures from Table 2.4-2, the effects of lift and trail construction would not result in any measurable increase in flow in either Coal Creek or Mill Creek. Therefore, no water quantity impacts are expected within the U. Yakima Watershed.

Flow Model

The results of the flow model for Modified Alternative 5 are displayed in Table 4.3.3-5. As shown, Creek Run, Hyak, and Summit South are the 7th field drainages whose Modified Alternative 5 streamflow would change in relation to Alternative 2, due to differences in forest clearing and creation of new impervious surfaces. Meanwhile, there would be no change to the streamflow between Alternative 2 and Modified Alternative 5 in the Beaver Lake, Lower Mill Creek, Ski Acres, Tunnel, and Upper Mill Creek 7th field drainages.

As described in Section 4.3.3.1 – Upper Yakima River Watershed, the predicted streamflow increases are typical of the types of streams in the 7th field drainages. In addition, any local increase in streamflow in the U. Yakima Watershed from the 5.83 acres of new impervious surfaces is expected to be mitigated through BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Water Quality

Summary

Under Modified Alternative 5, sediment delivery to streams would occur at 89 stream crossings (culverts, bridges, fords) and 13 utility crossings that would exist after project construction. Sediment delivery could result in associated increases in turbidity. Temperature and dissolved oxygen could increase due to the 0.58 mile of mature and immature forest proposed for removal along streambanks. The pH of streams could increase under Modified Alternative 5 due to the construction of 4.54 acres of impervious surfaces within Riparian Buffers. Other water pollution constituents, such as oil and grease, are expected to decrease under Modified Alternative 5 due to the implementation of the Stormwater Management Plan. After implementation of all projects in Modified Alternative 5, water quality levels would likely remain close to current conditions. Proper implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 would reduce the possibility of water quality exceedences.

Direct Impacts

Under Modified Alternative 5, there would be three new culverts installed in streams within the U. Yakima Watershed: one in the Lower Mill Creek drainage near the bottom terminal of the Mill Creek chairlift, one in the Summit South drainage near the bottom terminal of the Rampart chairlift, and one in the Tunnel Creek drainage near the bottom terminal of the Easy Street chairlift. The installation of two new bridges in Modified Alternative 5 would also result in direct impacts, both short-term and long-term, to water quality. One bridge would be installed where Trail 55B crosses Stream A. The other bridge would be built where Trail 71 crosses Hyak Creek. The construction of culverts and bridges would likely result in short-term increased sediment delivery and turbidity in the streams due to construction within the stream channel. Over the long-term, the presence of bridges and culverts in streams could result in increased potential for sediment mobilization and turbidity in the respective drainages. Implementation of

BMPs and Management Requirements MR3, MR9, MR10 as well as Other Management Provisions OMP9 and OMP10 from Table 2.4-2 would minimize the effect of sediment delivery and increased turbidity on the downstream waters. Bare soil areas around culverts and the footprint of the bridges would require proper stabilization through BMPs and Measures in order to minimize the risk of long-term delivery of sediment to the stream channels.

Under Modified Alternative 5, the construction of 13 utility crossings in surface waters within the U. Yakima Watershed would result in short-term, direct impacts to water quality. The impacts to water quality in the U. Yakima Watershed related to the construction of utility crossings are described under Alternative 2. The implementation of BMPs and Management Requirement MR27 as well as Other Management Provisions OMP2, OMP9, and OMP14 (see Table 2.4-2) would minimize the effect of sediment delivery and increased turbidity on downstream waters. Under project build-out in Modified Alternative 5, turbidity levels would likely remain below SWQS. Implementation of BMPs and Measures from Table 2.4-2 would reduce the probability of exceedences.

Under Modified Alternative 5, construction of lift terminals and lift towers, including concrete tower foundations, would occur within the Riparian Buffers of all the 7th field drainages in the U. Yakima Watershed. The pH of streams within these drainages could be affected as described under Alternative 2. Management Requirements MR15, MR16, and MR36 (see Table 2.4-2) would reduce the chance of high pH runoff entering the streams, and thereby would help maintain the current pH levels within streams in the U. Yakima Watershed. Another potential water quality impact that could occur during construction activities within Riparian Buffers under Modified Alternative 5 would be contamination of surface water by petroleum products, should equipment working in or adjacent to streams experiences fuel leaks or hydraulic system failures. All stream crossing structure locations have the potential for increased pollutant (e.g., fuel) and sediment delivery during construction activities under Modified Alternative 5. However, development of a SWPPP and the implementation of BMPs and Management Requirements MR14 and MR16 as well as Other Management Provisions such as OMP13, OMP15, and OMP17 would minimize the potential for any short-term, indirect delivery of pollutants to streams.

Beneficial effects to surface water quality would result from the implementation of the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan), which would limit sediment delivery to streams from sources such as road sanding as described in Alternative 2. Under implementation of the Stormwater Management Plan, the water quality of adjacent and nearby streams would improve because of a decrease in sediment delivery and oil and grease contents.

As reported in Alternative 2, the Upper South Fork Snoqualmie River and Coal Creek Watershed Condition Assessment (Jones & Stokes 2001) suggests that management objectives for water quality are currently being met under current ski area operations for all parameters in the S.F. Snoqualmie and U. Yakima Watersheds, except for temperature, dissolved oxygen, and turbidity in some streams within

drainages in the U. Yakima Watershed. Under Modified Alternative 5, impacts to these water quality parameters would be the same as described in Alternative 2.

Indirect Impacts

Under Modified Alternative 5, an additional 2.61 acres of mature and immature forests would be incorporated into Riparian Buffers because of the Mill Creek land donation[61] and the correspondent widening of Riparian Buffers in this parcel to NWFP specifications. Utility trenching would occur in Riparian Buffers, which would result in an increased potential for indirect sediment impacts to streams caused by proposed activities. Sediment impacts from construction activities would increase the turbidity in streams usually in the short-term. In the long-term, these turbidity impacts would likely be reduced to background levels following successful implementation of BMPs and Management Requirements MR2, and MR14 as well as Other Management Provisions OMP12, OMP13, and OMP15 (see Table 2.4-2) which would minimize turbidity impacts to streams.

Land cover changes in the Riparian Buffers due to activities proposed under Modified Alternative 5 could also indirectly affect the temperature of the streams as described in Alternative 2. Stream temperatures for Study Area streams would likely remain the same as existing conditions or increase slightly for all streams under Modified Alternative 5. In drainages, such as Stream B and Tunnel Creek, where small areas of trees would be removed from alongside the streambank, no temperature increase is likely due to the small area of proposed activities. Since water temperature and dissolved oxygen are correlated, Modified Alternative 5 would also likely maintain the existing stream dissolved oxygen concentrations for all streams within the U. Yakima Watershed portion of the Study Area.

Under Modified Alternative 5 The Summit-at-Snoqualmie would implement the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan), which is described in Alternative 2. With implementation under Modified Alternative 5 of the Stormwater Management Plan, long-term detrimental impacts to water quality from sand, oil, and grease introduced by polluted stormwater runoff parking lots would be reduced from existing conditions.

Via implementation of the MDP Implementation Plan and other specific Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, there would be several beneficial impacts to water quality within the U. Yakima Watershed under Modified Alternative 5. These beneficial effects are described in Alternative 2. Under Modified Alternative 5, 0.37 mile of road would be decommissioned and the 3 culverts that convey streams under this road would be removed. Also under Modified Alternative 5, tree islands are proposed at Summit East, Summit Central, and Summit West. Once these tree islands are healthy and established, they would help stabilize the soils in these areas. Under Modified Alternative 5, in addition to the restoration project to daylight Beaver Lake Creek, a

[61] In Modified Alternative 5, the proposed Mill Creek land donation would occur, resulting in the transition to land management under the Northwest Forest Plan. Riparian areas currently managed according to county regulations would transition to Riparian Reserves, with greater buffer widths.

second stream channel would be restored next to the tubing area, as described further in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). These stream restoration projects would result in decreases in the modified channel length and culverted channel length parameters for the Beaver drainage, and would decrease the modified channel length parameter to below threshold (see Table 4.3.6-1). Wetlands restoration and all proposed revegetation under Modified Alternative 5 are also described in Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan.

Riparian Buffers

Summary

Under Modified Alternative 5, the total area of developed impervious surfaces would increase by 4.54 acres within Riparian Buffers in the U. Yakima Watershed portion of the Study Area. This increase represents approximately 0.7 percent of the total Study Area Riparian Buffers within the U. Yakima Watershed. Approximately 1.90 miles of streams in the U. Yakima Watershed portion of the Study Area have been placed in culverts, including the 74 culverted stream crossings. Under Modified Alternative 5, 0.19 mile of new road would be built within Riparian Buffers. In addition, other mature and immature forested Riparian Buffers would be converted into other vegetation community types: 0.58 mile of streambank would be converted from natural conditions to modified and developed conditions. Through implementation of the Stormwater Management Plan, sediment yield to streams within the U. Yakima Watershed would decrease under Modified Alternative 5.

Direct Impacts

Direct impacts to Riparian Buffers under Modified Alternative 5 are almost the same as in Alternative 2 because of the ski trail and lift development in the Rampart and Creek Run pods. As displayed in Table 4.3.3-6, the total area of developed impervious surfaces would increase by 4.54 acres within Riparian Buffers in the U. Yakima Watershed portion of the Study Area, representing approximately 0.7 percent of the total Study Area Riparian Buffer area under Modified Alternative 5. 74 culverted stream crossings directly impact the Riparian Buffers under Modified Alternative 5, constraining streams, providing sites of increased sediment recruitment and erosion concerns, and eliminating most riparian functions. In Modified Alternative 5, approximately 1.90 miles of streams in the U. Yakima Watershed portion of the Study Area do not have functioning Riparian Buffers because they have been placed in culverts. This length includes the 74 culverted stream crossings. Under Modified Alternative 5, areas of mature and immature forested Riparian Buffers would be lost due to construction of ski trails, lift terminals, buildings, roads, and parking lots. Clearing and grading activities within Riparian Buffers would be minimized through implementation of Management Requirements MR2, and MR14 as well as Other Management Provisions OMP12, OMP13, and OMP15 (see Table 2.4-2).

Of the 17.32 linear miles of streambanks under Modified Alternative 5 (two sides to 8.66 miles of streams), 7.88 miles (45 percent) would remain under natural mature and immature forest cover, 0.79 mile

(4.6 percent) would remain in natural nonforest cover, 5.01 miles (29 percent) would adjoin ski trails and other modified vegetation, and 0.29 mile (1.6 percent) would be adjacent to developed areas. These impacts to Riparian Buffers and their associated stream functions would be less than under Alternative 2 after implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Indirect Impacts

Under Modified Alternative 5, the long-term beneficial and short-term detrimental impacts from the restoration projects listed and described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and the Stormwater Management Plan would be the same as described under Alternative 2. The restoration projects would result in several decreases in DPC parameters for several drainages, and would decrease the modified channel length parameter to below threshold for the Beaver drainage (see Table 4.3.6-1).

Indirect impacts to Riparian Buffers such as windthrow potential, noxious weed establishment, and mass wasting potential under Modified Alternative 5 would be similar to conditions described in Alternative 2.

4.3.6.2 South Fork Snoqualmie River Watershed

Streams

Summary

Within the S.F. Snoqualmie Watershed under Modified Alternative 5, there would be 17 stream crossings (culverts, bridges, and/or fords), 0.29 mile of culverted channels, 0.99 mile of ditches conveying streamflow, four new utilidor crossings, and six new trenched utility crossings. All of these proposed activities would directly impact stream channels, mostly over the long-term. However, some would also carry short-term consequences. Indirect impacts to streams under Modified Alternative 5 include clearing and grading activities within Riparian Buffers that would result in the removal of 6.45 acres of mature and immature forest. In addition, the construction of 2.99 acres of impervious surfaces within Riparian Buffers could modify the flow paths of runoff and erosion patterns. Beneficial impacts would include the application of MgCl to paved parking lots, which reduce sediment transported to streams and reduce the filling of pools in streams.

Drainages of Particular Concern Analysis

Under Modified Alternative 5, there would be two new threshold exceedences, in comparison to Alternative 1 conditions:

- Northside (Stream length with management concerns – 33.68 percent)
- Upper Alpental (Riparian Buffers in a non-natural condition – 31.96 percent)

Table 4.3.6-2:
Summary of DPC Analysis of Watershed Conditions for Modified Alternative 5 in the South Fork Snoqualmie River Watershed Portion of The Summit-at-Snoqualmie Study[a]

Parameter	Threshold	North-side	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)	**N/A**	**49.02**	**72.08**	**270.07**	**89.34**	**318.62**	**214.58**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.13	94.17	43.72	31.96	40.33	11.36
Change from Alternative 1 (% of total)		1.66	10.27	2.60	4.74	1.36	0.05
Stream Length w/ Management Concerns (% of total)	10	33.68	75.50	4.44	3.89	23.19	3.99
Change from Alternative 1 (% of total)		33.68	25.74	2.00	0.00	1.79	0.01
Road Density (miles/square mile)	3	5.48	7.01	0.50	0.72	1.71	2.36
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.04	0.01	0.01
Road Crossing Density (number/square mile)	6	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Impervious Cover (% of total)	8	1.89	17.73	0.27	2.36	1.96	2.68
Change from Alternative 1 (% of total)		0.25	3.47	0.05	2.13	0.04	0.00
Modified Channel Length (% of total)	8	0.00	76.34	1.96	0.00	22.20	5.50
Change from Alternative 1 (% of total)		0.00	-12.08	0.00	0.00	-2.97	0.01
Culverted Channel Length (% of total)	8	0.00	23.66	0.00	0.00	3.97	0.36
Change from Alternative 1 (% of total)		0.00	12.08	0.00	0.00	0.13	0.00
Parameters over Threshold		**3**	**7**	**1**	**2**	**4**	**1**
Change from Alternative 1		**1**	**0**	**0**	**1**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

In general, Modified Alternative 5 impacts to drainages would be similar to those described under Alternative 2. Under Modified Alternative 5, The Summit-at-Snoqualmie would implement the MDP Implementation Plan, Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, which includes restoration projects such as slope stabilization, road deactivation, revegetation, and stream and wetland restoration. These restoration projects would help to address areas of concern identified in the DPC analysis. The restoration projects would result in decreases

in the modified channel length parameter for two drainages, but would not result in any decreases to below threshold (see Table 4.3.6-2). These restorations, outlined in Section 5.0 – Restoration of Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, incorporate the concepts of creation, enhancement, revegetation, and road deactivation activities as means to achieve restoration. Tables 5-1 and 5-2 and Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, outline and describe the restoration projects that would be required by the USFS and implemented by The Summit-at-Snoqualmie under Modified Alternative 5.

Direct Impacts

Direct impacts to stream channels within the S.F. Snoqualmie Watershed under Modified Alternative 5 would be exactly the same as described under Alternative 2. Management Requirements MR3, MR8, MR9, and MR10 as well as Other Management Provision OMP9 (see Table 2.4-2), in tandem with the MDP Implementation Plan, would be implemented during culvert installation to reduce channel down-cutting and sediment delivery to streams. Under Modified Alternative 5, there would be no culvert removal within the S.F. Snoqualmie Watershed. No new bridges or fords are proposed within the S.F. Snoqualmie Watershed portion of the Study Area. However, existing bridges and fords would undergo regular maintenance as described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Modified Alternative 5 would also require the channelization of stream segments through the placement of culverts, creating CV-class channels in two places within the S.F. Snoqualmie Watershed. Both CV channels would be created to convey 0.07 mile of stream segments under Summit West Parking Lot 1. Management Requirement MR8 from Table 2.4-2, in tandem with the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), would be implemented during culvert installation to reduce channel down-cutting and sediment delivery to streams. The restoration projects described in the MDP Implementation Plan would result in decreases in the modified channel length parameter for two drainages, but would not result in any decreases to below threshold (see Table 4.3.6-2).

As in Alternative 2, the trenching of utilities would directly impact streams under Modified Alternative 5, although it would only be over a short-time period. Within the S.F. Snoqualmie Watershed there would be six utility trenching crossings of streams. These new utility crossings would directly impact streams as described in Section 4.3.3.1 – Upper Yakima River Watershed. Utility trenching impacts would be short-term because Management Requirements MR27 as well as Other Management Provisions OMP2, OMP9, and OMP14 (see Table 2.4-2) would be followed and the streambank would be stabilized as outlined in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). Under Modified Alternative 5, an above-ground utilidor

would be built within the S.F. Snoqualmie Watershed at Alpental. However, no direct impacts to stream channels are expected from utilidor construction.

Under Alternative 2, there would be no direct impact to streams within the S.F. Snoqualmie Watershed as a result of stream restoration. The stream restoration projects would result in decreases in the modified channel length parameter for two drainages, but would not result in any decreases to below the parameter threshold (see Table 4.3.6-2).

Indirect Impacts

The paving of Alpental Parking Lots 3, 4, 5, 6, and 7 as well as Summit West Parking Lot 1 under Modified Alternative 5 would have the same indirect impacts to streams within the S.F. Snoqualmie Watershed as described in Alternative 2.

As described in further detail in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), other indirect impacts to streams in the S.F. Snoqualmie Watershed under Modified Alternative 5 would result from operation and maintenance activities as described in Section 4.3.3.1 – Upper Yakima River Watershed. Performed on a routine basis, operation and maintenance activities would be beneficial to streams. With routine maintenance, the potential for further erosion and sediment impacts to stream channels would be minimized.

In the S.F. Snoqualmie Watershed under Modified Alternative 5, there would be 0.01 mile of new road built. At 1.99 mile/mile^2, the road density would be the same as Alternative 2 (see Table 4.3.3-8). The impacts to the stream channels and Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2) to minimize them are exactly the same as described in Alternative 2.

The impact of sediment delivery on stream channel conditions is expected to decline under Modified Alternative 5 due to the use of the ice inhibitor MgCl as described in Alternative 2. Consequently sediment delivery and channel stability impacts on streams within the S.F. Snoqualmie Watershed under Modified Alternative 5 would be reduced in the long-term.

Other off-channel construction activities could impact channels indirectly if large quantities of sediment or other contaminants are transported to streams. This would also occur under Modified Alternative 5 at Summit West and Alpental during the grading and paving of the parking lots as described in Alternative 2. These indirect stream channel impacts would be reduced through Management Requirements MR15 as well as Other Management Provisions such as OMP2, OMP4, OMP7, and OMP11 (see Table 2.4-2) as well as the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan).

Within the S.F. Snoqualmie Watershed, Modified Alternative 5 would increase ski trails and modified vegetation within Riparian Buffers by 1.64 acres. In addition, an additional 2.99 acres would be developed into base areas and other support facilities (see Table 4.3.3-12), the same as described under Alternative 2.

Wetlands

Summary

Under Modified Alternative 5, there would be 18 wetlands impacted within the S.F. Snoqualmie Watershed at The Summit-at-Snoqualmie under the proposed project activities. These activities would include 0.86 acre of clearing and 0.88 acre of grading (see Table 4.3.3-9). Direct impacts would be a result of construction of lift terminals and towers, buildings, utility trenching, and the clearing and grading of land for ski trails. Indirect impacts to wetlands within the S.F. Snoqualmie Watershed at The Summit-at-Snoqualmie under Modified Alternative 5 include application of the MgCl de-icer/ice-inhibitor, operation and maintenance activities, revegetation and stabilization measures, and construction activities on adjacent lands. All activities described above would cause long-term impacts to wetlands. The exception would be for utility trenching and subsequent stabilization measures, which would result in short-term impacts.

Direct Impacts

Wetlands impacts associated with the implementation of Modified Alternative 5 in the S.F. Snoqualmie Watershed portion of the Study Area would be the same as Alternative 2. Approximately 0.26 acre of these grading impacts to wetlands could be avoided by flagging and surveying wetlands in the proposed impact areas. This information would be used in detailed construction plans that would facilitate the project design to avoid and minimize unnecessary impacts to wetlands. Therefore, there would be less actual impact during field implementation than is currently identified through GIS analysis alone.

Activities that require only the clearing of vegetation, but no grading, under Modified Alternative 5 would be the same as Alternative 2. Under Modified Alternative 5, none of the wetlands impacts associated with vegetation clearing-only activities could be minimized or avoided during project implementation.

Under Modified Alternative 5, the same acreage of wetlands would be impacted due to utility trenching as Alternative 2. Utility trenching would cause no long-term loss of wetland acreage or wetland function because the wetland area would be restored immediately after installation of the utility line. The locations of utility trenching impacts under Modified Alternative 5 would be the same as Alternative 2. Trenching impacts to wetlands would be avoided by trenching around wetlands where possible. In addition, the use of Management Requirements MR24 as well as Other Management Provisions such as OMP7, OMP14, and OMP16 from Table 2.4-2 would also minimize potential impacts to wetland functions from utility trenching.

Indirect Impacts

Operational and maintenance activities that could impact wetlands under Modified Alternative 5 would be the same as those described under Alternative 2.

Under Modified Alternative 5, grading would take place in Riparian Reserves of wetlands, and would increase the potential for sediment delivery to wetlands during construction. Implementation of BMPs, Management Requirements MR24 as well as Other Management Provisions such as OMP7, OMP14, and OMP16 from Table 2.4-2, and the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan), would minimize the potential for these indirect impacts.

Under Modified Alternative 5, application of MgCl, as well as paving the parking lots, would carry potential indirect impacts to the large wetland complexes and individual wetlands in these areas in both beneficial and negative manners as described in Alternative 2.

Water Quantity

Summary

Under Modified Alternative 5, no snowmaking is proposed. Therefore there would be no new groundwater or surface water withdrawals, and no change in water rights would take place. The wastewater disposal technique would remain via sewer under SPUD, and represents the primary groundwater-related operational impact that would occur under Modified Alternative 5.

Under Modified Alternative 5 there would be no land use changes that differ from those described under Alternative 2.

Indirect Impacts

Approximately 473 acres of the Study Area within the S.F. Snoqualmie Watershed (47 percent of land cover) would remain as hydrologically mature forest under Modified Alternative 5. Because of proposed development and restoration, 6.62 acres of land cover would be converted to hydrologically immature land, which includes naturally non-forested areas, young saplings planted for restoration, and ski trails (both new and existing) consisting of modified shrubs and herbaceous vegetation (see Table 4.3.3-10). The creation of ski trails and other development clearing would therefore increase the area of immature land cover in the S.F. Snoqualmie Watershed portion of the Study Area by 0.7 percent. Land conversions (ski trails, impervious areas) would likely generate a slight net export of water from the S.F. Snoqualmie Watershed. Differences in land cover between Alternative 1 and Modified Alternative 5 may indirectly affect snow accumulation and snowmelt locally, which could affect the runoff patterns of the Watershed.

Construction techniques, including the embedding of coarse woody debris within the ground surface, along with Other Management Provisions OMP25, OMP26, and OMP33 would minimize localized increases in sheet flow on construction sites during and after construction (see Table 2.4-2). Under current

maintenance practices at The Summit-at-Snoqualmie, modified vegetation would continue to be maintained in a hydrologically immature condition to support ski area management. Water from these areas generally runs off quickly to streams. Considering that several streams within the S.F. Snoqualmie Watershed portion of the Study Area are typically ephemeral or intermittent at this elevation, and given that source protection measures are included in the construction techniques and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, the effects of lift and trail construction would not result in any measurable increase in flow in the S.F. Snoqualmie River. Therefore no water quantity impacts are expected within the S.F. Snoqualmie Watershed.

Flow Model

The results of the flow model are displayed in Table 4.3.3-11. As shown, International and Upper Alpental are the 7th field drainages whose streamflow would change under Modified Alternative 5 because of differences in forest clearing and creation of new impervious surfaces, as compared to Alternative 2. Meanwhile, there would be no change in streamflow between Alternative 2 and Modified Alternative 5 in the Nacrinomical, Northside, and Summit North 7th field drainages.

As described in Section 4.3.3.1 – Upper Yakima River Watershed, these small amounts of streamflow increases are typical of the types of streams in the 7th field drainages. In addition, local increases in streamflow in the S.F. Snoqualmie Watershed from the 4.78 acres of new impervious surfaces are expected to be mitigated through BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Water Quality

Summary

Under Modified Alternative 5, sediment delivery to streams within the S.F. Snoqualmie Watershed would occur at 17stream crossings (culverts, bridges, fords) and six utility crossings that would exist after project construction. Sediment delivery could result in increased turbidity. Temperature and dissolved oxygen could increase due to the 0.27 mile of mature and immature forest proposed for removal along streambanks. The pH of streams could increase under Modified Alternative 5 due to the construction of 2.99 acres of impervious surfaces within Riparian Buffers. Other water pollution constituents, such as oil and grease, are expected to decrease under Modified Alternative 5 due to the implementation of the Stormwater Management Plan. After implementation of all projects in Modified Alternative 5, water quality levels would likely remain close to current conditions. Implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2 would reduce the possibility that water quality exceedences could occur.

Direct Impacts

Under Modified Alternative 5, there would be one new culvert installed within the S.F. Snoqualmie Watershed: an unnamed stream would be culverted under Alpental Parking Lot 7. Impacts to the S.F.

Snoqualmie Watershed from this culvert are described in Alternative 2. Implementation of BMPs and Management Requirements MR3, MR9, and MR10 as well as Other Management Provisions OMP9 (see Table 2.4-2) would reduce water quality impacts to streams as a result of this culvert installation.

The construction of six utility crossings in surface waters within the S.F. Snoqualmie Watershed would result in short-term, direct impacts to water quality. Impacts due to the construction of utility crossings are described in Section 4.3.3.1 – Upper Yakima River Watershed. Implementation of BMPs and Management Requirement MR27 as well as Other Management Provision OMP2, OMP9, and OMP14 (see Table 2.4-2) would minimize the effect of sediment delivery and increased turbidity on the downstream waters. Under implementation of Modified Alternative 5, turbidity levels would likely remain below SWQS. Implementation of BMPs and Measures would reduce the possibility that exceedences could occur.

In Modified Alternative 5, the impacts of pH increases and potential introduction of petroleum products to the S.F. Snoqualmie Watershed would be exactly the same as described under Alternative 2. Development of a SWPPP and the implementation of BMPs and Management Requirements MR14, MR15, MR16, and MR36 as well as Other Management Provisions OMP13, OMP15, and OMP17 (see Table 2.4-2) would minimize the potential for any short-term, indirect delivery of pollutants to streams that would affect the water quality in the S.F. Snoqualmie Watershed under Modified Alternative 5.

Other impacts on surface water quality could result from the implementation of the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan), which is described in more detail under Alternative 2.

No exceedences of water quality standards for fecal coliform are expected under Modified Alternative 5. Temperature and dissolved oxygen are not currently parameters of concern within the S.F. Snoqualmie Watershed.

Under Modified Alternative 5, the dissolved oxygen standards would continue to be met within the S.F. Snoqualmie Watershed. Dissolved oxygen is partly dependent on water temperature, with colder temperatures enabling higher dissolved oxygen concentrations. Under Modified Alternative 5, dissolved oxygen is not expected to decrease significantly and any impacts on fish would be negligible (see Section 4.4 - Fisheries).

Indirect Impacts

Under Modified Alternative 5, 6.45 acres of mature and immature forests would be cleared and graded in Riparian Buffers. These impacts include utility trenching that would occur in Riparian Buffers. All of these activities would result in an increased potential for indirect sediment impacts to streams. Sediment impacts from the construction activities listed above would increase the turbidity in streams usually in the short-term. In the long-term, these turbidity impacts would likely be reduced to background levels

following successful implementation of BMPs and Management Requirements MR2, and MR14 as well as Other Management Provisions OMP12, OMP13, and OMP15 (see Table 2.4-2) which would minimize turbidity impacts to streams.

The water temperature at the outlet of a stream is a cumulative result of the temperatures and flow volumes of its contributing sources. Temperatures typically become higher as the water flows downstream. Existing conditions exhibit limited canopy coverage along streams. Due to the limited areas of vegetation removal associated with MDP Implementation, the current stream temperatures within the Study Area would likely remain the same as existing conditions or increase slightly for all streams. Modified Alternative 5 would likely maintain the existing stream dissolved oxygen concentrations for all streams within the S.F. Snoqualmie Watershed portion of the Study Area, since levels of dissolved oxygen are a function of water temperature, and temperatures would be likely to remain the same.

Under Modified Alternative 5, The Summit-at-Snoqualmie would implement the Stormwater Management Plan (see Appendix G – Conceptual Stormwater Management Plan). This plan calls for the paving of Summit West Parking Lot 1, Alpental Parking Lots 3, 4, 5, 6, and 7, and the portion of Alpental Road along these parking lots. In addition, a new treatment train would process water flowing off the parking lots to improve water quality, by collecting oil and grease, and retaining sediment. With implementation of the Stormwater Management Plan, long-term detrimental impacts to water quality from sand, oil, and grease from polluted stormwater runoff parking lots would be reduced under Modified Alternative 5.

Through implementation of the MDP Implementation Plan and other specific Mitigation Measures, Management Requirements, and Other Management Provisions from Table 2.4-2, there would be several beneficial impacts to water quality within the S.F. Snoqualmie Watershed under Modified Alternative 5 that are described in more detail under Alternative 2.

Riparian Buffers

Summary

In Modified Alternative 5, the total area of developed impervious surfaces would increase by 2.99 acres within Riparian Buffers in the S.F. Snoqualmie Watershed portion of the Study Area. This increase represents approximately 1.1 percent of the total Study Area Riparian Buffer area within the S.F. Snoqualmie Watershed. Approximately 0.29 mile of streams in the S.F. Snoqualmie Watershed portion of the Study Area have been placed in culverts, including the 13 culverted stream crossings. Under Modified Alternative 5, no new roads would be built within Riparian Buffers and 6.45 acres of mature and immature forested Riparian Buffers would be converted into other vegetation community types. 0.43 mile of streambank would be converted from natural conditions to modified and developed conditions. Through implementation of the Stormwater Management Plan, overall sediment yield to streams within the S.F. Snoqualmie Watershed would decrease under Modified Alternative 5.

Direct Impacts

Direct impacts to Riparian Buffers under Modified Alternative 5 would be the same as described in Alternative 2. As displayed in Table 4.3.3-12, the total area of developed impervious surfaces within Riparian Buffers in the S.F. Snoqualmie Watershed portion of the Study Area would increase by 2.99 acres, from a total of 13.18 acres to 16.17 acres. This total represents approximately 1.1 percent of the total Study Area Riparian Buffer area within the S.F. Snoqualmie Watershed under Modified Alternative 5. 13 culverted stream crossings directly impact the Riparian Buffers under Modified Alternative 5, constraining streams, providing sites of increased sediment recruitment and erosion concerns, and eliminating most riparian functions. In Modified Alternative 5, approximately 0.29 mile of streams in the S.F. Snoqualmie Watershed portion of the Study Area do not have functioning Riparian Buffers because they have been placed in culverts. This total includes the length of the 13 culverted stream crossings. Under Modified Alternative 5, 6.45 acres of mature and immature forested Riparian Buffers would be lost due to construction of ski trails, lift terminals, buildings, roads, and parking lots (see Table 4.3.3-12). Clearing and grading activities within Riparian Buffers would be minimized through implementation of Management Requirements MR2 and MR14 as well as Other Management Provisions such as OMP12, OMP13, and OMP15 (see Table 2.4-2).

Of the 9.72 linear miles of streambanks within the S.F. Snoqualmie Watershed under Modified Alternative 5 (two sides to 4.86 miles of streams), 3.99 miles (41 percent) would remain under natural mature and immature forest cover, 2.64 miles (27 percent) would remain in natural nonforest cover, 2.81 miles (29 percent) would adjoin ski trails and other modified vegetation, and 0.25 mile (2.6 percent) would be adjacent to developed areas. These impacts to Riparian Buffers and their associated stream functions would be less than under Alternative 2 after implementation of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2.

Indirect Impacts

Under Modified Alternative 5, the long-term beneficial and short-term detrimental impacts from the restoration projects listed and described in the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and the Stormwater Management Plan would the same as described under Alternative 2. The restoration projects would result in decreases in the modified channel length parameter for two drainages, but would not result in any decreases to below threshold (see Table 4.3.6-2).

Indirect impacts to Riparian Buffers such as windthrow potential, noxious weed establishment, and mass wasting potential under Modified Alternative 5 would be similar to conditions described in Alternative 2.

4.3.7 Riparian Reserves Standards and Guidelines

As stated in Section 3.3 – Water and Watershed Resources, the Aquatic Conservation Strategy (ACS) was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems on public

lands. As clarified in the March 2004 ROD (USDA and USDI 2004a), the nine objectives of the ACS apply at the 5th -field watershed or larger scales. However, at the project level, all activities must be consistent with the standards and guidelines of the *Forest Plan, as Amended*, including applicable standards and guidelines for Riparian Reserves. The intent of the analysis presented in Tables 4.3.7-1 and 4.3.7-2 is to evaluate the effects of the alternatives on Riparian Reserves, organized by the applicable Riparian Reserve standards and guidelines.

Throughout Section 4.3.7 – Riparian Reserves Standards and Guidelines, Riparian Buffers are utilized as an analytical proxy for Riparian Reserves. Riparian Buffers were developed for use within the multi-jurisdictional Study Area, incorporating the regulatory buffer appropriate to the jurisdiction within which each riparian area is located. In other words, Kittitas and King County buffer widths were applied around riparian areas on private lands, whereas Forest Plan requirements for Riparian Reserves were applied to riparian areas managed by the USFS. Thus, Riparian Buffers represent a superset that contains Riparian Reserves. Therefore, when implementation effects to Riparian Buffers are disclosed, the analysis is conservative relative to the management of USFS lands, because the effects of projects occurring on private land are included also.

The information within this section is provided so that the decision maker has an outline to evaluate the proposals of The Summit-at-Snoqualmie MDP within the framework of compliance with the standards and guidelines of Riparian Reserves, at the 5th field scale for each alternative.

4.3.7.1 Upper Yakima River Watershed

Table 4.3.7-1:
Evaluation of Riparian Reserves Standards and Guidelines within the Upper Yakima River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Road Management					
RF-2 – For each existing or planned road, meet Aquatic Conservation Strategy (ACS) objectives by: a) minimizing road and landing locations in Riparian Reserves (RR), b) completing watershed analyses prior to construction of new roads or landings in RRs, c) preparing road design criteria, elements, and standards that govern construction and reconstruction, d) preparing operation and maintenance criteria that govern road operation, maintenance, and management, e) minimizing disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow, f) restricting sidecasting as necessary to prevent the introduction of sediment to streams, and g) avoiding wetland entirely when constructing new roads.	No new roads would be developed under Alternative 1. Road operation and maintenance would be carried out based on current approvals and the annual operating plan, which would not include road obliteration or restoration. The road management provisions of the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would not be implemented.	a) All Action Alternatives were designed to minimize the development of roads within Riparian Buffers (RBs), including wetlands. Under the Action Alternatives road impacts within RBs would be associated with re-development of existing roads. Where road re-development would occur near wetlands, wetlands impacts would be avoided. Road re-development within RBs by alternative break down as follows: • Alternative 2 – 0.17 acre (0.0 percent of 5th field RR) • Alternative 3 – 0.17 acre (0.0 percent of 5th field RR) • Alternative 4 – 0.00 acre (0.0 percent of 5th field RRs) • Modified Alternative 5 – 0.17 acre (0.0 percent of 5th field RRs). b) The Coal Creek (Jones & Stokes 2001) and Yakima River Watershed Condition Assessments (USFS 1997) have been completed to address roads and other watershed issues, specifically for The Summit-at-Snoqualmie MDP. c/d) The MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) has been developed to address road construction, operation, monitoring and maintenance specifically for The Summit-at-Snoqualmie MDP. e) Under the Action Alternatives, culverts would be sized to pass the 100-year flow, with considerations for debris and fish passage (see Table 2.4-2, MR8). f) All road construction would be conducted within approved construction limits, and proper placement of sidecasting would be conducted according to management requirements, constraints and Management Requirements MR2, MR9, MR10, MR15, and MR36, as well as Other Management Provisions OMP2, OMP5, OMP6, OMP7, and OMP17 to ensure that sediment introduction is minimized (see Table 2.4-2). g) Under the Action Alternatives, no new roads would be constructed in wetlands. Wetlands would be completely avoided wherever road construction would occur near wetlands.				

Table 4.3.7-1:
Evaluation of Riparian Reserves Standards and Guidelines within the Upper Yakima River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
RF-3 – Determine the influence of each road on the ACS objectives through watershed analysis. Meet ACS objectives by: a) reconstructing roads and associated drainage features that pose a substantial risk, b) prioritizing reconstruction based on current and potential impact to riparian resources and the ecological value of the riparian resources affected, and c) closing and stabilizing, or obliterating and stabilizing roads based on the ongoing and potential effects the ACS objectives and considering short-term and long-term transportation needs.	Under Alternative 1, no roads would be obliterated or reconstructed. Road management would be carried out based on current approvals and the annual operating plan.	Under Alternatives 2 through Modified Alternative 5, the U. Yakima Watershed portion of The Summit-at-Snoqualmie Study Area would realize a net reduction of road mileage in RBs (see Table 2.3.3-8). The acreage of road obliteration would be as follows: • Alternative 2 – 0.47 acre • Alternative 3 – 0.47 acre • Alternative 4 – 0.47 acre • Modified Alternative 5 – 0.47 acre a) Under Alternatives 2 through Modified Alternative 5, slope stabilization would occur adjacent to Road M-5 at Summit East performed in conjunction with the deactivation of Road M-5). Slope stabilization would also occur adjacent to Roads TR-17, TR-17-1, TR-17-3 and TR-17-4 at Summit East. b) Prioritization of road reconstruction and deactivation would be carried out based the phasing of MDP projects. c) Alternatives 2 through Modified Alternative 5 include deactivation of roads in RRs as a means of maintaining or improving the condition of RRs in the Study Area. See Appendix F – The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, Section 5.3 – Road Deactivation and Figure 2, Locations of Proposed Road Construction and Deactivation, for a list and discussion of these deactivation projects.				

Table 4.3.7-1:
Evaluation of Riparian Reserves Standards and Guidelines within the Upper Yakima River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
RF-4 – New culverts, bridges and other stream crossings shall be constructed, and existing culverts, bridges and other stream crossings determined to pose a substantial risk to riparian conditions will be improved, to accommodate at least the 100-year flood, including associated bedload and debris. Priority for upgrading will be based on the potential impact and the ecological value of the riparian resource affected. Crossings will be constructed and maintained to prevent diversion of streamflow out of the channel and down the road in the event of a crossing failure.	Under Alternative 1, no new culverts or bridges would be constructed. The MDP Implementation Plan would not be implemented.	Under Alternatives 2 through Modified Alternative 5, culverts would be sized to pass the 100-year flow, with considerations for debris and fish passage (see Table 2.4-2, MR8). The MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) has been developed to address road management and watershed restoration specifically for The Summit-at-Snoqualmie MDP and would ensure proper monitoring of watershed processes, including channel flow conditions at stream crossings (see MR10 in Table 2.4-2).			
RF-5 – minimize sediment delivery to streams from roads. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping in unfeasible or unsafe. Route road drainage away from potentially unstable channels, fills, and hillslopes.	Under Alternative 1, the MDP Implementation Plan would not be implemented.	Under Alternatives 2 through Modified Alternative 5, all new roads would be sloped to drain away from potentially unstable channels, fills, and hillslopes so that sediment from roads would not be transported to these areas (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). For all construction activities, a SWPPP would be prepared to direct the use of BMPs, which would minimize sediment impacts during road construction. Implementation of the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would minimize sediment delivery to streams from existing roads.			

Table 4.3.7-1:
Evaluation of Riparian Reserves Standards and Guidelines within the Upper Yakima River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
RF-6 – Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.	Under Alternative 1, fish passage conditions would remain unchanged. There would remain a total of five human-caused fish barriers within the U. Yakima Watershed portion of the Study Area, one in the Lower Mill Creek drainage, and four within Other U. Yakima drainages.	Under Alternatives 2 through Modified Alternative 5, no new fish barriers would occur on fish bearing streams. Implementation of the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would help maintain channel conditions to ensure fish passage at current locations where fish are present			
RF-7 – Develop and implement a Road Management Plan or a Transportation Management Plan that will meet the ACS objectives. As a minimum, this plan shall include provisions for the following activities: a) inspections and maintenance during storm events, b) inspections and maintenance after storm events, c) road operation and maintenance, giving high priority to identifying and correcting road drainage problems that contribute to degrading riparian resources, d) traffic regulation during wet periods to prevent damage to riparian resources, and e) establish the purpose of each road by developing the Road Management Objective.	Under Alternative 1, the MDP Implementation Plan would not be implemented.	The MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) has been developed specifically for The Summit-at-Snoqualmie MDP and Alternatives 2 through Modified Alternative 5, and includes the following provisions: a/b) The MDP Implementation Plan addresses inspection and maintenance during and after storm events. c) The MDP Implementation Plan also provides a basis for prioritizing road maintenance activities, d) Provides for use guidelines based on road conditions, e) Details the purpose of use for roads in the Study Area (e.g., maintenance, access). Additional management constraints that would be implemented are described in Table 2.4-2. For all construction activities, a SWPPP would be prepared to direct the use of BMPs, which would minimize sediment impacts during road construction.			

Table 4.3.7-1:
Evaluation of Riparian Reserves Standards and Guidelines within the Upper Yakima River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Recreation Management					
RM-1 – New Recreational Facilities within Riparian Reserves, including trails and dispersed sites, should be designed to not prevent meeting ACS objectives. For existing recreation facilities within Riparian Reserves, evaluate and mitigate impact to ensure that these do not prevent, and to the extent practicable, contribute to attainment of ACS objectives.	Under Alternative 1, the MDP Implementation Plan would not be implemented.	All Action Alternatives would result in site scale impacts within RRs. However cumulative RR impacts from any Action Alternative at the 5th field U. Yakima Watershed would be immeasurable. Implementation of the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would help maintain or improve riparian and channel conditions within The Summit-at-Snoqualmie Study Area. Additional management constraints would be implemented, as described in Table 2.4-2. For all construction activities, a SWPPP would be prepared to direct the use of BMPs, which would minimize sediment impacts during road construction.			
RM-2 – Adjust dispersed and developed recreation practices that retard or prevent attainment of ACS objectives. Where adjustment measures such as education, use limitations, traffic control devices, increased maintenance, relocation of facilities, and/or specific site closures are not effective, eliminate the practice or occupancy.	See RM-1				
Fire/Fuels Management					
FM-1 - Design Fuel treatment and fire suppression strategies, practices, and activities to meet ACS objectives, and to minimize disturbance or riparian round cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuels management activities could be damaging to long-term ecosystem function.	Under Alternative 1, no new timber removal and slash burning would take place, other than previously approved projects.	Under Alternatives 2 through Modified Alternative 5, the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would guide vegetation management, including fuel treatments. As described in Table 2.4-2, lift and trail construction would include Best Management Practices in order to reduce the impacts of the clearing prescriptions on RRs and other sensitive areas. These include: yarding over the snow, heli-logging, lop and scatter where fuel loads permit, and hand excavation of tower footings, where feasible. Table 2.4-2 presents additional Mitigation Measures, Management Requirements, and Other Management Provisions.			

Table 4.3.7-1:
Evaluation of Riparian Reserves Standards and Guidelines within the Upper Yakima River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Riparian Area Management					
RA-1 – Identify and attempt to secure in-stream flows needed to maintain riparian resources, channel conditions, and aquatic habitat.	In-stream flows would be maintained at existing conditions under all alternatives, since no new surface or ground water withdrawals would occur.				
RA-2 – Fell trees in Riparian Reserves when they pose a safety risk. Keep felled trees on-site when needed to meet coarse woody debris objectives.	Under Alternative 1, no new timber removal and slash burning would take place, other than previously approved projects. Hazard trees, exhibiting structural defects that could result in failure of the tree, would be removed where they pose safety concerns.	With implementation of Alternatives 2 through Modified Alternative 5, Measures in Table 2.4-2 would specifically provide that trees would only be felled in RRs for construction of approved projects or for safety reasons. Where possible, these trees would be felled where they can be left on the ground. Further, LWD would only be removed from RRs for safety reasons.			
RA-3 – Herbicides, insecticides, and other toxicants, and other chemicals shall be applied only in a manner that avoids impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.	All alternatives involve no use of herbicides, insecticides, toxicants, or other chemicals. To avoid the spread of weeds during construction and restoration projects under all alternatives, all vehicles and equipment doing work outside the limits of the road surface or in infested areas will follow appropriate Prevention Strategies and BMPs within Forest-wide standards and guidelines (MBSNF Forest Plan Amendment #14), the mediated agreement (1989), relevant portions of the Final EIS for Managing Competing and Unwanted Vegetation (USFS 1988) and the Action Alternatives include management and operational guidelines in Section 2.4 - Mitigation of the FEIS.				
RA-4 – Locate water drafting sites to minimize adverse effects on stream channel stability, sedimentation, and in-stream flows needed to maintain riparian resources, channel conditions, and fish habitat.	Under all alternatives, existing water drafting sites would maintain existing conditions. Existing water drafting sites are functioning properly, and are not adversely affecting riparian system function.				

Table 4.3.7-1:
Evaluation of Riparian Reserves Standards and Guidelines within the Upper Yakima River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Watershed and Habitat Restoration					
WR-1 – Design and implement watershed restoration projects in a manner that promotes long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and attains ACS objectives.	Under Alternative 1, the MDP Implementation Plan would not be implemented. Drainages within the Study Area would continue to be managed under current annual maintenance practices by The Summit-at-Snoqualmie. The watershed restoration projects within the MDP Implementation Plan would not occur.	Under Alternative 2, implementation of the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would include the watershed restoration projects listed in Table 5-1. The MDP Implementation Plan also incorporates Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2).	Under Alternatives 3 through Modified Alternative 5, the watershed restoration projects listed in the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, Tables 5-1 *and* 5-2), would be required by the Forest Service, and implemented by The Summit-at-Snoqualmie. The MDP Implementation Plan also incorporates Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2).		
WR-2 – Cooperate with federal, state, local, and tribal agencies, and private landowners to develop watershed-based Coordinated Resource Management Plans or other cooperative agreements to meet ACS objectives.	Under Alternative 1, the MDP Implementation Plan would not be implemented.	Table 1.7-1 lists the federal, state and local, agencies that permits need to be obtained from during the implementation of The Summit-at-Snoqualmie MDP. The Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2 as well as the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) were created in conjunction with input from cooperating federal agencies.			

Table 4.3.7-1:
Evaluation of Riparian Reserves Standards and Guidelines within the Upper Yakima River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
WR-3 – Do not use mitigation or planned restoration as a substitute for preventing habitat degradation.	Under Alternative 1, there would be no new impacts to Riparian Buffers.	Under Alternatives 2 through Modified Alternative 5, impacts to Riparian Buffers have been minimized to the extent practicable. As such, the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and BMPs are intended to work in conjunction with avoidance and minimization of Riparian Buffer impacts in order to help maintain or improve watershed conditions.			
Fish and Wildlife Management					
FW-1 – Design and implement fish and wildlife habitat restoration and enhancement activities in a manner that contributes to attainment of ACS objectives.	Under Alternative 1, the MDP Implementation Plan would not be implemented.	Under Alternatives 2 through Modified Alternative 5, implementation of the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would occur and along with the Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2), helping to maintain or improve the long-term ecological health of wildlife and fisheries habitat.			

4.3.7.2 South Fork Snoqualmie River Watershed

Table 4.3.7-2:
Evaluation of Riparian Reserves Standards and Guidelines within the South Fork Snoqualmie River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Road Management					
RF-2 – For each existing or planned road, meet Aquatic Conservation Strategy (ACS) objectives by: a) minimizing road and landing locations in Riparian Reserves (RR), b) completing watershed analyses prior to construction of new roads or landings in RRs, c) preparing road design criteria, elements, and standards that govern construction and reconstruction, d) preparing operation and maintenance criteria that govern road operation, maintenance, and management, e) minimizing disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow, f) restricting sidecasting as necessary to prevent the introduction of sediment to streams, and g) avoiding wetland entirely when constructing new roads.	No new roads would be developed under Alternative 1. Road operation and maintenance would be carried out based on current approvals and the annual operating plan, which would not include road obliteration or restoration. The road management provisions of the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would not be implemented.	a) New roads within RBs have been minimized to the greatest degree possible. Under the Action Alternatives new roads in RBs break down as follows: • Alternative 2 – 0.04 acre (0 percent of 5th field RR). • Alternative 3 – 0.04 acre (0 percent of 5th field RR). • Alternative 4 – 0.00 acre (0 percent of 5th field RRs). • Modified Alternative 5 – 0.04 acre (0 percent of 5th field RRs). b) The Upper Snoqualmie River Watershed Condition Assessment (Jones & Stokes 2001), and the South Fork Snoqualmie River Watershed Analysis (USFS 1995) have been completed to address roads and other watershed issues, specifically for The Summit-at-Snoqualmie MDP. c/d) The MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) has been developed to address road construction, operation, monitoring and maintenance specifically for The Summit-at-Snoqualmie MDP. e) Under the Action Alternatives, culverts would be sized to pass the 100-year flow, with considerations for debris and fish passage (see Table 2.4-2, MR8). f) All road construction would be conducted within approved construction limits, and proper placement of sidecasting would be conducted according to Management Requirements MR2, MR9, MR10, MR15, MR36, and Other Management Provisions OMP2, OMP5, OMP6, OMP7, OMP17, to ensure that sediment introduction is minimized (see Table 2.4-2). g) Under the Action Alternatives, no new roads would be constructed in wetlands. Wetlands would be completely avoided wherever road construction would occur near wetlands				

Table 4.3.7-2:
Evaluation of Riparian Reserves Standards and Guidelines within the South Fork Snoqualmie River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
RF-3 – Determine the influence of each road on the ACS objectives through watershed analysis. Meet ACS objectives by: a) reconstructing roads and associated drainage features that pose a substantial risk, b) prioritizing reconstruction based on current and potential impact to riparian resources and the ecological value of the riparian resources affected, and c) closing and stabilizing, or obliterating and stabilizing roads based on the ongoing and potential effects the ACS objectives and considering short-term and long-term transportation needs.	Under Alternative 1, no roads would be obliterated or reconstructed.	Under Alternative 2, the S.F. Snoqualmie Watershed portion of the Study Area would not realize a net loss of road mileage in RBs. However, under Alternative 2: a) Alpental road would be paved, reducing the introduction of sediment to the S.F. Snoqualmie River from the existing native-surface road. b) The paving would be prioritized according to the MDP Implementation Plan. c) No roads would be closed or obliterated within that portion of the S.F. Snoqualmie watershed within the Study Area.	Under Alternative 3, the S.F. Snoqualmie Watershed portion of the Study Area would not realize a net loss of road mileage in RBs. However, under Alternative 3: a) Alpental road would be paved, reducing the introduction of sediment to the S.F. Snoqualmie River from the existing native-surface road. b) The paving would be prioritized according to the MDP Implementation Plan. c) No roads would be closed or obliterated within that portion of the S.F. Snoqualmie watershed within the Study Area.	Under Alternative 4, the S.F. Snoqualmie Watershed portion of the Study Area *would* realize a net loss of road mileage in RBs. However, under Alternative 4: a) Alpental road would be re-located outside of the RB of S.F. Snoqualmie River. The existing road-bed would be stabilized and re-vegetated b) The re-location of Alpental Road and removal of Alpental Parking Lot 7 would be prioritized according to the MDP Implementation Plan (Appendix F). c) See description of re-location above under (a).	Under Modified Alternative 5, the S.F. Snoqualmie Watershed portion of the Study Area would not realize a net loss of road mileage in RBs. However, under Modified Alternative 5: a) Alpental road would be paved, reducing the introduction of sediment to the S.F. Snoqualmie River from the existing native-surface road. b) The paving would be prioritized according to the MDP Implementation Plan (Appendix F). c) No roads would be closed or obliterated within that portion of the S.F. Snoqualmie watershed within the Study Area.

Table 4.3.7-2:
Evaluation of Riparian Reserves Standards and Guidelines within the South Fork Snoqualmie River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
RF-4 – New culverts, bridges and other stream crossings shall be constructed, and existing culverts, bridges and other stream crossings determined to pose a substantial risk to riparian conditions will be improved, to accommodate at least the 100-year flood, including associated bedload and debris. Priority for upgrading will be based on the potential impact and the ecological value of the riparian resource affected. Crossings will be constructed and maintained to prevent diversion of streamflow out of the channel and down the road in the event of a crossing failure.	Under Alternative 1, no new culverts or bridges would be constructed. The MDP Implementation Plan would not be implemented.	Under Alternatives 2 through Modified Alternative 5, culverts would be sized to pass the 100-year flow, debris and fish passage (see Table 2.4-2, MR8), meeting the standards and guidelines of the Forest Plan, as Amended. The MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) has been developed to address road management and watershed restoration specifically for The Summit-at-Snoqualmie MDP and would insure proper monitoring of watershed processes, including channel flow conditions at stream crossings (see MR10 in Table 2.4-2).			
RF-5 – minimize sediment delivery to streams from roads. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping in unfeasible or unsafe. Route road drainage away from potentially unstable channels, fills, and hillslopes.	Under Alternative 1, the MDP Implementation Plan would not be implemented.	Under Alternatives 2 through Modified Alternative 5, all new roads would be sloped to drain away from potentially unstable channels, fills, and hillslopes so that sediment from roads would not be transported to these areas (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan). For all construction activities, a SWPPP would be prepared to direct the use of BMPs, which would minimize sediment impacts during road construction. Implementation of the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would minimize sediment delivery to streams from existing roads.			

Table 4.3.7-2:
Evaluation of Riparian Reserves Standards and Guidelines within the South Fork Snoqualmie River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
RF-6 – Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.	Under Alternative 1, fish passage conditions would remain unchanged. There would remain a total of one human-caused fish barrier within the S.F. Snoqualmie portion of the Study Area, located in the Summit North drainage.	Under Alternatives 2 through Modified Alternative 5, no new fish barriers would occur on fish bearing streams. Implementation of the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would help maintain channel conditions to ensure fish passage at current locations where fish are present			
RF-7 – Develop and implement a Road Management Plan or a Transportation Management Plan that will meet the ACS objectives. As a minimum, this plan shall include provisions for the following activities: a) inspections and maintenance during storm events, b) inspections and maintenance after storm events, c) road operation and maintenance, giving high priority to identifying and correcting road drainage problems that contribute to degrading riparian resources, d) traffic regulation during wet periods to prevent damage to riparian resources, and e) establish the purpose of each road by developing the Road Management Objective.	Under Alternative 1, the MDP Implementation Plan would not be implemented.	The MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) has been developed specifically for The Summit-at-Snoqualmie MDP and Alternatives 2 through Modified Alternative 5, and includes the following provisions: a/b) The MDP Implementation Plan addresses inspection and maintenance during and after storm events. c) The MDP Implementation Plan also provides a basis for prioritizing road maintenance activities, d) Provides for use guidelines based on road conditions, e) Details the purpose of use for roads in the Study Area (e.g., maintenance, access). Additional management constraints that would be implemented are described in Table 2.4-2. For all construction activities, a SWPPP would be prepared to direct the use of BMPs, which would minimize sediment impacts during road construction.			

Table 4.3.7-2:
Evaluation of Riparian Reserves Standards and Guidelines within the South Fork Snoqualmie River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Recreation Management					
RM-1 – New Recreational Facilities within Riparian Reserves, including trails and dispersed sites, should be designed to not prevent meeting ACS objectives. For existing recreation facilities within Riparian Reserves, evaluate and mitigate impact to ensure that these do not prevent, and to the extent practicable, contribute to attainment of ACS objectives.	Under Alternative 1, the MDP Implementation Plan would not be implemented. Except for previously-approved projects, no new Recreational Facilities would be located within Riparian Reserves.	All Action Alternatives would result in site scale impacts within RRs. However cumulative RR impacts from any Action Alternative at the 5th field South Fork Snoqualmie River Watershed would be immeasurable. Implementation of the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would help maintain or improve riparian and channel conditions within The Summit-at-Snoqualmie Study Area. Additional management constraints would be implemented, as described in Table 2.4-2. For all construction activities, a SWPPP would be prepared to direct the use of BMPs, which would minimize sediment impacts during construction.			
RM-2 – Adjust dispersed and developed recreation practices that retard or prevent attainment of ACS objectives. Where adjustment measures such as education, use limitations, traffic control devices, increased maintenance, relocation of facilities, and/or specific site closures are not effective, eliminate the practice or occupancy.	See RM-1				

Table 4.3.7-2:
Evaluation of Riparian Reserves Standards and Guidelines within the South Fork Snoqualmie River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
Fire/Fuels Management					
FM-1 - Design Fuel treatment and fire suppression strategies, practices, and activities to meet ACS objectives, and to minimize disturbance or riparian round cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuels management activities could be damaging to long-term ecosystem function	Under Alternative 1, no new timber removal and slash burning would take place, other than previously approved projects.	Under Alternatives 2 through Modified Alternative 5, the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would guide vegetation management, including fuel treatments. As described in Table 2.4-2, lift and trail construction would include Best Management Practices in order to reduce the impacts of the clearing prescriptions on RRs and other sensitive areas. These include: yarding over the snow, heli-logging, lop and scatter where fuel loads permit, and hand excavation of tower footings, where feasible. Table 2.4-2 presents additional Mitigation Measures, Management Requirements, and Other Management Provisions.			
Riparian Area Management					
RA-1 – Identify and attempt to secure in-stream flows needed to maintain riparian resources, channel conditions, and aquatic habitat.	In-stream flows would be maintained at existing conditions under all alternatives, since no new surface or ground water withdrawals would occur.				
RA-2 – Fell trees in Riparian Reserves when they pose a safety risk. Keep felled trees on-site when needed to meet coarse woody debris objectives.	Under Alternative 1, no new timber removal and slash burning would take place, other than previously approved projects. Hazard trees, exhibiting structural defects that could result in failure of the tree, would be removed where they pose safety concerns.	With implementation of Alternatives 2 through Modified Alternative 5, Measures in Table 2.4-2 would specifically provide that trees would only be felled in Riparian Reserves for construction of approved projects or for safety reasons. Where possible, these trees would be felled where they can be left on the ground. Further, LWD would only be removed from Riparian Reserves for safety reasons.			

Table 4.3.7-2:
Evaluation of Riparian Reserves Standards and Guidelines within the South Fork Snoqualmie River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
RA-3 – Herbicides, insecticides, and other toxicants, and other chemicals shall be applied only in a manner that avoids impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.	All alternatives include no use of herbicides, insecticides, toxicants, or other chemicals. To avoid the spread of weeds during construction and restoration projects under all alternatives, all vehicles and equipment doing work outside the limits of the road surface or in infested areas would follow appropriate Prevention Strategies and BMPs within Forest-wide standards and guidelines (MBSNF Forest Plan Amendment #14), the mediated agreement (1989), relevant portions of the Final EIS for Managing Competing and Unwanted Vegetation (USFS 1988) and the Action Alternatives include management and operational guidelines in Section 2.4 - Mitigation of the FEIS.				
RA-4 – Locate water drafting sites to minimize adverse effects on stream channel stability, sedimentation, and in-stream flows needed to maintain riparian resources, channel conditions, and fish habitat.	Under all alternatives, existing water drafting sites would maintain existing conditions. Existing water drafting sites are functioning properly, and are not adversely affecting riparian system function.				
Watershed and Habitat Restoration					
WR-1 – Design and implement watershed restoration projects in a manner that promotes long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and attains ACS objectives.	Under Alternative 1, the MDP Implementation Plan would not be implemented.	Under Alternative 2, implementation of the MDP Implementation Plan (see Appendix F) would include the watershed restoration projects listed in Table 5-1. The Implementation Plan also incorporates Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2).	Under Alternatives 3 through Modified Alternative 5, the watershed restoration projects listed in the MDP Implementation Plan (Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan, Tables 5-1 *and* 5-2), would be required by the Forest Service, and implemented by The Summit-at-Snoqualmie. The MDP Implementation Plan also incorporates Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2).		

Table 4.3.7-2:
Evaluation of Riparian Reserves Standards and Guidelines within the South Fork Snoqualmie River Watershed

Standard and Guideline from the 1994 ROD	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
WR-2 – Cooperate with federal, state, local, and tribal agencies, and private landowners to develop watershed-based Coordinated Resource Management Plans or other cooperative agreements to meet ACS objectives.	Under Alternative 1, the MDP Implementation Plan would not be implemented.	Table 1.7-1 lists the federal, state and local, agencies that permits need to be obtained from during the implementation of The Summit-at-Snoqualmie MDP. The Mitigation Measures, Management Requirements, and Other Management Provisions listed in Table 2.4-2 as well as the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) were created in conjunction with input from cooperating federal agencies.			
WR-3 – Do not use mitigation or planned restoration as a substitute for preventing habitat degradation.	Under Alternative 1, there would be no new impacts to Riparian Buffers.	Under Alternatives 2 through Modified Alternative 5, impacts to Riparian Buffers have been minimized to the extent practicable. As such, the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) and BMPs are intended to work in conjunction with avoidance and minimization of Riparian Buffer impacts in order to help maintain or improve watershed conditions.			
Fish and Wildlife Management					
FW-1 – Design and implement fish and wildlife habitat restoration and enhancement activities in a manner that contributes to attainment of ACS objectives.	Under Alternative 1, the MDP Implementation Plan would not be implemented.	Under Alternatives 2 through Modified Alternative 5, implementation of the MDP Implementation Plan (see Appendix F - The Summit-at-Snoqualmie MDP – Implementation, Operations, Restoration and Monitoring Plan) would occur and along with the restoration projects, Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2), helping to maintain or improve the long-term ecological health of wildlife and fisheries habitat.			

4.3.8 Cumulative Effects

Cumulative effects on watershed resources include those impacts associated with The Summit-at-Snoqualmie MDP, and other past, present, and reasonably foreseeable projects identified in the U. Yakima and S.F. Snoqualmie watersheds. Table 4.3.8-1 and Table 4.3.8-3 list these projects and summarize their potential impact. The effects of past, present, and reasonably foreseeable projects at The Summit-at-Snoqualmie include areas developed in the SUP and on private lands for recreational facilities and related infrastructure (see Tables 4.3.8-2 and 4.3.8-4 for the U. Yakima and S.F. Snoqualmie watersheds respectively). The baseline conditions described in Chapter 3 include the effects of the past projects associated with the development, operation, and maintenance of The Summit and Alpental facilities.

The Action Alternatives would be expected to have a negligible effect on watershed resources at the 5th field scale within the U. Yakima and S.F. Snoqualmie watersheds. The management of lands that have recently become NFSL is expected to be beneficial to the forest ecosystem. Long-term management goals are focused towards maintaining a multi-age forest ecosystem and could have potential beneficial impacts on watershed resources.

4.3.8.1 Upper Yakima River Watershed

Projects Associated with The Summit-at-Snoqualmie

Culvert replacements would have beneficial impacts on watershed resources by reducing the road crossing density within the watershed (see Table 4.3.8-1).

Projects not associated with The Summit-at-Snoqualmie

Several projects not associated with The Summit-at-Snoqualmie involve land exchanges and purchases. Land exchanges and acquisitions would have potential beneficial impacts to watershed resources as land management direction for those parcels changes from timber harvest to management as directed in the SPAMA, which provides for managing these areas as Late Successional Habitat (LSH). Beneficial impacts would occur as riparian areas gradually become reforested. However, the timeframe over which beneficial impacts may be realized extends well into the future, on the order of 50 to 80 years. Therefore impacts from land exchanges and acquisitions cannot be quantified and are only discussed qualitatively in this analysis.

Management plans can also have beneficial impacts to watershed resources. The Plum Creek road restoration and other road assessments can also create beneficial impacts to watershed resources through road obliteration. Road obliteration reduces the road density, thereby reducing sediment loading and groundwater interception.

Table 4.3.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately ten existing culverts have been replaced or repaired within the last five years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately two per year.	The replacement and repair of culverts at The Summit-at-Snoqualmie overlaps spatially and temporally with the MDP at the site scale. Approximately 0.01 acre around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would be beneficial (i.e., reduced sediment delivery, erosion and natural sediment regime), and would, as a whole, improve the watershed condition at the site scale. As the culverts occupy several hundred square feet within the watershed, they would directly contribute to improved sediment and watershed conditions downstream.
Projects Not Associated with The Summit-at-Snoqualmie		
Kachess Vegetation Management	Hazard trees were identified in the Kachess Lake Campground through an exhaustive survey. All identified trees are scheduled to be removed by the winter of 2004. The campground contains old growth trees suffering from various stages of root rot. A small amount of timber would be sold as merchantable, the rest would be disposed of through firewood sales, lop and scatter, or burned.	The removal of hazard trees has reduced the canopy cover within the treated areas of the campground. Implementation of the vegetation management plan resulted in localized soil impacts and potential sediment yields associated with tree removal, yarding, lopping/scattering, and burning. Spatially, the vegetation removal was limited to the campground site, and did not overlap with the MDP or other identified cumulative effects at the site scale. Temporally, the work has been completed and would not overlap with the MDP. As this project is assumed to have stabilized, no measurable impacts to watershed resources are expected to have occurred at the 5th field scale.
Plum Creek Road Restoration	The Cle Elum Ranger District is performing a road analysis covering approximately 50-70 miles of harvest roads on 65,000 acres of land acquired in the last five years from Plum Creek Timber lands. Currently, approximately 18 miles of roads that were acquired and deemed to be unsafe or were already closed have been decommissioned by the Forest Service. Under the Proposed Action, approximately 30.57 miles of road would be decommissioned.	Currently, approximately 26.2 acres roads have been decommissioned within the watershed. Both spatially and temporally, this road decommissioning would overlap with the road obliteration, and other restoration projects identified in the MDP alternatives at the 5th field scale. As a result, the road obliteration under the MDP and the Cle Elum Roads Analysis would cumulatively reduce the available road mileage and resulting sediment yield from roads, resulting in an improvement in the sediment regime at the 5th field scale.

Table 4.3.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	Depending on which alternative is selected, approximately 50.9 acres of soils would be impacted by road expansions. This project would directly overlap with the MDP in both space and time at the site and 5th field scales. Alternative 2 and Modified Alternative 5 would increase detrimental soil conditions at the site scale, cumulatively increasing the potential for sediment yield to streams in the vicinity of Snoqualmie Pass. Alternatives 3 and 4 would reduce detrimental soil conditions through proposed restoration projects.
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	In the Yakima watershed, the acquired lands would be managed under the SPAMA allocation with a late-seral habitat emphasis. The management of these acquired lands would spatially and temporally overlap with the MDP at the 5th field scale, resulting in cumulative benefits to watershed conditions under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions would contribute to overall improvement in watershed conditions at the 5th field scale.
Keechelus Dam Repairs	The Keechelus Lake dam was repaired in 2003. The existing dam was rebuilt in place to correct structural problems. The project has been completed. Approximately 70 acres of vegetation was cleared to provide a work corridor. The project impacted 3.8 acres of wetlands.	While the dam replacement did not overlap in time with the MDP, stabilization (i.e., grow-in) of the site is projected to overlap with the MDP in both space (at the 5th field) and time. Cumulatively, stabilization of 70 acres of vegetation removal would contribute to reduced soil erosion in the U. Yakima watershed. As Lake Keechelus serves as a sink for sediment, the downstream effects to the Yakima River are not measurable. The project impacted 3.8 acres of wetlands in the vicinity of the dam, which did not overlap in space or time with the MDP, but would result in a cumulative loss of wetland acreage at the 5th field scale when coupled with the Action Alternatives.
Gold Creek Pond Trail Development	A native surface foot trail, approximately 100 feet long was constructed. This project was completed in 2001.	Temporary impacts to 0.005 acre occurred during trail construction. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space (at the 5th field scale) or time with any projected watershed impacts under the Action Alternatives.
U.S. West Telephone line	Installation of an underground telephone line in old road prism. This project was completed in 2001.	Temporary impact of 1.82 acres to install an underground line created disturbance to an already modified soil profile in the road prism. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space (at the 5th field scale) or time with any projected watershed impacts under the Action Alternatives.

Table 4.3.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
WSDOT I-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical de-icer/ice-inhibitors to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile are applied to I-90 within the Snoqualmie Pass area (WSDOT 1999, 2001).	I-90 Maintenance would overlap with the MDP in both space and time at the site and 5th field scales. Increases in detrimental soil conditions and sediment yield would occur under the Action Alternatives (Alternative 2 being the largest impact and Alternative 4 being the lowest of the Action Alternatives). When added to the possible I-90 widening, repairs to the Keechelus dam and private land development, cumulative effects on soils affect the sediment regime in Coal Creek. Approximately 380 tons of sand reach Coal Creek each year from I-90 sanding operations alone.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	The recent purchase of Sections 5, 17, and 25 of Township 21N Range 11E occur within portions of the Yakima River Watershed. These acquired lands would be allocated to the SPAMA and managed with an emphasis for late-seral habitat preservation. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP, resulting in cumulative benefits to watershed conditions under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions would also contribute to overall improvement in watershed conditions at the 5th field scale.
Plum Creek Cascade Habitat Conservation Plan	A HCP was developed for the Plum Creek Timber Company to manage timber harvest and protect wildlife habitat over several 5th field watersheds in the vicinity of Snoqualmie Pass.	Approximately 52,100 acres of land is managed under the HCP. Protection of wildlife habitat would temporally and spatially overlap at the 5th field scale with the MDP resulting in cumulative benefits to watershed resources under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), lands managed under the HCP, combined with private land acquisitions would contribute to overall improvement in watershed conditions at the 5th field scale.

Table 4.3.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of the Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in both space at the site scale and time with the MDP development. Alternative 2 and Modified Alternative 5 would increase detrimental soil conditions in the Study Area, and in conjunction with the private land developments and other ground disturbing activities, would cumulatively affect sediment yield to Mill Creek.
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the Upper Yakima River watershed. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	A total of 210 acres of forest would be commercially thinned to accelerate the development of late-successional forest structure. Short-term impacts resulting in soil disturbance would occur, some of which would overlap in space (at the 5th field) and time with the MDP implementation. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Protection of wildlife habitat under the Plum Creek HCP would temporally and spatially (at the 5th field scale) overlap with the MDP resulting in cumulative benefits to soil productivity, sediment yield under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek HCP and private land acquisitions would contribute to overall improvement in watershed conditions at the 5th field scale.
Snoqualmie Pass AMA Plan	Land management plan for the AMA emphasizing late successional habitat maintenance and enhancement	The management of lands to emphasize late-successional habitat would overlap spatially and temporally with the MDP at the site and 5th field scales. The management of lands under the SPAMA would result in cumulative benefits to watershed conditions under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek HCP and private land acquisitions would contribute to overall improvement in watershed conditions at the 5th field scale.

Table 4.3.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
Cle Elum RD Roads Analysis	Analysis of road system to determine long-term need. Implementation is expected in 2010.	The analysis of road systems and implementation of the plan would overlap spatially (at the 5th field) and temporally with the MDP. In conjunction with the Implementation, Operations, Restoration and Management Plan for the Summit-at-Snoqualmie MDP (see Appendix F), the roads analysis would improve road and trail management in the U. Yakima Watershed. The result will be a cumulative benefit to the sediment regime and watershed conditions in the 5th field with improved road and trail management under both plans.
WSDOT road de-icing	Application of sand and chemical de-icer/ice-inhibitors to roadway surfaces	Deicing of roadways would overlap spatially, at the site and 5th field scales, and temporally with the MDP. Impacts to watershed condition and sediment regime would result due to road maintenance from sanding operations. Coupled with the Action Alternatives and other road maintenance projects, this project could affect the sediment regime in Coal Creek.
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the Okanogan-Wenatchee National Forest Land and Resource Management Plan.	The study of lands to determine suitability for preservation as wilderness would overlap spatially (at the 5th field scale) and temporally with the MDP. If lands are re-allocated to Wilderness under this project, cumulative benefits to watershed condition and sediment regime would result. Coupled with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisitions, this project would contribute to overall improvement in watershed conditions at the 5th field scale.
Pro Guiding Service Area Expansion	Pro Guiding has requested expansion of their area of operation to include the Cascade crest area from Kendall Lakes to Mt. Daniel, plus the Alta Mountain area. They are not requesting an increase in number of service days.	The expansion of Pro Guiding's area of operation would overlap spatially (at the 5th field scale) and temporally with the MDP. No impacts to watershed resources are expected from this project.

Table 4.3.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (W. Keechelus subwatershed). The proposed project includes thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	The thinning of forests to accelerate late-successional habitat structure and restore ecological conditions would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in changes to the sediment regime could occur during thinning operations. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Combined with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisition projects, this project would result in cumulative benefits to watershed condition and sediment regime. Under Alternatives 2 and 4 (with no land donation), this project and the other private land acquisitions would contribute to overall improvement in watershed conditions at the 5th field scale.
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (E. Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and fish passage improvements, and other restoration projects.	The thinning of forests to accelerate late-successional habitat structure and restore ecological conditions would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in changes in sediment regime would occur during thinning operations. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Combined with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisition projects, this project would result in cumulative benefits to watershed conditions and sediment regime. Under Alternatives 2 and 4 (with no land donation), this project and the other private land acquisitions would contribute to overall improvement in watershed conditions at the 5th field scale.

Under Action Alternatives, approximately 0.38 to 0.41 percent of the total acreage of Riparian Buffers within the U. Yakima watershed would be impacted due to projects associated with The Summit-at-Snoqualmie (see Table 4.3.8-2). Implementation of the MDP, combined with the past, present and reasonably foreseeable projects listed in the table above, would result in short and long-term cumulative effects to 5.06 to 5.09 percent of the U. Yakima Watershed.

Under Alterative 2, even though implementation of the MDP would result in a decrease in sediment loading by 9.72 tons per year due to actions at The Summit-at-Snoqualmie (see Table 4.2.3-2), overall sediment loading to the U. Yakima Watershed from implementation of the MDP and the cumulative effects projects would increase to approximately 1044.63 tons per year (1.88 percent of the total U.

Yakima Watershed sediment load), largely due to I-90 continuing to act as a major source of sediment from winter sanding operations. This increase represents the most of any Action Alternative.

Table 4.3.8-2:
Cumulative Acreage of Effects on Water and Watershed Resources from Past, Present and Reasonably Foreseeable Projects within the 5th Field Upper Yakima River Watershed

Impact Type	Alt. 1a		Alt. 2		Alt. 3		Alt. 4		Mod. Alt. 5	
	Impacts	% 5th	Impacts	% 5th	Impacts	% 5th	Impacts	% 5th	Impacts	% 5th
Summit-at-Snoqualmie Projects										
Summit At Snoqualmie Impacts (acres)[b]	168.22	0.36	192.25	0.41	178.18	0.38	177.11	0.38	181.61	0.39
Impacts Not Associated with The Summit-at-Snoqualmie										
Long-Term Impacts (acres)[c]	50.90	0.07	50.90	0.07	50.90	0.07	50.90	0.07	50.90	0.07
Short-Term Impacts (acres)	2126.34	2.86	2126.34	2.86	2126.34	2.86	2126.34	2.86	2126.34	2.86
Total Long-Term and Short-Term Impacts (acres)	2177.24	2.92	2177.24	2.92	2177.24	2.92	2177.24	2.92	2177.24	2.92
Beneficial (acres)[d]	2023.12	2.72	2023.12	2.72	2023.12	2.72	2023.12	2.72	2023.12	2.72
Total Impacts (acres)	**2345.46**	**5.04**	**2369.49**	**5.09**	**2355.42**	**5.06**	**2354.35**	**5.06**	**2358.85**	**5.07**
Impacts to Stream Channels										
Summit-at-Snoqualmie Impacts (miles)[e]	4.14	0.35	4.26	0.36	4.19	0.35	4.06	0.34	4.14	0.35
Impacts to Flow										
Average Annual Discharge (cubic feet/second)[f]	62.8	1.76	63.2	1.78	63.1	1.77	63.0	1.77	63.2	1.77
Impacts to Water Quality										
Average Annual Sediment Loading (tons/year)[g]	1035.76	1.86	1044.63	1.88	1041.16	1.87	1033.09	1.86	1044.33	1.88

[a] The impacts associated with ongoing, maintenance related activities at The Summit-at-Snoqualmie are displayed in Alternative 1 (the No Action Alternative), since these activities would occur under all alternatives, they have been added to the impacts for Alternatives 2 through 5.
[b] Summit-at-Snoqualmie impacts to watershed resources is calculated through impacts to Riparian Buffers. Total Riparian Buffers in the Upper Yakima Watershed in 46,564 (USFS 1997).
[c] Long Term, but non-quantifiable, impacts occur to the watershed as a result of winter sanding and deicing operations on I-90.
[d] Beneficial, but non-quantifiable, impacts occur to the watershed as a result of land acquistions that change land management practices from timber harvest to NFSL practices.
[e] The total drainage network within the U. Yakima Watershed is 1183 miles (USFS 1997)
[f] An average annual flow of 3,560 cubic feet per second for the U. Yakima River was used as the 5th field scale comparison. Flows listed in the Table indicate the amount contributed by the Study Area.
[g] An average annual sediment load for the U. Yakima River of 55,670.8 tons/year was used as the 5th field scale comparison (USFS 1997). Sediment loading indicated in the Table are estimated sediment contributions from the Study Area.
Note- This table does not include Mill Creek acreage.

4.3.8.2 South Fork Snoqualmie River Watershed

Project s Associated with The Summit-at-Snoqualmie

Culvert replacements can have beneficial impacts on watershed resources by reducing the road crossing density within the watershed (see Table 4.3.8-3).

Projects Not Associated with The Summit-at-Snoqualmie

Winter sanding and maintenance of I-90 would continue to be a major source of sediment loading at approximately 294 tons per year.

Projects not associated with The Summit-at-Snoqualmie include land exchanges and purchases. Land exchanges and acquisitions, such as the Huckleberry Land Exchange, completed in 2001, are expected to result in potential beneficial impacts to watershed resource as land management direction for those parcels under the Forest Service changes away from management for timber harvest. Beneficial impacts would occur as watershed areas gradually become reforested. The timeframe over which beneficial impacts may be realized extends well into the future, on the order of 50 to 80-years. Therefore impacts from land exchanges and acquisitions are difficult to quantify and are only discussed qualitatively in this analysis.

Management plans can also have beneficial impacts to watershed resources. For example, the South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project would create beneficial impacts to watershed resources through road obliteration. Road obliteration reduces the road density, thereby reducing sediment loading and groundwater interception.

Table 4.3.8-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately ten existing culverts have been replaced or repaired within the last five years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately two per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	Approximately 0.01 acre around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would likely be beneficial (i.e., reduced sediment delivery and erosion). These culvert replacements would overlap spatially (at the site scale) and temporally with the MDP, and would, as a whole, improve the culvert conditions throughout the Study Area. As the culverts occupy several hundred square feet within the watershed, this project would directly contribute to improved sediment conditions downstream.

Table 4.3.8-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
Alpental Covered Bridge Replacement	The existing covered footbridge at Alpental washed out during a storm in 2003. The Summit-at-Snoqualmie replaced the bridge in 2005.	No new permanent impacts occurred as the new bridge was placed within the footprint of the old bridge. Temporary soil disturbance occurred during construction and riparian vegetation was re-established in 2006. While the bridge replacement overlaps spatially with the MDP at the site scale, the re-establishment of riparian vegetation, and stabilization will not overlap in time with the MDP and therefore would not cumulatively affect sediment yield or watershed resources.
Cave Ridge Land Donation	The Summit-at-Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	The land donation would overlap spatially (at the site and 5th field watershed scale) and temporally with the MDP. Up to 100 acres would be added to Wilderness, and the remainder would continue to be managed in its current unroaded character. This project would not cumulatively effect water or watershed resources in the site or 5th field scale.
Projects Not Associated with The Summit-at-Snoqualmie		
FS Road 58 Bridge Replacement	An existing steel bridge over the South Fork Snoqualmie River was replaced on Forest Service Road 58 due to structural problems. The new bridge was expanded from one to two lanes with upgraded load capacity. Construction of the bridge was completed in spring 2005.	Approximately 0.05 acre was graded to provide an expanded roadway approach. Bridge footings were installed below the ordinary high water mark and required temporary flow diversion structures to create a dry work zone. With completion of the project in 2005, the bridge replacement does not overlap with the MDP in either space or time. Thus the bridge replacement would not cumulatively affect watershed resources at the 5th field scale.
Huckleberry Land Exchange	Exchange of NFSL for Weyerhaeuser Lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	Approximately 6,798 acres of Weyerhaeuser land was received by the Forest Service. Approximately 701 acres are managed as Late Successional Reserves. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP, resulting in cumulative benefits to watershed conditions under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions contribute to a cumulative improvement in watershed conditions at the 5th field scale.

Table 4.3.8-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
WSDOT 1-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical de-icer/ice-inhibitors to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile is applied to I-90 within the Snoqualmie Pass area.	Approximately 294 tons of sand reach the South Fork Snoqualmie River each year from I-90 sanding operations. I-90 Maintenance would overlap with the MDP in both space and time at both the site and 5th field scales. Increases in detrimental soil conditions and sediment yield under the Action Alternatives (Alternative 2 being the largest impact and Alternative 4 being the lowest of the Action Alternatives) would cumulatively affect sediment yield and sediment regime.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The recent purchase of Section 19 of Township 22N Range 11E occurs within portions of the South Fork Snoqualmie River Watershed, and its management overlaps spatially (in the 5th field) and temporally with the MDP. These lands will be allocated to Late Successional Reserve. Coupled with other land acquisitions in the Snoqualmie Pass area, cumulative sediment regime and watershed conditions would improve at the 5th field scale, with a greater improvement under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation).
U.S. West Telephone line	Installation of an underground telephone line in the I-90 corridor	Temporary impacts to sediment regime occurred during installation of an underground line, which created disturbance to an already modified soil profile in the road prism. This project is assumed to have been stabilized as of 2005, and therefore does not overlap spatially or temporally with any projected watershed impacts under the MDP.
WSDOT road de-icing	Application of sand and chemical de-icer/ice-inhibitors to roadway surfaces	Deicing and maintaining roadways during the winter overlaps spatially and temporally with the MDP at the site and 5th field scales. Increases in sediment yield and changes in sediment regime under the Action Alternatives (Alternative 2 being the largest impact and Alternative 4 being the lowest impact) and other soil disturbing projects, combined with roadway deicing, would cumulatively affect watershed conditions and sediment regime in the S.F. Snoqualmie River.

Table 4.3.8-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
BPA Proposed Additional Power Lines	Supplemental DEIS to examine development of an additional powerline. Options include adding lines to existing towers or adding new towers.	The construction of additional power lines would overlap spatially (in the 5th field) and temporally with the MDP. This project, coupled with other soil-disturbing activities and the Action Alternatives, could result in cumulative effects to sediment yield and sediment regimes if new towers are constructed.
McClellan Butte Trail Reconstruction Project	The project will relocate approximately 1.5 miles of trail to newly constructed trail orl old road bed, abandon 1.5 miles of trail, and rehabilitate tread, drainage and switchbacks as required along the remainder of the 4.4-mile trail.	Temporary impacts along 5.9 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected watershed impacts under the MDP.
Bandera Mountain/Mason Lake Trail Relocation Project	Project reorganized trail access to Mason Lake and Bandera Mountain in order to minimize social and resource impacts associated with the existing trails. The project involved construction of 1.5 miles of new trail, reconstructing 2.0 miles of existing trail and decommissioning 2.3 miles of existing trail.	Temporary impacts along 3.5 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected watershed impacts under the MDP.
High Lakes Trail #1012 and Snow Lake Trail #1013 Reconstruction	This project repaired seven switchbacks on the Snow Lake Trail and reconstructed 2 miles on the High Lakes Trail from Snow to Gem Lake.	Temporary impacts along 3.5 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected watershed impacts under the MDP.
South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project	Reduce the maintenance level (ML) on 11 roads (26.3 miles). 19.4 miles would be reduced to ML 1 (closed to motorized access) and utilized as loop and destination trail routes; 2.7 miles would be closed - placed in storage for future forest management; 1.1 mile would be removed from the transportation system and converted to trail; approximately 22.2 miles of spur roads mostly associated with roads proposed for reduction to ML 1 would be closed and removed from the Forest Road Transportation System.	The road decommissioning and maintenance level reductions would overlap spatially (in the 5th field) and temporally with the MDP. Road closure and decommissioning would decrease the road network and sediment yield at road crossings. Coupled with the Implementation, Restoration, Operation, and Monitoring Plan (see Appendix F), the South Fork Access and Travel Management Plan and other road management projects, this project would result in cumulative benefits to watershed conditions and sediment regimes at the 5th field scale.

Table 4.3.8-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
Denny Salvage	This project would salvage approximately 50 mbf of windblown trees utilizing a ground based logging system. All undamaged trees with secure root systems would be left.	The salvage of approximately 50 mbf would not overlap spatially (in the 5th field) or temporally with the MDP. Stabilization of the salvage area is expected to overlap temporally with implementation of the MDP at the 5th field scale. Short-term impacts resulting in increased soil erosion and subsequent sediment yield to streams would occur due to tree removal and logging equipment. Following the stabilization of disturbed areas, approximately two to three years, this project is not expected to contribute cumulative effects to watershed resources at the 5th field scale.
Annual Road Maintenance	Brushing/blading of roads on a rotating schedule as funds allow. Includes roads 55, 5510, 58, and road 9030 and 9031 systems.	Brushing and blading of roads would overlap spatially (at the 5th field) and temporally with the MDP. Increases in soil erosion as the roads are disturbed would change the sediment regime in the watershed. Coupled with the Action Alternatives and other roadway projects, this project would cumulatively affect watershed conditions and sediment regime at the 5th field scale.
Road 9020 ERFO Repair	The project proposes to either replace the culvert at Alice Creek or reduce the ML of Road 9020 pas Alice Creek to 1 (no motorized access).	The replacement of a culvert or closure of the road to motorized access would overlap spatially (at the 5th field) and temporally with the MDP. If the road is decommissioned, this project would result in an improvement in detrimental soil conditions and sediment regime. If the culvert is replaced, this project would result in temporary increases in sediment yield and short-term impacts to sediment regime. Long-term impacts of the culvert replacement would likely be beneficial, resulting in reduced sediment delivery and erosion.
I-90 Corridor Thin	The project involves commercially thinning approximately 338 acres in the I-90 Corridor. About 4.3 mmbf would be thinned from 14 units.	The thinning of approximately 338 acres would overlap spatially (in the 5th field) and temporally with the MDP. The thinning project would result in short-term impacts to watershed due to soil disturbance and increased sediment yield.
Snoqualmie Pass Utility District Permit Amendment	The project would extend water and sewer lines along Forest Service Road 4832 from the I-90 Hyak interchange for approximately 3,000 feet. The new lines would stop before reaching Gold Creek. Lines would be lain within the existing road right of way.	Temporary impacts from extension of water and sewer lines within the previously disturbed soils of the road prism would overlap spatially (in the 5th field) and temporally with the MDP. Short-term impacts would result from soil disturbance and could, combined with other soil-disturbing activities including the Action Alternatives, result in impacts to the sediment regime at the 5th field scale.

Table 4.3.8-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Watershed Resources in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Water and Watershed Resources
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	The construction of a new trail and trailhead parking would overlap spatially (in the 5th field) and temporally with the MDP. Temporary impacts would result from trail and parking area construction. This project, coupled with other soil-disturbing activities and the Action Alternatives, would result in increases in detrimental soil conditions and potential impacts to sediment regime at the 5th field scale.

Under all Action Alternatives, sediment loading decreases as a result of restoration projects and paving gravel parking lots (see Table 4.3.8-4). Decreased sediment in the watershed would potentially create more spawning habitat, and improve water quality.

Under Action Alternatives, approximately 0.67 to 0.68 percent of the total acreage of Riparian Buffers within the S.F. Snoqualmie Watershed would be impacted by projects associated with The Summit-at-Snoqualmie (see Table 4.3.8-2). Implementation of the MDP, coupled with the past, present and reasonably foreseeable projects described above, would result in short and long-term cumulative effects to 2.69 to 2.70 percent of the S.F. Snoqualmie Watershed.

Alterative 2 would result in a decrease in sediment loading to the S.F. Snoqualmie Watershed by 18.16 tons per year due to actions at The Summit-at-Snoqualmie, reducing sediment loading by 0.03 percent as compared to Alternative 1 (see Table 4.2.3-2). However, winter sanding of I-90 and other roads in the Snoqualmie Pass area would continue to be the greatest contributors to sediment loading in the S.F. Snoqualmie River.

Table 4.3.8-4:
Cumulative Acreage of Effects to Water and Watershed Resources from Past, Present, and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed

Impact Type	Alt. 1[a]		Alt. 2		Alt. 3		Alt. 4		Mod. Alt. 5	
	Impact	% 5th	Impact	% 5th	Impact	% 5th	Impact	% 5th	Impact	% 5th
Summit-at-Snoqualmie Projects										
Impacts from The Summit-at-Snoqualmie (acres)[b]	110.82	0.65	116.42	0.68	115.11	0.67	114.87	0.67	116.42	0.68
Impacts Not Associated with The Summit-at-Snoqualmie										
Long-Term Impacts (acres)	0.26	0.00	0.26	0.00	0.26	0.00	0.26	0.00	0.26	0.00
Short-Term Impacts (acres)	346.55	1.17	346.55	1.17	346.55	1.17	346.55	1.17	346.55	1.17
Total Long-Term and Short-Term Impacts (acres)	346.82	1.17	346.82	1.17	346.82	1.17	346.82	1.17	346.82	1.17
Beneficial Impacts (acres)	7167.88	24.26	7167.88	24.26	7167.88	24.26	7167.88	24.26	7167.88	24.26
Total Cumulative Effects (acres)	**457.64**	**2.67**	**463.24**	**2.70**	**461.93**	**2.69**	**461.69**	**2.69**	**463.24**	**2.70**
Impacts to Stream Channels[c]										
Impacts from The Summit-at-Snoqualmie (miles)[d]	1.26	0.38	1.54	0.47	1.48	0.45	1.40	0.42	1.50	0.45
Impacts to Flow										
Average Annual Discharge (cubic feet/second)[e]	33.70	6.17	33.83	6.20	33.80	6.19	33.83	6.20	33.83	6.20
Impacts to Water Quality										
Average Annual Sediment Loading (tons/year)[f]	682.81	1.34	664.65	1.31	664.65	1.31	664.52	1.31	664.65	1.31

[a] The impacts associated with ongoing, maintenance related activities at The Summit-at-Snoqualmie are displayed in Alternative 1 (the No Action Alternative), since these activities would occur under all alternatives, they have been added to the impacts for Alternatives 2 through Modified Alternative 5.
[b] Summit-at-Snoqualmie impacts to watershed resources is calculated through impacts to Riparian Buffers (Riparian Buffers in a developed of modified condition).
[c] Impacts to stream channels are measured as the total length of modified channels and the total length of channels that are culverted.
[d] The total drainage network within the S.F. Snoqualmie Watershed is 329.9 miles (USFS 1995)
[e] An average annual flow of 546 cubic feet per second for the S.F. Snoqualmie River was used as the 5th field scale comparison. Flows listed in the Table indicate the amount contributed by the Study Area.
[f] An average annual sediment load for the S.F. Snoqualmie River of 50,880 tons/year was used as the 5th field scale comparison (USFS 1995). Sediment loading indicated in the Table are estimated sediment contributions from the Study Area.

4.3.9 Irreversible and Irretrievable Commitments of Resources

No irreversible effects to watershed resources are anticipated as a result of implementation any of the alternatives. An irretrievable commitment of resources refers to losses of production, harvest or use of watershed resources. For example, riparian capability of an area is irretrievably lost while it cleared or culverted for use as a winter recreation site, but the action is not irreversible. The culverts could be removed and riparian revegetation could be re-established. Thus, the changes in land allocation and use associated with the projects within the Action Alternatives, such as creation of new ski trails, construction of lifts, etc., would result in irretrievable commitments of watershed resources.

4.4 FISHERIES

This section describes the potential effects of the MDP alternatives on fish resources in the Study Area. The Study Area has been used to quantitatively describe most impacts, but where related actions extend beyond the Study Area boundary, effects are described for the analysis area at the larger upper S.F. Snoqualmie River and U. Yakima River watersheds.

A description of the existing fisheries conditions within the Study Area is provided in Section 3.4 – Fisheries. The MBSNF and OWNF Forest Plans as Amended (USDA 1990a and USDA 1990b), direct that the existing conditions are the basis by which management actions are evaluated.

Primary issues addressed in this section include the impact of the proposed projects on fish habitat and fish presence including threatened and endangered species. The analysis of these issues focuses on changes in watershed and riparian conditions that are most relevant to fish habitat conditions such as stream and road crossings, road density, Riparian Buffer conditions (i.e., the length of streams or amount of Riparian Buffers in a modified condition), LWD recruitment potential, sediment yield, and potential for stormwater pollution.

4.4.1 Impact Mechanisms

The physical actions associated with any MDP project that result in impacts to fisheries resources are referred to as impact mechanisms. Impacts can be classified and discussed in many different ways. For the purposes of this EIS, impacts to fisheries would be discussed in terms of direct, indirect, short-term, and long-term impacts. Finally, MDP impacts can be evaluated at a larger scale (watershed), incorporating the incremental impacts of other past, present, and reasonably foreseeable projects through a cumulative effects analysis. Cumulative effects to fisheries are discussed further in Section 4.4.7 – Cumulative Effects.

Impacts to fish habitat include changes to the flow regime, pool frequency and quality, cover, spawning habitat, barriers, substrate quality, and water quality. Although land cover changes throughout the watershed can result in indirect impacts to fish, the most significant land cover changes, and those with the highest probability of impacting fish are those that occur in Riparian Buffers. With increasing distance from streams, the probability of impacts to water quality and aquatic habitat is reduced.

Direct and indirect impacts to fisheries resources associated with MDP development are described in the following sections:

Direct

Direct impacts that could occur from implementation of the Action Alternatives would cause changes in physical stream habitat features; or an immediate increase in instream pollution or sediment deposition in fish habitat. Management Requirements and Other Management Provisions for watershed, geology and

soils, and fisheries (see Table 2.4-2) would reduce or eliminate these potential impacts. Direct impacts that would affect instream fish habitat include:

- Instream construction (such as culverts and bridges) in known or presumed fish habitat could cause increased turbidity during construction. Mitigation measures for soils, watershed, riparian, and fish resources would be used to isolate instream construction, and minimize the potential for increased turbidity.
- Creating barriers to fish passage that would isolate fish populations and prevent access by adfluvial species. However, the passage barriers described in Section 3.4 - Fisheries would not be affected by any of the alternatives. Likewise, none of the Action Alternatives include structures in fish bearing stream segments or other new barriers to passage. Therefore, barriers to passage are not discussed throughout all of the alternative impact sections.

Indirect

Indirect impacts are those that occur as a result of the project but occur later in time or are spatially removed from the activity and the instream fish habitat. As with direct impacts, the indirect impacts to fisheries may be reduced or eliminated through implementation of mitigation measures identified for soils, watershed, riparian, and fish resources. The effectiveness of erosion and sedimentation mitigation measures increase with distance to surface waters, reduced slope, and increased soil stability. Indirect impacts to fisheries resources include some impacts that are direct impacts to other resources, including soils and vegetation. Potential indirect impacts from the MDP on fisheries include:

- Reduced forested area or increased impervious surface area in some drainages resulting in changes in watershed hydrology such as higher peak flows and lower base flows.
- Changes in road density resulting in changes in sediment loading (increases in road density result in increased sediment loading, increases in roads within Riparian Buffers more so).
- Riparian clearing and conversion from forested to non-forested condition can result in a loss of LWD recruitment into streams resulting in a long-term reduction in bank stability, pool development, habitat complexity, cover, and sediment retention.
- Increased parking areas can be a source of stormwater contamination, contributing sediment and toxic substances such as hydrocarbons and metals to receiving streams.
- Ground disturbing construction (buildings, lift corridors, trails, lift terminals, roads, parking) can result in increased erosion, sediment delivered to streams, and turbidity. Management Requirements and Other Management Provisions (see Table 2.4-2) would be effective at eliminating or reducing sediment erosion and delivery to streams. The effectiveness of these erosion control mitigation measures can be expected to increase with distance from streams and other factors such as soils type and slope gradient.

- Riparian clearing can result in loss of shade, increased stream temperatures, reduced LWD recruitment, reduced filtration of sediment and other pollutants from overland flow, and reduced bank stability.

Beneficial impacts that would occur could include:

- Reduced sediment yield in some areas due to road obliteration and revegetation.
- Improved stormwater management and treatment can improve peak and base flow conditions and stormwater discharge water quality from paved parking areas.
- Increased forest area in some drainages can improve precipitation interception and storage and reduce erosion and soil loss.
- Reduced sediment inputs from paved parking areas and roads with reduced use of traction sand.
- Implementation of restoration projects that stabilize soils, plant trees in Riparian Buffers, and remove culverted sections of streams.

Potential short-term and long-term impacts to fisheries resources are discussed in the following sections:

Short-Term

Short-term impacts are those impacts which would take place during construction, generally immediately following the MDP activity causing the impact mechanism, and are expected to persist for one to two years. Short-term impacts would potentially include:

- Potential increased turbidity from instream construction.
- Potential increased turbidity from erosion of bare soil in cleared and graded areas.
- Potential pollution from construction equipment (fuels, lubricants, hydraulic fluids).
- Potential temporary barriers to instream migration during installation, replacement, or maintenance of culverts.

Long-Term

Long-term impacts would persist for more than two years to many years following the completion of the MDP activity. Potential long-term impacts to fisheries resources would include:

- Changes in LWD recruitment related to conversion of Riparian Buffers from forested to non-forested vegetative cover types. Loss of forested Riparian Buffers results in a decreased LWD recruitment/potential.
- Changes in stream shading and stream temperatures from conversion of riparian vegetative cover types. Loss of forested riparian results in a loss of shade and increased stream temperatures.

- Change in hydrologic regime from land cover conversion, increases in impervious surface area, and changes in stormwater management.
- Change in sediment dynamics from restoration projects, changes in land cover, changes in stormwater management, and changes in snow clearing management.
- Changes in stormwater runoff quality from changes to vehicle maintenance facilities and stormwater management facilities.

4.4.2 Impacts – Alternative 1 (No Action Alternative)

Under Alternative 1, there would be no additional effects on fish and fish habitat resulting from the construction of new facilities. Existing conditions for fish, as discussed in Section 3.4 - Fisheries, would continue with only slight changes occurring over time.

4.4.2.1 Upper Yakima River Watershed

Within the U. Yakima Watershed, a number of watershed condition parameters have the potential to detrimentally influence fish and aquatic habitat. The majority of fish habitat in this watershed is in Mill Creek and Coal Creek, with very little in tributary streams. Fish habitat in Coal Creek would continue to be the only fish habitat in the Tunnel Drainage, and be downstream of the Ski Acres and Beaver drainages. The relatively poor fish habitat conditions in Coal Creek would continue to be influenced by the riparian condition and road related impacts outside of the MDP Study Area. These conditions would be unchanged under Alternative 1. Watershed conditions that would continue to indirectly affect the 3.2 miles of fish bearing streams or the 2.4 miles of presumed fish habitat are discussed below.

Road Crossings

The number of road crossings would not change under Alternative 1. Road crossings would continue to be potential sources of sediment into the streams, and a loss of shade. Road crossings could also continue to restrict wood transport down stream channels. The number of road crossings would continue to be high throughout the U. Yakima Watershed (with the exception of the Upper Mill Creek drainage). The highest concentration of road crossings would continue to occur in Tunnel Creek (85 crossings per square mile) and Ski Acres drainages (50 crossings per square mile). The lowest number of road crossings per mile would continue to be Other Yakima (4.11 crossing per square mile) and Hyak (9.96 crossings per square mile).

Road Density

Under Alternative 1, road density in Riparian Buffers would remain unchanged. Overall, road density within the U. Yakima Watershed (6.43 miles per square mile) would continue to exceed the threshold (3 miles per square mile) for this parameter. Road density within individual drainages would continue to range from a low of approximately 1.66 miles per square mile in Other Yakima to a high of approximately 12.34 miles per square mile in Tunnel (see Table 4.4.2-1). Roads would continue to be sediment sources

that could cause alterations in natural watershed hydrology by increasing the channel network and functional impervious surface area. Roads in Riparian Buffers are especially likely to contribute sediment to streams and could also result in interruptions in riparian hydrology. The result of high road density would generally increase in sediment load, increase peak flows, and reduce base flows. Drainages with the highest number of road crossings per square mile would continue to occur in Tunnel Creek and Ski Acres drainages reflecting the number of native surface service roads in the Summit Central ski area.

Riparian Buffer Condition

Under Alternative 1, a total of 293.2 acres of Riparian Buffers would continue to remain in a non-natural condition (as calculated from Appendix I – Physical and Biological Resource Data Tables with summaries of conditions for the sub-watersheds in the Study Area). Within the U. Yakima Watershed, only the Creek Run and Hyak drainages have less than 30 percent of the Riparian Buffer area in a modified condition, and remain relatively intact.

Large Woody Debris Recruitment Potential

LWD recruitment potential is defined by the condition of Riparian Buffers. Those areas in mature or immature forested condition provide an adequate potential for LWD recruitment. Developed, modified, or sapling forested condition do not provide an adequate potential for LWD recruitment. Under Alternative 1, these conditions would continue throughout the watershed. Over a period of many years, sapling and immature forest areas would mature increasing LWD recruitment potential. However, most modified or developed Riparian Buffers would not change.

Sediment Yield

Sediment yields have been estimated for sub-watersheds and MDP alternatives, and are reported in detail in Section 4.2 – Geology and Soils. Under Alternative 1, there would be no change in sediment yield from existing conditions. Sediment yield to Coal Creek would continue to be 670 tons per year, and sediment yield to Mill Creek would continue to be 365 tons per year (see Table 3.2.1-5). Since the Mill Creek watershed is relatively undeveloped (no buildings, parking lots, facilities), the modeled sediment yield is largely the result of natural processes.[62] Approximately 99 percent of the sediment yield in Mill Creek is from forested areas compared to 15 percent in the U. Yakima watershed (see Table 3.2.1-5). Non-forested and other developed areas contribute the majority of the sediment in the two developed watersheds, 85 percent in the U. Yakima. In this respect, the Mill Creek watershed is in a fair condition compared to the U. Yakima, which is in a poor condition, since the majority of the sediment yield is generated from forested areas through natural processes, which typically generate less sediment per unit area than anthropogenic influences (see Section 3.2 – Geology and Soils). As described in Sections 3.2 and 4.2 –

[62] While the Mill Creek area does contain roads, culverts, and has had recent timber management activity, it has a low percentage of developed areas compared to the Upper Yakima and S.F. Snoqualmie watersheds. The Mill Creek watershed is not considered to be undisturbed in this analysis, however it does present a means for comparing sediment yields from largely forested areas to developed areas (i.e., the ski area).

Geology and Soils, road sand from I-90 would continue to be the largest contributor of sediment to the U. Yakima watershed.

Stormwater Pollution Potential

As described in Sections 3.3 and 4.3 – Watershed Resources, parking areas, fueling areas, and the maintenance shop would continue to be potential stormwater pollution sources. Potential contaminants from these areas would include fuel, lubricants, hydraulic fluids, and coolants. All of these substances would be detrimental to fish. Under Alternative 1, potential sources of stormwater contamination including parking lots and the vicinity of the vehicle maintenance facility next to Beaver Lake Creek would remain unchanged.

Drainages of Particular Concern

A summary of the drainage condition parameters that relate most directly to fish habitat is shown in Table 4.4.2-1. Although these conditions can be analyzed to assess fish habitat, it must be noted that the extent of fish habitat would continue to be very limited in the Tunnel, Ski Acres, and Beaver Drainages.

The threshold of concern for modification of Riparian Buffer area is 30 percent (see Appendix I – Physical and Biological Resource Data Tables). Where greater than 30 percent of the Riparian Buffer area is modified, there is a high probability of impaired riparian function. Within the U. Yakima Watershed, only the Creek Run and Hyak drainages have less than 30 percent of the Riparian Buffer area in a modified condition, all other drainages exceed the 30 percent threshold. The greatest area of modified Buffer would continue to occur in the Upper Mill Creek drainage where all of the Buffers are in a modified condition. Approximately 56 percent of the Beaver Creek drainage would continue in a modified condition because of the existing ski trails.

Road density within the entire U. Yakima Watershed (6.43 miles per square mile) would continue to exceed the threshold (3 miles per square mile) for this parameter. Road density would continue to exceed the threshold of concern in the Lower Mill Creek, Summit South, Tunnel, Ski Acres, and Beaver seventh-field drainages.

Within the U. Yakima Watershed, 21.6 percent of the length of streams have a limited LWD recruitment potential and are a management concern. This would continue to exceed the threshold of concern of 10 percent. Drainages that would continue to exceed the 10 percent threshold are the Upper Mill Creek (18.3 percent), Tunnel (27.2 percent), Ski Acres (44.5 percent), Beaver (48.6 percent), and Other Yakima (32.4 percent) seventh-field drainages. Beaver drainage would continue to have the greatest percentage (48.6 percent) of its stream length with management concerns. Modified channel length would also continue to exceed threshold values in both the Ski Acres and Beaver drainages (12.7 percent and 10.5 percent, respectively) where there are numerous water bars and ditches on ski trails at Summit West and Summit Central. However, it should be noted that these channels do not provide fish habitat within the Study Area.

Table 4.4.2-1:
Summary of DPC Analysis of Fish Habitat Conditions for Alternative 1 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Upper Yakima River Watershed								
		L. Mill Creek	U. Mill Creek	Creek Run	Summit South	Hyak	Tunnel	Ski Acres	Beaver	Other
Drainage Area (acres)		**395.67**	**33.22**	**220.24**	**223.89**	**192.70**	**134.41**	**358.08**	**171.38**	**155.63**
Riparian Buffers in a Non-Natural Condition (% of total)	30.0	83.16	100.00	18.87	45.06	27.37	42.00	52.78	56.38	44.52
Stream Length w/ Management Concerns (% of total)	10.0	7.78	18.33	1.89	6.60	5.81	27.23	44.48	48.63	32.40
Road Density (miles/square mile)	3.0	7.42	2.90	2.52	5.66	2.78	12.34	9.28	8.65	1.66
Road Crossing Density (number/ square mile)	6.0	27.50	0.00	20.34	14.29	9.96	85.71	50.04	33.61	4.11
Modified Channel Length (% of total)	8.0	0.00	0.00	0.00	1.69	0.00	5.60	12.68	10.45	0.00
Parameters Over Threshold		**3**	**2**	**1**	**3**	**1**	**4**	**5**	**5**	**2**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

4.4.2.2 South Fork Snoqualmie River Watershed

Under Alternative 1, fish habitat conditions in the S.F. Snoqualmie Watershed would remain unchanged. Watershed conditions that would continue to indirectly affect the 2.2 miles of fish bearing streams or the 1.6 miles of presumed fish habitat within the S.F. Snoqualmie Watershed are discussed below.

Road Crossings

The number of road crossings described in Section 3.4 – Fisheries would be unchanged under Alternative 1. The number of road crossings per mile would continue to range from a low at Northside (0 crossings per mile) to a high at Summit North (26.6 crossings per mile). Although most road crossings are on headwater streams that do not contain fish habitat, they would continue to be potential points for increased sediment loading. Existing barriers to passage, as described in Section 3.4 – Fisheries, would remain under Alternative 1. Fish populations in the S.F. Snoqualmie Watershed (in the S.F. Snoqualmie River and one unnamed tributary) would remain isolated by natural falls on the S.F. Snoqualmie River and by a long culvert that passes under the road to the upper Alpental parking lots and on the one unnamed fish bearing tributary.

Road Density

Under Alternative 1, road density would remain unchanged (1.96 miles per square mile). Much of the road density is associated with the Alpental Road that would continue to run parallel to the S.F. Snoqualmie River and within its Riparian Buffers. Road density would continue to range from a low of 0.5 mile per square mile in International, to a high of 7.02 miles per square mile in the Summit North drainage.

Riparian Buffer Condition

Riparian Buffer condition would remain essentially unchanged under Alternative 1. With no new clearing, sapling and immature forested Riparian Buffers would gradually mature resulting in improved Riparian Buffer condition. However, maintaining ski trails would continue and modified Riparian conditions would continue to be high.

LWD Recruitment Potential

Under Alternative 1, LWD recruitment potential would not change. The majority of stream length in Riparian Buffers would continue to have inadequate LWD recruitment potential, based on the vegetative condition along stream channels. Reduced LWD in the S.F. Snoqualmie River tributaries would continue to result in reduced sediment retention, and a reduced quantity of wood routed downstream to the S.F. Snoqualmie River, where the majority of fish habitat is located.

Sediment Yield

Sediment yield is discussed in detail in Section 3.2 – Geology and Soils under Alternative 1. Sediment yield to the S.F. Snoqualmie River would continue to be about 427 tons per year. Compared to the Mill Creek watershed, a largely undeveloped watershed,[63] approximately 17 percent of the sediment yield is from forested areas in the S.F. Snoqualmie watershed (see Table 3.2.1-5). Non-forested and other developed areas contribute the majority of the sediment in the S.F. Snoqualmie watershed, approximately 83 percent. In this respect, the Mill Creek watershed is in a better condition compared to the S.F. Snoqualmie since the majority of the sediment yield is generated from forested areas through natural processes. As described in Sections 3.2 and 4.2 – Geology and Soils, road sand from I-90 would continue to be the largest contributor of sediment to the S.F. Snoqualmie watershed. Fish habitat parameters that relate to sediment yield, including turbidity, pool quality, and substrate quality would be unchanged under Alternative 1.

Stormwater Pollution Potential

As described in Section 3.3 – Water and Watershed Resources, parking areas, fuel storage, and the maintenance shop would be potential stormwater pollution sources. Potential contaminants from these

[63] While the Mill Creek area does contain roads, culverts, and has had recent timber management activity, it has a low percentage of developed areas compared to the Upper Yakima and S.F. Snoqualmie watersheds. The Mill Creek watershed is not considered to be undisturbed in this analysis, however it does present a means for comparing sediment yields from largely forested areas to developed areas (i.e., the ski area).

areas include fuel, lubricants, hydraulic fluids, and coolants. All of these substances would be detrimental to fish. However, there have been no observed indication of stormwater contamination from these sources and would not expect to occur under Alternative 1. Under Alternative 1, there would be no change in the potential for stormwater contamination.

Drainages of Particular Concern

In the S.F. Snoqualmie Watershed, a number of watershed condition parameters would continue to exceed threshold values including Riparian Buffers and length of stream channel with management concerns (see Table 4.4.2-2). The Summit North and Nacrinomical drainages are the two drainages with the most parameters that would continue to exceed threshold values.

Table 4.4.2-2:
Summary of DPC Analysis of Fish Habitat Conditions for Alternative 1
in the South Fork Snoqualmie Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Northside	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Area (acres)		**49.04**	**72.11**	**270.19**	**89.37**	**318.76**	**214.67**
Riparian Buffers in a Non-Natural Condition (% of total)	30.0	81.47	83.90	41.12	27.22	38.97	11.32
Stream Length w/ Management Concerns (% of total)	10.0	0.00	49.76	2.44	3.89	21.40	3.98
Road Density (miles/square mile)	3.0	4.88	7.02	0.50	0.68	1.70	2.34
Road Crossing Density (number/square mile)	6.0	0.00	26.62	4.76	7.16	12.05	11.93
Modified Channel Length (% of total)	8.0	0.00	88.43	1.96	0.00	25.17	5.49
Parameters Over Threshold		**2**	**5**	**1**	**1**	**4**	**1**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

The number of road crossings would continue to exceed the threshold value in the watershed as a whole, due to the high density of road crossings in the Summit North and Nacrinomical drainages (26.6 and 12.0 crossings per square mile, respectively). Road density would continue to exceed the threshold of concern for in the Northside (4.88 miles per square mile) and Summit North (7.02 miles per square mile) seventh-field drainages, but not for the watershed as a whole.

Under Alternative 1, the Northside, Summit North, International, and Nacrinomical drainages would all continue to exceed the threshold of concern for modified Riparian Buffers (30 percent). The Summit

North and Nacrinomical drainages would continue to exceed the threshold of concern for stream length in a modified condition (10 percent).

Stream lengths within management concerns would continue to exceed the 10 percent threshold values at Summit North (49.8 percent) and Nacrinomical (21 percent) drainages. In addition, modified Riparian Buffer conditions would continue to exceed threshold values as reported above for the Northside, Summit North, International, and Nacrinomical drainages. LWD recruitment potential is limited along the modified channels in the Summit North (88 percent) and Nacrinomical (25.2 percent) drainages where ski trails are located. These conditions would remain under Alternative 1.

4.4.3 Impacts – Alternative 2 (Proposed Action)

Projects associated with implementation of Alternative 2 include all actions discussed in Section 2.3.3 - Alternative 2 – Proposed Action. Since the project elements proposed under Alternative 2 are not located in fish bearing streams, potential indirect impacts are primarily limited to those related to changes in land cover, with the most important changes being those associated with Riparian Buffers. A comprehensive listing of watershed parameters in the Study Area that affect fish habitat, and that differ by alternative are listed in Table 4.4.3-3. Because the Study Area includes both areas involved in the Mill Creek Land Donation and well as in the MDP area, the watershed parameters are shown for the MDP Area (see Table 4.4.3-1) and Mill Creek area (see Table 4.4.3-2) areas separately. In this way, differences between alternatives can more easily be discerned.

Alternative 2 would include few changes in headwater road crossings, and no work in fish bearing streams or changes in the number of crossings of fish bearing streams (see Table 4.4.3-3). New road crossings installed under Alternative 2 would include one new bridge on Hyak Creek, a stream identified as “presumed fish bearing” and one bridge on a non-fish bearing stream segment (Stream A). Alternative 2 would also include one new culvert and removal of an existing culvert on separate non-fish bearing headwater streams.

As discussed in Section 3.4 - Fisheries, federally listed (Endangered Species Act [ESA]) threatened or endangered fish species do not occur in the Study Area, and fish passage barriers would prevent them from accessing fish bearing streams in the Study Area. Therefore, no direct impacts would occur on these species due to the distance from the proposed action to accessible habitat. Indirect impacts would not be expected to occur on threatened or endangered species since water and habitat quality in waters accessible to ESA listed fish species (Keechelus Lake and lower Coal Creek) would continue to be influenced to a much greater degree by conditions in different watersheds outside of the Study Area.

Clearing for trails, lifts, and facilities would result in a long-term net loss of forested Riparian Buffers and an increase in modified or developed Riparian Buffer areas under Alternative 2. LWD recruitment potential within the Study Area would be reduced slightly under Alternative 2, but only in mountain slope channels that generally do not provide fish habitat. High gradient, confined channels (MS1 channels) can

transport some wood downstream, but the effect of reducing LWD recruitment in mountain slope channels would be primarily localized. In mountain slope channels, LWD functions to retain sediment and stabilize stream bed and banks. Due to restoration projects (i.e., road obliteration), beneficial impacts would occur by slightly reducing the length of roads and therefore road density within Riparian Buffers in the Study Area (see Table 4.4.3-3). However, construction of new ski trails and chairlifts would increase the amount of modified and developed Riparian Buffers in the Study Area by approximately 24 acres (see Table 4.4.3-3).

Table 4.4.3-1:
MDP Area: Comparison of Fish Impact Related Parameters by MDP Alternatives

Parameter (units)	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Culverted Stream Length (miles)[a]	2.07	2.18	2.18	2.18	2.18
Road Length within the Study Area[b]					
Total Roads (miles)	18.52	18.23	18.23	17.97	18.23
Total Road Density (miles/square mile)	4.72	4.65	4.65	4.58	4.65
Road Length within Riparian Buffers[b]					
Total Roads (miles)	4.31	4.16	4.15	4.07	4.15
Total Road Density (miles/square mile)	3.92	3.78	3.81	3.70	3.81
Number of Fish Bearing Road Crossings[a]					
Culvert	13	13	13	13	13
Bridge	7	7	7	7	7
Ford	0	0	0	0	0
Number of Presumed Fish Bearing Road Crossings[a]					
Culvert	10	10	10	10	10
Bridge	0	1	1	0	1
Ford	0	0	0	0	0
Number of Non Fish Bearing Road Crossings[a]					
Culvert	85	85	85	84	85
Bridge	0	1	1	0	1
Ford	14	14	14	14	14
Land Cover Types within Riparian Buffers (acres)[b]					
Forested – Mature	312.35	290.97	297.47	304.35	297.29
Forested – Immature	37.40	30.99	30.58	31.81	30.68
Forested – Sapling	8.40	13.89	22.44	16.71	15.94
Naturally Non-Forested	71.47	69.56	70.31	71.11	69.70
Modified	237.34	253.08	241.43	236.24	247.28
Developed	28.79	35.57	33.94	33.84	35.27

Table 4.4.3-1:
MDP Area: Comparison of Fish Impact Related Parameters by MDP Alternatives

Parameter (units)	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Total Riparian Buffers (acres)	695.74	694.06	696.16	694.06	696.16
Total Riparian Buffers (miles^2)	1.09	1.08	1.09	1.08	1.09
Large Woody Debris Recruitment Potential by Channel Type (miles)[c, d]					
MS1 Channels (miles)					
Adequate LWD Recruitment	3.89	3.64	3.71	3.74	3.66
Inadequate LWD Recruitment	1.72	2.11	2.04	2.01	2.09
MS2 and MS3 Channels (miles)					
Adequate LWD Recruitement	5.63	5.32	5.30	5.53	5.34
Inadequate LWD Recruitment	6.75	7.00	7.03	6.79	6.98
VB1 Channels (miles)					
Adequate LWD Recruitment	1.53	1.50	1.50	1.50	1.50
Inadequate LWD Recruitment	0.66	0.64	0.64	0.64	0.64
VB2 Channels (miles)					
Adequate LWD Recruitment	0.14	0.14	0.14	0.14	0.14
Inadequate LWD Recruitment	0.20	0.20	0.20	0.20	0.20

[a] Includes jurisdictional and non-jurisdictional streams inside and outside of the Study Area (Study Area and channels downstream to Keechelus Lake in Upper Yakima subwatershed and to Franklin Falls in SFSW) does not include temporary crossings.
[b] Includes jurisdictional streams and conditions within the Study Area only. Totals may not match between alternatives due the fine grained GIS analysis and rounding.
[c] Adequate LWD recruitment potential includes all forested land cover types except for sapling forests. Inadequate includes all other landcover types.
[d] Channel types are also defined in Section 3.3 – Water and Watershed Resources: MS1- high gradient, confined mountain slope channels; MS2 – high gradient, low-to variable confinement mountain slope channels; MS3 – moderate to low-gradient, unconfined mountain bench channels; VB1 – high to moderate gradient valley bottom channels, VB2 – low gradient, variable confinement valley bottom channels.
Note: This table does not include the Mill Creek portion of the Study Area.

Table 4.4.3-2:
Mill Creek Area: Comparison of Fish Impact Related Parameters by MDP Alternatives

Parameter (units)	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Culverted Stream Length (miles)[a]	0	0	0	0	0
Road Length within the Study Area[b]					
Total Roads (miles)	3.52	3.52	3.52	3.52	3.52
Total Road Density (miles/square mile)	5.76	5.76	5.76	5.76	5.76
Road Length within Riparian Buffers[b]					
Total Roads (miles)	0.81	0.81	1.37	0.81	1.37
Total Road Density (miles/square mile)	1.33	1.33	2.25	1.33	2.25
Number of Fish Bearing Road Crossings[b]					
Culvert	0	0	0	0	0
Bridge	0	0	0	0	0
Ford	0	0	0	0	0
Number of Presumed Fish Bearing Road Crossings[b]					
Culvert	1	1	1	1	1
Bridge	0	0	0	0	0
Ford	0	0	0	0	0
Number of Non Fish Bearing Road Crossings[b]					
Culvert	13	13	13	13	13
Bridge	0	0	0	0	0
Ford	0	0	0	0	0
Land Cover Types within Riparian Buffers (acres)[c]					
Forested – Mature	7.09	7.09	23.54	7.09	23.54
Forested – Immature	5.82	5.82	6.09	5.82	6.09
Forested – Sapling	64.61	64.47	122.60	64.47	122.60
Naturally Non-Forested	0.25	0.25	0.34	0.25	0.34
Modified	25.42	25.56	27.59	25.56	27.59
Developed	1.58	1.58	2.64	1.58	2.64
Total Riparian Buffers (acres)	104.76	104.76	182.80	104.77	182.80
Total Riparian Buffers (miles^3)	0.16	0.16	0.29	0.16	0.29
Large Woody Debris Recruitment Potential by Channel Type (miles)[d,e]					
MS1 Channels (miles)					
Adequate LWD Recruitment	0.10	0.10	0.10	0.10	0.10
Inadequate LWD Recruitment	0.88	0.88	0.88	0.88	0.88
MS2 and MS3 Channels (miles)					
Adequate LWD Recruitment	0.17	0.17	0.17	0.17	0.17
Inadequate LWD Recruitment	1.80	1.80	1.80	1.80	1.80

Table 4.4.3-1:
MDP Area: Comparison of Fish Impact Related Parameters by MDP Alternatives

Parameter (units)	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
VB1 Channels (miles)					
Adequate LWD Recruitment	0.56	0.56	0.56	0.56	0.56
Inadequate LWD Recruitment	0.79	0.79	0.79	0.79	0.79
VB2 Channels (miles)					
Adequate LWD Recruitment	0	0	0	0	0
Inadequate LWD Recruitment	0	0	0	0	0

[a] For Alternative 3 and Modified Alternative 5, the total impact acreage includes the revisions to Buffer widths resulting from conversion from private lands (i.e., Kittitas County Buffers) to wider Riparian Reserve widths under USFS management.
[b] Includes jurisdictional and non-jurisdictional streams inside and outside of the Study Area (Study Area and channels downstream to Keechelus Lake in Upper Yakima subwatershed and to Franklin Falls in SFSW) does not include temporary crossings.
[c] Includes jurisdictional streams and conditions within the Study Area only.
[d] Adequate LWD recruitment potential includes all forested land cover types except for sapling forests. Inadequate includes all other landcover types.
[e] Channel types are also defined in Section 3.3 – Water and Watershed Resources: MS1- high gradient, confined mountain slope channels; MS2 – high gradient, low-to variable confinement mountain slope channels; MS3 – moderate to low-gradient, unconfined mountain bench channels; VB1 – high to moderate gradient valley bottom channels, VB2 – low gradient, variable confinement valley bottom channels.
Note: This table includes only the Mill Creek portion of the Study Area.

Table 4.4.3-3:
Study Area Total[a]: Comparison of Fish Impact Related Parameters by MDP Alternatives

Parameter (units)	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Culverted Stream Length (miles)[b]	2.07	2.18	2.18	2.18	2.18
Road Length within the Study Area (miles)[c]					
Total Roads (miles)	22.03	21.74	21.74	21.48	21.74
Total Road Density (miles/square mile)	4.86	4.80	4.80	4.74	4.80
Road Length within Riparian Buffers (miles)[c]					
Total Roads (miles)	5.12	4.97	5.52	4.88	5.52
Total Road Density (miles/square mile)	4.09	3.98	4.00	3.91	4.00
Number of Fish Bearing Road Crossings[b]					
Culvert	13	13	13	13	13
Bridge	7	7	7	7	7
Ford	0	0	0	0	0
Number of Presumed Fish Bearing Road Crossings[b]					
Culvert	11	11	11	11	11
Bridge	0	1	1	0	1
Ford	0	0	0	0	0
Number of Non Fish Bearing Road Crossings[b]					
Culvert	98	98	98	97	98
Bridge	0	1	1	0	1
Ford	14	14	14	14	14

Table 4.4.3-1:
MDP Area: Comparison of Fish Impact Related Parameters by MDP Alternatives

Parameter (units)	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Land Cover Types within Riparian Buffers (acres)[c]					
Forested – Mature	319.44	298.06	321.01	311.44	320.84
Forested – Immature	43.22	36.81	36.67	37.63	36.77
Forested – Sapling	73.02	78.36	145.04	81.18	138.54
Naturally Non-Forested	71.72	69.81	70.64	71.36	70.03
Modified	262.75	278.64	269.01	261.80	274.86
Developed	30.36	37.15	36.58	35.42	37.91
Total Riparian Buffers (acres)	800.51	798.83	878.95	798.83	878.95
Total Riparian Buffers (miles^3)	1.25	1.25	1.37	1.25	1.37
Large Woody Debris Recruitment Potential by Channel Type (miles)[d,e]					
MS1 Channels (miles)					
Adequate LWD Recruitment	3.99	3.74	3.81	3.84	3.76
Inadequate LWD Recruitment	2.60	2.99	2.92	2.89	2.97
MS2 and MS3 Channels (miles)					
Adequate LWD Recruitment	5.80	5.48	5.46	5.70	5.51
Inadequate LWD Recruitment	8.55	8.80	8.83	8.59	8.78
VB1 Channels (miles)					
Adequate LWD Recruitment	2.09	2.06	2.06	2.06	2.06
Inadequate LWD Recruitment	1.45	1.43	1.43	1.43	1.43
VB2 Channels (miles)					
Adequate LWD Recruitment	0.14	0.14	0.14	0.14	0.14
Inadequate LWD Recruitment	0.20	0.20	0.20	0.20	0.20

[a]- For Alternative 3 and Modified Alternative 5, the total impact acreage includes the addition of acquired lands from the Mill Creek Land Donation, including the increased Buffer widths under Alternative 3 and Modified Alternative 5 resulting from a change in management from private lands to public lands. Totals may not match between alternatives due the fine grained GIS analysis and rounding.
[b]- Includes jurisdictional and non-jurisdictional streams inside and outside of the Study Area (Study Area and channels downstream to Keechelus Lake in Upper Yakima subwatershed and to Franklin Falls in SFSW) does not include temporary crossings.
[c]- Includes jurisdictional streams and conditions within the Study Area only.
[d]- Adequate LWD recruitment potential includes all forested land cover types except for sapling forests. Inadequate includes all other landcover types.
[e] Channel types are also defined in Section 3.3 – Water and Watershed Resources: MS1- high gradient, confined mountain slope channels; MS2 – high gradient, low-to variable confinement mountain slope channels; MS3 – moderate to low-gradient, unconfined mountain bench channels; VB1 – high to moderate gradient valley bottom channels, VB2 – low gradient, variable confinement valley bottom channels.
Note: This table includes the Mill Creek portion of the Study Area.

4.4.3.1 Upper Yakima River Watershed

No instream work in fish-bearing streams is proposed under Alternative 2. Therefore, potential impacts to fish are only those related to work in the terrestrial environment that could affect water quality or quantity, and impacts in non-fish bearing stream segments upstream of fish habitat. Alternative 2 includes the greatest number of plan components and the greatest area of activity. Drainage conditions of parameters relative to fish habitat quality that would change in the U. Yakima Watershed under Alternative 2 are discussed below. The location of proposed project elements are shown in Figure 2.3.3-1, Alternative 2 Proposed Conditions – The Summit. Proposed road crossing changes are shown in Figure 4.4.1-1, Proposed Fisheries Conditions – Alternative 2 – The Summit.

The potential for impacts to hydrology and water quality are discussed in detail in Section 4.3 – Water and Watershed Resources. The potential for indirect impacts to fish depend in part on the effectiveness of mitigation measures for fish, erosion and sediment control, and water quality presented in Chapter 2. All of the mitigation measures would reduce or eliminate sediment indirect impacts from construction and soil disturbance on potential fish habitat. Since much of the proposed clearing and grading is located a considerable distance upslope and upstream of fish bearing streams, the potential for impacts to fish is reduced.

The following discussion describes different parameters in the U. Yakima Watershed that are relevant to assessing potential indirect impacts on fish habitat. Since no projects proposed in fish-bearing stream segments, and the road crossing replacements are located at least 0.5 mile upstream of confirmed fish bearing streams, it is anticipated that no direct impacts to fish would occur. One possible exception would be if fish are present in Hyak Creek, currently fish presence is assumed based on stocking history in Hyak Lake, and there would be a short-term sediment release associated with installation of a new bridge crossing that stream. Management Requirements 20 -21 and Other Management Provision OMP23 (see Table 2.4-2) would be used to reduce impacts on any fish present by insuring that established procedures for instream work are followed and by implementing bmps during such work.

Changes in the terrestrial environment may result in indirect impacts through changes in hydrology, water quality, or sediment dynamics that effect conditions downstream. A number of variables determine the magnitude, location, and probability of these potential impacts occurring. Although there would be some potential for adverse indirect impacts, Management Requirements MR20 – 21 and Other Management Provisions OMP21 – 24 (see Table 2.4-2), in addition to the soil and water requirements and provisions, would minimize these impacts. The location of fish habitat (see Figure 3.4.1-1, Existing Fisheries Conditions – The Summit) and distribution of projects through the watershed are such that existing fish habitat conditions are not expected to be altered to the degree that would cause changes in the westslope cutthroat trout or sculpin populations in Mill Creek, Coal Creek, Beaver Lake Creek or the accessible portions of Hyak Creek and Pulse Creek, or other species present in lower Coal Creek (kokanee trout,

redside shiner, burbot, eastern brook trout, and mountain whitefish). The length of known or presumed fish habitat reported to occur in the U. Yakima Watershed would not change under Alternative 2.

Road Crossings

Two new road crossings, located well upstream of fish habitat, would be constructed under Alternative 2. These include bridges completely spanning Hyak Creek and Stream A (see Figure 4.4.1-1, Proposed Fisheries Conditions – Alternative 2 – The Summit). Because these bridges would span the stream channels, instream construction would not occur. Indirect impacts would include a localized loss of stream shading and LWD recruitment potential. Management Requirement MR8, Management Requirements MR20-21 and Other Management Provision OMP24 (see Table 2.4-2) would reduce the impact by ensuring vegetation is replanted to provide shade and bank stabilization. Snow bridges would be used at other trail crossings of headwater streams. Natural water flow would continue under snow bridges, therefore snow bridges are not anticipated to have an effect on streams or fish habitat located downstream.

Road Density

Under Alternative 2, three new road segments would be constructed in the U. Yakima Watershed. These would be located at the upper Rampart Chairlift terminal, at the lower terminals to the Creek Run and Rampart Chairlifts, and between the upper Pacific Crest chairlift and the Northside Chairlift. In addition to new roads, approximately 1,300 linear feet of road would be abandoned and revegetated. The net change in road density would, therefore, be a reduction of 0.25 mile per square mile within the U. Yakima Watershed. The length of roads in Riparian Buffers in the U. Yakima Watershed would be reduced from 6.36 miles per square mile under existing conditions to 5.87 miles per square mile under Alternative 2 (see figures by watershed in Appendix I – Physical and Biological Resource Data Tables).

Riparian Buffer Condition

Under Alternative 2, the percentage of Riparian Buffers in a non-natural condition would increase from 48.8 percent to 53.8 percent in the U. Yakima Watershed. Development of the Rampart and Creek Run ski trails and lifts would be a long-term impact on Riparian Buffers by removing mature forest. The percentage of Riparian Buffers in a non-natural condition would increase in the Creek Run and Hyak drainages by 10 percent and 1 percent, respectively, under Alternative 2.

Development of ski trails, chairlifts, and roads would increase the amount of non-natural Riparian Buffers in the Summit South drainage as well. Restoration projects that would help to improve local Riparian Buffers would include removing a culverted segment and restoring associated Riparian Buffers along Beaver Lake Creek in the Beaver drainage. Other restoration actions that would improve riparian conditions would be planting native vegetation in a Riparian Buffers near the tubing center in the Ski Acres drainage.

The change in Riparian Buffers and stream length conditions in the watershed does not occur on known fish bearing streams. Although fish are presumed to be present in Hyak Creek, the revegetation of the existing cross over trail would result in a slight improvement to the amount of stream channels in a modified condition in the Hyak drainage. The proposed activities in Riparian Buffers could contribute slightly to stream temperature increases in Coal Creek.

LWD Recruitment Potential

LWD recruitment potential would not change along the valley bottom fish bearing stream segments (i.e., Coal Creek) under Alternative 2. LWD recruitment would be reduced slightly in some mountain slope channels as forested Buffer area would be reduced along about 0.57 mile of headwater streams, primarily in the Summit South and Tunnel Creek drainages. In the Beaver drainage, restoration planting along Beaver Lake Creek, planting tree islands, and along Road C at Summit West would increase the stream length with adequate (forested) Riparian Buffer. In addition, a culverted stream length on Beaver Lake Creek would be removed, increasing available aquatic habitat.

The effects of these changes would be effective after a period of decades. Within this time period, it is expected that some of the area currently in sapling forest (especially in the Mill Creek drainages) cover would mature to a size that would allow some additional recruitment of LWD. Because the stream energy in mountain slope channels, particularly in the channels with lower confinement, is generally insufficient to transport a significant quantity of wood downstream to fish-bearing stream segments, the net result being decrease in LWD recruitment for the watershed is not anticipated to alter fish habitat conditions. Other Management Provision OMP12 (see Table 2.4-2) would maintain LWD in the system.

Sediment Yield

Sediment yield is discussed in detail in Section 4.2 – Geology and Soil Resources. Under Alternative 2, sediment yield from the Study Area to mainstem streams would be increased by about 1 percent in the Summit South drainage, where sediment yield to Coal Creek would increase by about 10.72 tons/year primarily from land use. However, the Summit South drainage has a relatively small influence on fish habitat. The Summit South is located low in the Coal Creek portion of the watershed, draining through the lowest tributary to Coal Creek; approximately 400 feet of presumed fish habitat upstream in a Coal Creek Tributary and about 400 feet of Coal Creek between this tributary and Keechelus Lake are potentially affected by the Summit South drainage.

Not all Coal Creek drainages in the U. Yakima Watershed would result in increased sediment yield. Proposed restoration plantings that would mature over time would reduce sediment yield in the Beaver (reduced by 4.72 tons/year) and Ski Acres drainages (reduced by 3.03 tons/year). These improvements would affect the lower portion of Beaver Lake Creek, and to a lesser degree, Coal Creek.

To date, sediment input from I-90 has been the largest and most concentrated sediment source affecting conditions in Coal Creek. However, WSDOT has reduced the quantity of traction sand that it uses on I-90

and SR 906, relying on chemical de-icer/ice-inhibitors instead. During the winter of 2004-2005, WSDOT used a 1:1 ratio of sand and chemical de-icer/ice-inhibitor (magnesium chloride, salt, and rust inhibitor), compared to a 5:1 ration used previously. During the winter of 2005-2006, WSDOT plans to use just chemical de-icer/ice-inhibitor without sand (Cernick 2005 pers. comm.). Because traction sand was estimated to contribute approximately 36 percent of the sediment load to Coal Creek, the improvement in sediment loading from changes in road sanding could be significantly greater than changes in land use cover associated with Alternative 2. Under Alternative 2, fish habitat parameters that relate to sediment yield; including turbidity, pool quality, and substrate quality could be slightly improved in Beaver Lake Creek, and would likely be the same as under Alternative 1 in Coal Creek.

Sediment yield to Mill Creek would be increased by 2.71 tons per year (less than a 1 percent increase) under Alternative 2. This change would have a relatively small and probably immeasurable indirect impact on fish habitat in Mill Creek.

Stormwater Pollution Potential

Water quality impacts are discussed in Section 4.3 – Water and Watershed Resources. In addition to reducing traction sand use as described above, stormwater management facilities associated with paved parking lots on NFSL can reduce chemical stormwater pollutants. The maintenance shop at Summit East would be improved under Alternative 2, reducing the need to park vehicles and equipment outside which could also reduce stormwater contamination.

Under Alternative 2, parking lots at Summit West and Summit Central would be paved. Improved stormwater management facilities would also be added to these lots occurring on NFSL. Paved lots would be treated with a magnesium chloride solution in place of traction sand and chemical de-icer/ice-inhibitor mixture that is currently used for winter snow management. As a result, the sediment discharged from these lots would be reduced and the loading to Pulse Creek and Tunnel Creek would be reduced. While these are not fish bearing streams, they drain to Coal Creek, a fish bearing stream with excessive fine sediment. Therefore, these changes provide an improved condition with regard to sediment that could potentially have a beneficial impact on fish habitat.

Magnesium chloride de-icer/ice-inhibitor is only deleterious to fish at relatively high concentrations. During the winter of 2001-2002, another Washington ski area, switched to the use of magnesium chloride for road management. Stream monitoring indicated that the chloride concentration in the receiving stream was only slightly above background concentrations and far below Washington State water quality standards (WAC 173-201a) or concentrations that would be deleterious to aquatic species (SE GROUP 2002). Similar results are expected at The Summit-at-Snoqualmie. Water quality monitoring would occur to verify that water quality standards are not exceeded.

Drainages of Particular Concern

Drainages of particular concern for fish habitat related parameters are shown in Table 4.4.3-4. Under Alternative 2 there would be one new threshold exceedance compared to Alternative 1.

- Summit South (Stream length with management concerns – 13.5 percent)

Additionally, there would be one parameter that drops below threshold as a result of restoration activities.

- Beaver (Modified channel length – 5.5 percent)

Table 4.4.3-4:
Summary of DPC Analysis of Fish Habitat Conditions for Alternative 2
in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Thre-shold	U. Yakima Watershed								
		L. Mill Creek	U. Mill Creek	Creek Run	Sum-mit South	Hyak	Tun-nel	Ski Acres	Bea-ver	Other
Drainage Area (acres)		**395.67**	**33.22**	**220.24**	**223.89**	**192.70**	**134.41**	**358.08**	**171.38**	**155.63**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.76	100.00	28.44	67.67	28.58	51.26	55.29	59.30	44.52
Change from Alternative 1 (% of total)		0.59	0.00	9.58	22.61	1.22	9.26	2.51	2.92	0.00
Stream Length with Management Concerns (% of total)	10	8.37	18.33	4.88	13.50	5.34	37.77	45.11	27.98	32.40
Change from Alternative 1 (% of total)		0.59	0.00	3.00	6.91	-0.47	10.54	0.63	-20.65	0.00
Road Density (miles/square mile)	3	7.47	2.90	2.25	5.61	2.78	11.77	8.80	7.68	1.66
Change from Alternative 1 (mile/square mile)		0.05	0.00	-0.27	-0.05	0.00	-0.57	-0.48	-0.97	0.00
Road Crossing Density (number/square mile)	6	29.13	0.00	20.35	11.44	13.29	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	0.01	-2.85	3.33	4.80	0.02	-3.72	0.00
Modified Channel Length (% of total)	8	0.00	0.00	0.00	1.69	0.00	5.61	12.65	5.48	0.00
Change from Alternative 1 (% of total)		0.00	0.00	0.00	0.00	0.00	0.01	-0.03	-4.97	0.00
Parameters over Threshold		**3**	**2**	**1**	**4**	**1**	**4**	**5**	**4**	**2**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**0**	**0**	**-1**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Under Alternative 2, one culvert would be removed in the Summit South drainage from a non-fish bearing headwater stream segment. This would reduce the crossings per square mile in this drainage from existing conditions from 14.3 to 11.4 crossings per square mile, but would still exceed the threshold value of 6 crossings per square mile. Additionally, the road crossing density in Beaver would decrease from 33.6 to 29.9 due to restoration of Beaver Lake Creek. The number of road crossings would remain above the threshold for concern in the all the U. Yakima Watershed drainages except the Upper Mill Creek and "Other" drainages. The highest density of crossings would be the same as the existing condition with the highest concentrations occurring at Tunnel Creek (90.5 crossings per square mile) and Ski Acres (50.1 crossings per square mile).

Although road density would continue to exceed the threshold of concern in several of the seventh-field drainages, it would be slightly reduced in the Creek Run, Summit South, Tunnel, Ski Acres, and Beaver drainages under Alternative 2. Road density in each of these drainages would be reduced by approximately 0.5 to 1.0 mile per square mile (see Table 4.4.3-4).

Under Alternative 2, the overall percentage of Riparian Buffers in a non-natural condition would increase from 48.8 percent to 53.8 percent in the U. Yakima Watershed and would continue to exceed the threshold for concern. Although the percentage of Riparian Buffers in a non-natural condition would increase in the Creek Run and Hyak drainages by 10 percent and 1 percent, respectively, these two drainages would remain under the 30 percent threshold of concern.

Stream length with management concerns would also increase in the Summit South drainage from 6.6 percent to 13.5 percent, which would result in a new threshold exceedance. The amount of non-natural Riparian Buffers in this drainage would also increase from 45 percent to 67.7 percent. Removing a culverted stream length along Beaver Lake Creek would reduce the amount stream length with management concerns to 5.5 percent, under the 8 percent threshold value. These restoration projects would decrease the amount of stream length with management concerns from 49 percent to 28 percent in Beaver drainage. The percent of modified channel length in the Ski Acres drainage would be reduced from 12.68 to 12.65, although a beneficial change, it still exceeds the threshold of concern.

4.4.3.2 South Fork Snoqualmie River Watershed

Under Alternative 2, no changes to fish bearing stream segments or in-water work in those stream segments are proposed, therefore the only potential indirect impacts to fish would be associated with terrestrial construction activities and changes in land use. Project elements proposed under Alternative 2 are shown in Figures 2.3.3-1, Alternative 2 Proposed Conditions – The Summit and 2.3.3-2, Alternative 2 Proposed Conditions – Alpental. Proposed road crossing changes are shown in Figures 4.4.1-1, Proposed Fisheries Conditions – Alternative 2 – The Summit and 4.4.1-2, Proposed Fisheries Conditions – Alternative 2 - Alpental.

The probability of indirect impacts affecting fish habitat would be reduced with distance between projects and fish-bearing streams and would be minimized through the Management Requirements and Other Management Provisions for fish, watershed, and soils (see Table 2.4-2). The cutthroat trout and sculpins that inhabit the S.F. Snoqualmie River and one tributary are unlikely to be adversely affected by the proposed action. Under Alternative 2, modified Riparian Buffers and stream lengths, and the density of road crossings would continue to be high in the S.F. Snoqualmie Watershed.

Road Crossings

Under Alternative 2 there would be one new road crossing, a culvert on a headwater non-fish bearing stream. There would be no change in fish passage or road crossings on fish-bearing stream segments in the S.F. Snoqualmie Watershed. The density of road crossings would increase slightly for the watershed due to an increase in road density in the Nacrinomical drainage from the proposed culvert crossing.

Road Density

Under Alternative 2, Alpental Road and Parking lots 3, 4, 5, 6, and 7 would be repaved. Although road density would be unchanged, the impacts overall on potential fish habitat in the S.F. Snoqualmie River would be reduced. Road and parking lot paving would allow the use of a chemical de-icer/ice-inhibitor and eliminate the use of traction sand. The newly paved lots would also have improved stormwater management facilities. These changes would reduce the sediment volume discharged to the S.F. Snoqualmie River with stormwater runoff and snow removal.

Riparian Buffer Condition and LWD Recruitment Potential

Under Alternative 2, forested Riparian Buffer area would be reduced from about 41 percent to about 39 percent of the total Riparian Buffer area in the S.F. Snoqualmie Watershed (as calculated from acreages presented in Appendix I – Physical and Biological Resource Data Tables). This would occur primarily in Riparian Buffers of non-fish bearing waters on unnamed streams in the watershed and would be dispersed throughout the drainages. The condition along the S.F. Snoqualmie River would be essentially unchanged from existing condition, therefore no direct reduction in LWD recruitment potential would occur along the S.F. Snoqualmie River. Forested Riparian Buffers of fish bearing stream segments (the S.F. Snoqualmie River and an unnamed tributary) would be unchanged under Alternative 2.

The area of modified Riparian Buffers and length of streams in a modified condition would increase in the streams on mountain slopes. The percentage of modified Riparian Buffer conditions would slightly increase in the Northside, Summit North, International, and Nacrinomical drainages. In addition, the development of the pulse gondola and International chairlifts would increase the amount of modified riparian conditions in the Upper Alpental drainage to 32 percent. While these conditions may affect in-stream habitat conditions, fish are not present in the affected mountainslope channels of these drainages. Other Management Provision OMP12 (see Table 2.4-2) would maintain LWD in the Riparian Buffers.

Sediment Yield

Sediment yield is discussed in detail in Section 4.2 – Geology and Soil Resources. Under Alternative 2, sediment yield to the S.F. Snoqualmie River would be reduced by about 4 percent. Although clearing and development in the International drainage would increase sediment yield from that drainage by 4.28 tons/year, restoration planting would reduce sediment yield in the Nacrinomical (reduced by 14.16 tons/year) and North Summit drainages (reduced by 8.29 tons/year). The overall reduction in sediment yield to the S.F. Snoqualmie River would be beneficial to turbidity, pool quality, and substrate quality under Alternative 2.

Stormwater Pollution Potential

In addition to the benefits of lot paving stated above, stormwater management facilities can reduce other chemical stormwater pollutants. Lot 1 at Summit West would be enlarged and repaved under this alternative. Although the enlargement would mean increased stormwater interception, the use of chemical de-icer/ice-inhibitor (magnesium chloride) instead of traction sand, and a stormwater management system should result in improved stormwater discharge quality. The potential benefit of reduced sediment loading would primarily affect a short segment of fish bearing stream on an unnamed tributary to the S.F. Snoqualmie River, and to a lesser extent the S.F. Snoqualmie River downstream. Water quality would be monitored to determine if the chemical de-icer/ice-inhibitor use should be controlled to ensure state water quality standards are not exceeded in streams draining to fish habitat.

In addition, relocation of fuel storage tanks is not anticipated to have an impact on stormwater contamination potential. The ski area would continue to operate under a stormwater pollution prevention plan and would keep a spill control kit on site.

Drainages of Particular Concern

Drainage conditions of parameters relative to fish habitat quality that would change in the S.F. Snoqualmie Watershed under Alternative 2 are shown in Table 4.4.3-5. Two new parameters would exceed threshold compared to Alternative 1.

- Northside (Stream length with management concerns – 58.8 percent)
- Upper Alpental (Riparian Buffers in a non-natural condition – 31.96 percent)

Table 4.4.3-5:
Summary of DPC Analysis of Fish Habitat Conditions for Alternative 2 in the South Fork Snoqualmie River Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	S.F.Snoqualmie River Watershed					
		Northside	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Drainage Area (acres)		**49.04**	**72.11**	**270.19**	**89.37**	**318.76**	**214.67**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.13	94.17	43.72	31.96	40.33	11.36
Change from Alternative 1 (% of total)		1.66	10.27	2.60	4.74	1.36	0.05
Stream Length with Management Concerns (% of total)	10	58.79	75.40	4.44	3.89	23.19	3.99
Change from Alternative 1 (% of total)		58.79	25.65	2.00	0.00	1.79	0.01
Road Density (miles/square mile)	3	5.48	7.02	0.50	0.68	1.70	2.35
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.00	0.00	0.00
Road Crossing Density (number/square mile)	6	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Modified Channel Length (% of total)	8	0.00	76.25	1.96	0.00	22.20	5.50
Change from Alternative 1 (% of total)		0.00	-12.18	0.00	0.00	-2.97	0.01
Parameters over Threshold		**3**	**5**	**1**	**2**	**4**	**1**
Change from Alternative 1		**1**	**0**	**0**	**1**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

The road density for the watershed, 1.99 miles per square mile, would remain under the threshold of concern. Only the Northside and Summit North drainages would exceed the road density threshold value of 3 miles per square mile with approximately 5.5 and 7.0 miles per square mile, respectively.

The percentage of modified Riparian Buffer conditions would slightly increase for those drainages that currently exceed the threshold of concern (Northside, Summit North, International, and Nacrinomical). In addition, the new pulse gondola and International chairlifts would increase the area of modified riparian conditions in the Upper Alpental drainage to 32 percent, causing this parameter to exceed the threshold of concern.

4.4.3.3 Proposed, Endangered, Threatened and Sensitive Species

Under Alternative 2, there would be no in-stream work in fish-bearing streams (see Sections 4.4.3.1 – Upper Yakima River Watershed and 4.4.3.2 – South Fork Snoqualmie River Watershed). Therefore, potential impacts to fish are only those related to work in the terrestrial environment that could affect

water quality or quantity, and impacts in non-fish bearing stream segments upstream of fish habitat. Alternative 2 includes the greatest number of plan components and the greatest area of activity. As described for each watershed, proposed activities have the potential to indirectly impact fish and fish habitat through increased road crossing density, increased development within Riparian Buffers, and increased sediment generation. The incorporation of Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2) would reduce potential impacts to fish under Alternative 2. Table 4.4-FEIS-1 presents the determination of effect to Proposed, Endangered and Threatened species as a result of Alternative 2.

Table 4.4-FEIS-1:
Threatened and Endangered Species Known or Suspected to Occur within the Study Area

Species	Effect Determination All Alternatives	Rationale
Puget Sound Chinook salmon[a] (*Oncorhynchus tshawytscha*)	No Effect	Not present within the Study Area, limit of distribution is 31 miles downstream at Snoqualmie Falls
Bull trout (*Salvelinus confluentus*)	May Affect, Not Likely to Adversely Affect	Refer to the Biological Assesment on Appendix N for a complte discussion of impacts to Bull trout.
Middle Columbia River steelhead[a] (*Oncorhyncus mykiss*)	No Effect	Not present within the Study Area, excluded by Keechelus Lake dam.
Puget Sound steelhead[a] (*Oncorhyncus mykiss*)	No Effect	Not present within the Study Area, limit of distribution is 31 miles downstream at Snoqualmie Falls

[a] Denotes species is also included as MIS

USFS Sensitive Species

Table 4.4-FEIS-2 presents the determination of effect for USFS Sensitive Species under Alternative 2.

Table 4.4-FEIS-2:
USFS Sensitive Species Known or Suspected to Occur within the Study Area

Species	Determination of Effect All Alternatives	Rationale
Cutthroat trout[b] (*Oncorhynchus clarki*)	May impact individuals but would not likely contribute to a trend toward federal listing	Cutthroat trout were observed during surveys conducted for the watershed condition assessment. The proposed activities described in preceding sections would generate increased sediment yields and decreased water quality that could potentially impact habitat for cutthroat trout within the Study Area.
Westslope cutthroat trout[b] (*Oncorhynchus clarki lewsii*)	May impact individuals but would not likely contribute to a trend toward federal listing	Cutthroat trout were observed during surveys conducted for the watershed condition assessment. The proposed activities described in preceding sections would generate increased sediment yields and decreased water quality that could potentially impact habitat for cutthroat trout within the Study Area.
Coho salmon[b] (*Oncorhynchus kitsuch*)	No Impact	Not present within the Study Area, limit of distribution is 31 miles downstream at Snoqualmie Falls
Sockeye salmon[b] (*Oncorhynchus nerka*)	No Impact	Not present within the Study Area, limit of distribution is 31 miles downstream at Snoqualmie Falls
Pink salmon[a] (*Oncorhynchus gorbuscha*)	No Impact	Not present within the Study Area, limit of distribution is 31 miles downstream at Snoqualmie Falls
Puget Sound chum salmon[a] (*Oncorhynchus keta*)	No Impact	Not present within the Study Area, limit of distribution is 31 miles downstream at Snoqualmie Falls
River Lamprey (*Lampetra ayresi)*	No Impact	Has not been detected within the Study Area, therefore no impacts would occur to this species.
Redband Trout[b] (*Oncorhynchus mykiss*)	No Impact	Has not been detected within the Study Area, therefore no impacts would occur to this species.
Pygmy whitefish (*Prosopium coulteri*)	No Impact	Has not been detected within the Study Area, therefore no impacts would occur to this species.
Umatilla dace (*Rhinichthys umatilla*)	No Impact	Has not been detected within the Study Area, therefore no impacts would occur to this species.

[a] MIS listing only
[b] MIS and Sensitive listing

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) includes a mandate that NMFS must identify Essential Fish Habitat (EFH) for federally-managed marine fish and federal agencies must consult with NMFS on all activities, or proposed activities, authorized, funded, or undertaken by the agency that may adversely affect EFH. EFH is defined as "the waters and benthos necessary to a species spawning, breeding, feeding, or growth to maturity – its full life cycle" (PFMC 1999).

The Pacific Fishery Management Council (PFMC 1999), with the concurrence of the U.S. Secretary of Commerce, defines freshwater salmon EFH as "the aquatic component of streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon (except above certain impassable barriers) in Washington, Oregon, Idaho, and California identified by USGS hydrologic units."

The species to which the Magnuson-Stevens Act applies include Chinook, coho, pink and chum salmon in the South Fork Snoqualmie River, and Chinook and coho salmon in the Yakima River. As these species are excluded from the Study Area by natural or man-made barriers, there will be no effect to EFH under all Action Alternatives for these species.

4.4.4 Impacts – Alternative 3

The potential for indirect impacts to fish and fish habitat under Alternative 3 would be similar to those under Alternative 2, but would be somewhat reduced since Alternative 3 would not include development of the *Creek Run* lift and trails. Summary comparisons of alternatives over the MDP Area, Mill Creek area and the Total Study Area are shown in Tables 4.4.3-1, 4.4.3-2, and 4.4.3-3.

Under Alternative 3, culverted stream length, road length and density, and the number of road crossings would all be equal to those under Alternative 2 within the Study Area. The amount of Riparian Buffer area in a modified condition would be approximately 10 acres less than under Alternative 2. The adequacy of LWD recruitment in valley bottom streams (including all confirmed fish-bearing stream segments) would be the same as under Alternative 2. The adequacy of LWD recruitment would be slightly improved in confined, high gradient, mountain slope channels, and slightly worse in mountain slope channels with variable to low confinement.

Alternative 3 would include a Land Donation from Ski Lifts, Inc. in the Mill Creek sub-watershed. As a result, the donated lands would be managed by the USFS under Alternative 3. This would result in an increase in regulated Riparian Buffer area, since the USFS regulates a wider Riparian Buffer than Kittitas County. This change can be seen in the "road length in Riparian Buffers" and the acres of "land cover types within Riparian Buffers" and "total Riparian Buffers" parameters shown in Table 4.4.3-3. Table 4.4.3-1 shows just the MDP area and Table 4.4.3-2 shows just the Mill Creek area. So, while Alternative 3 would result in an increased area managed as Riparian Buffers, and the length of roads in Riparian

Buffers would increase in the Study Area (see Table 4.4.3-3), the road length in Riparian Buffers would be unchanged in the MDP area (see Table 4.4.3-1).

4.4.4.1 Upper Yakima River Watershed

Project elements proposed under Alternative 3 are described in Section 2.3.4 – Alternative 3 – Reduced Section 16 Development, and are shown in Figure 2.3.4-1, Alternative 3 Proposed Conditions – The Summit. Projects and impact mechanisms within the U. Yakima Watershed for Alternative 3 are as discussed for Alternative 2, with the following exceptions:

- The Creek Run chairlift and associated road to the upper terminal at Summit East would not be constructed
- Existing Trails 55, 66, and 67 would be revegetated
- Land donation to offset impacts to Section 16 is proposed

With regard to potential aquatic impacts, the greatest difference between Alternative 3 and Alternative 2 in the U. Yakima Watershed is that Alternative 3 would not include the Creek Run chairlift and associated ski trails.

The Mill Creek Land Donation included in Alternative 3 would increase Riparian Buffers in land that is transferred from private to federal ownership. However, since most of the Riparian Buffer area is currently sapling forest, the increased buffer width would only affect stream habitat conditions when these sapling trees have matured, and the increased buffer width offers enhanced protection and riparian function. Over the lifetime of the MDP, there would be no change in fish habitat conditions that result from the Mill Creek Land Donation. Over a longer timeframe, increased buffer protection under federal land management could have a slight beneficial effect on aquatic habitat conditions downstream in Mill Creek.

Stream and Road Crossings

The bridge proposed for trail 55B across Stream A in the Creek Run drainage would have a smaller footprint under Alternative 3 than under Alternative 2, reducing the modification to the Stream A riparian environment. It is not anticipated that this would have a measurable change to the closest confirmed fish habitat since it is located about 0.8 mile downstream in Coal Creek. Otherwise stream and road crossing impacts would be the same for all of the drainages as under Alternative 2.

Road Density

Under Alternative 3, road related impacts in the U. Yakima Watershed would be the same. The road length under the management of the USFS within Riparian Buffers would increase under Alternative 3, but only because the buffer area would increase as a result of the Land Donation in the Mill Creek drainages.

Under the Land Donation, those Riparian Buffers that switch from Kittitas County jurisdiction to federal jurisdiction would increase. There would be no change to fish habitat related to this change.

Riparian Buffer Condition and LWD Recruitment Potential

The Mill Creek Land Donation that would occur under Alternative 3 would not have a direct impact on fish or fish habitat. During the lifetime of the MDP, there would be no measurable change in fish habitat quality associated with this Land Donation. More stringent riparian management requirements would be put into effect under USFS management. Eventually this change could mean improved stream shade, LWD recruitment, and channel stability. However, since the area that would be donated is currently forested with sapling-sized trees, it would be many years before this benefit would be realized. Under Alternative 3, a greater percentage of riparian area would be in a natural condition due to revegetation of trails 55, 66, and 67, and because the Creek Run trails and chairlift would not be constructed. Similarly, the stream length with management concerns would decrease in the Creek Run drainage by approximately 4.4 percent.

Sediment Yield

Under Alternative 3, the Creek Run chairlift, and clearing along trails 55A and 55B would not be included. As a result of these land use changes, the potential for sediment delivery to Coal Creek from the Creek Run drainage would be 5.09 tons per year less than under Alternative 2. While this is an improvement compared to Alternative 2, it is unlikely that a change in habitat conditions in Coal Creek would be observed under either Alternative 2 or 3.

Sediment yield is discussed in detail in Section 4.2 – Geology and Soils. Under Alternative 3, sediment yield would be increased from existing conditions by about 2.69 tons/year, 3.47 tons/year less than under Alternative 2 in the U. Yakima Watershed. This difference would be the net effect of increased sediment yield in the South Summit drainage (1.6 tons/year) and a reduction (5.09 tons/year) in sediment yield in the Creek Run drainage compared to Alternative 2 (a reduction of 4.16 tons/year compared to Alternative 1). Conditions in all other drainages in the U. Yakima Watershed including Mill Creek would be the same as under Alternative 2. Aquatic habitat parameters that relate to sediment yield, including turbidity, pool quality, and substrate quality could be slightly improved for the presumed fish habitat in Hyak Creek relative to Alternatives 1 or 2.

Stormwater Pollution Potential

Under Alternative 3 stormwater pollution potential would be the same as under Alternative 2.

Drainages of Particular Concern

Drainage conditions of the parameters relative to fish habitat quality that would change in the U. Yakima Watershed under Alternative 3 are shown in Table 4.4.4-1. One new parameter would exceed threshold compared to Alternative 1.

- Summit South (Stream length with management concerns – 13.5 percent)

Additionally, one parameter would fall below threshold as a result of restoration activities.

- Beaver (Modified channel length – 5.5 percent)

Table 4.4.4-1:
Summary of DPC Analysis of Fish Habitat Conditions for Alternative 3 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Upper Yakima River Watershed								
		L. Mill Creek	U. Mill Creek	Creek Run	Summit South	Hyak	Tunnel	Ski Acres	Beaver	Other
Drainage Area (acres)		**395.67**	**33.22**	**220.24**	**223.89**	**192.70**	**134.41**	**358.08**	**171.38**	**155.63**
Riparian Buffers in a Non-Natural Condition (% of total)	30.0	80.34	99.86	20.81	66.88	27.79	51.26	55.29	59.34	44.52
Change from Alternative 1 (% of total)		-2.83	-0.14	1.94	21.82	0.43	9.27	2.51	2.96	0.00
Stream Length w/ Management Concerns (% of total)	10.0	8.37	18.33	1.40	13.50	6.45	37.77	45.19	27.98	32.40
Change from Alternative 1 (% of total)		0.59	0.00	-0.49	6.91	0.64	10.54	0.72	-20.65	0.00
Road Density (miles/square mile)	3.0	7.47	2.90	2.25	5.61	2.78	11.77	8.80	7.68	1.66
Change from Alternative 1 (miles/square mile)		0.05	0.00	-0.27	-0.05	0.00	-0.57	-0.48	-0.97	0.00
Road Crossing Density (number/square mile)	6.0	29.13	0.00	20.35	11.44	13.29	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	0.01	-2.85	3.33	4.80	0.02	-3.72	0.00
Modified Channel Length (% of total)	8.0	0.00	0.00	0.00	1.69	0.00	5.61	12.65	5.48	0.00
Change from Alternative 1 (% of total)		0.00	0.00	0.00	0.00	0.00	0.01	-0.03	-4.97	0.00
Parameters over Threshold		**3**	**2**	**1**	**4**	**1**	**4**	**5**	**4**	**2**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**0**	**0**	**-1**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Drainages that would continue to exceed thresholds of concern for non-natural Riparian Buffers and stream conditions would be the same as Alternative 2. The percent of non-natural Riparian Buffers in the Creek Run drainage would be reduced by about 8 percent to 20.8 percent due to the revegetation of trails 55, 66, and 67, and by not constructing the Creek Run trails and chairlift.

4.4.4.2 South Fork Snoqualmie River Watershed

Project elements proposed under Alternative 3 are described in Section 2.3.4 – Alternative 3 – Reduced Section 16 Development and are shown in Figures 2.3.4-1, Alternative 3 Proposed Conditions – The Summit and 2.3.4-2, Alternative 3 Proposed Conditions - Alpental. Projects and impact mechanisms within the S.F. Snoqualmie Watershed for Alternative 3 are as discussed for Alternative 2 (Section 4.4.3 – Impacts – Alternative 2 [Proposed Action]), with the following exceptions:

- The Pulse Gondola and mountain-top restaurant (including ADA facilities) at Alpental would not be constructed
- The existing Edelweiss ski patrol duty station would not be replaced

Under Alternative 3, the quantity and locations of clearing and grading would be slightly less than under Alternative 2. The most significant difference being that there would be no utility trench associated with the Alpental mountain-top restaurant constructed under Alternative 3. This would reduce the quantity and duration of soil disturbance. Although the potential for short-term sediment impacts would be slightly less under Alternative 3 than under Alternative 2 during construction, there would be no change in sediment yield during operations and no changes in existing fish habitat are anticipated under Alternative 3.

Stream and Road Crossings

Under Alternative 3, road crossing impacts in the S.F. Snoqualmie Watershed would be as described under Alternative 2 Summit North and Nacrinomical drainages would increase to 26.6 and 14.1 crossings per square mile, respectively.

Riparian Buffer Condition and LWD Recruitment Potential

Under Alternative 3, Riparian Buffer condition and LWD recruitment potential in the S.F. Snoqualmie Watershed would be similar to that under Alternative 2. However, the amount of non-natural Riparian Buffers in the Upper Alpental drainage would decrease from 32 percent in Alternative 2 to 27.3 percent in Alternative 3 which is similar to Alternative 1.

Sediment Yield

Under Alternative 3, sediment yield in the S.F. Snoqualmie Watershed would be as described under Alternative 2.

Stormwater Pollution Potential

Under Alternative 3 stormwater pollution potential would be as described under Alternative 2.

Drainages of Particular Concern

Under Alternative 3, there would be one new parameter that exceeds threshold.

- Northside (Steam length with management concerns – 33.7 percent)

Drainage conditions of parameters relative to fish habitat quality that would change in the S.F. Snoqualmie Watershed under Alternative 3 are shown in Table 4.4.4-2. Alternative 3 would not result in any new exceedances of thresholds. Likewise, all of the drainages that exceed thresholds of concern under Alternative 2 would also exceed those thresholds under Alternative 3.

Table 4.4.4-2:
Summary of DPC Analysis of Fish Habitat Conditions for Alternative 3 in the South Fork Snoqualmie Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	S.F. Snoqualmie River Watershed					
		Northside	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Drainage Area (acres)		**49.04**	**72.11**	**270.19**	**89.37**	**318.76**	**214.67**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.13	94.17	43.31	27.26	40.19	11.36
Change from Alternative 1 (% of total)		1.66	10.27	2.19	0.04	1.22	0.05
Stream Length with Management Concerns (% of total)	10	33.68	75.50	3.75	3.89	23.19	3.99
Change from Alternative 1 (% of total)		33.68	25.74	1.30	0.00	1.79	0.01
Road Density (miles/square mile)	3	5.48	7.02	0.50	0.68	1.70	2.35
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.00	0.00	0.00
Road Crossing Density (number/ square mile)	6	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Modified Channel Length (% of total)	8	0.00	76.34	1.96	0.00	22.20	5.50
Change from Alternative 1 (% of total)		0.00	-12.08	0.00	0.00	-2.97	0.01
Parameters over Threshold		**3**	**5**	**1**	**1**	**4**	**1**
Change from Alternative 1		**1**	**0**	**0**	**0**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

The number of road crossings in the SF Snoqualmie Watershed would continue to exceed the threshold value for the watershed (10.75 crossings per square mile compared to the threshold of 6 crossings per square mile), as well as in the Summit North and Nacrinomical drainages. Road crossings in the Nacrinomical drainage would increase to 14.1 crossings per square mile.

4.4.4.3 Proposed, Endangered, Threatened and Sensitive Species

Under Alternative 3, there would be no in-stream work in fish-bearing streams (see Sections 4.4.4.1 – Upper Yakima River Watershed and 4.4.4.2 – South Fork Snoqualmie River Watershed). Therefore, potential impacts to fish are only those related to work in the terrestrial environment that could affect water quality or quantity, and impacts in non-fish bearing stream segments upstream of fish habitat. Impacts to fish under Alternative 3 would be slightly less than as described under Alternative 2 because it would not include development of the *Creek Run* lift and trails. As described for each watershed, proposed activities have to potential to indirectly impact fish and fish habitat through increased road crossing density, increased development within Riparian Buffers, and increased sediment generation. The incorporation of Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2) would reduce potential impacts to fish under Alternative 2. Table 4.4-FEIS-1 presents the determination of effect to Proposed, Endangered and Threatened species as a result of Alternative 3. Table 4.4-FEIS-2 presents the determination of effect for USFS Sensitive Species as a result of Alternative 3. Impacts to EFH would be as described for Alternative 2.

4.4.5 Impacts – Alternative 4

Projects associated with implementation of Alternative 4 include actions discussed in Section 4.4.3 – Impacts – Alternative 2 (Proposed Action) as well as additional projects unique to Alternative 4 (as discussed below). These additional projects are located on public land and are the focus of the range of alternatives analyzed in this EIS.

Alternative 4 is unique from a fisheries habitat perspective in that it includes a road relocation and riparian revegetation proposal at Alpental, in the S.F. Snoqualmie Watershed. In the U. Yakima Watershed, the Creek Run and Rampart chairlifts would not be constructed, and Trails 55A and 55B would not be revegetated.

Summary comparisons of alternatives over the MDP Study Area, MDP management area, and Mill Creek Sub-watershed portion of the Study Area are shown in Tables 4.4.3-1, 4.4.3-2, and 4.4.3-3.The amount of Riparian Buffer in a non-natural condition is approximately 20 acres less than Alternative 2 since the Creek Run and Rampart ski pods would not be developed, and because of the proposed improvements to the Alpental Road along the S.F. Snoqualmie River.

4.4.5.1 Upper Yakima River Watershed

Project elements proposed under Alternative 4 are described in Section 2.3.5 – Alternative 4 – No Section 16 Development and shown in Figure 2.3.5-1, Alternative 4 Proposed Conditions – The Summit. Projects and impact mechanisms within the U. Yakima Watershed for Alternative 4 are as discussed for Alternative 2 (see Section 4.4.3 – Impacts – Alternative 2 [Proposed Action]), with the exception that the *Creek Run* and *Rampart* chairlifts and associated roads at Summit East would not be constructed.

Under Alternative 4, the Creek Run chairlift, and clearing along trails 55A and 55B would not be included (as under Alternative 3), although these trails would not be revegetated (as they would under Alternative 3). As a result, the potential for sediment delivery to non-fish bearing streams and presumed fish habitat in Hyak Creek would be reduced from that of Alternative 2. Downstream in Coal Creek, where fish are present, any change in sediment delivery would be diluted by other sources.

Road Crossings

No trail crossings are proposed across Stream A or Hyak Creek under Alternative 4, reducing the number of road crossings from those proposed under Alternative 2. The density of road crossings would decrease by approximately 3 crossings per square mile in each of the Creek Run, Summit South, and Hyak drainages compared to Alternative 2. It is not anticipated that this change would have a measurable change to the closest confirmed fish habitat that is located about 0.8 mile downstream in Coal Creek. However, the potential for impacts to these streams is minimized under Alternative 4 compared to the other Action Alternatives.

Road Density

Under Alternative 4, the total road length, and road density would be slightly less than under Alternative 2 for the U. Yakima Watershed. Within the watershed, road density would decrease in the Summit South drainage compared to Alternative 2 from 5.61 to 5.08 miles per square mile. Road density in the other drainages would remain the same as Alternative 2.

Riparian Buffer Condition and LWD Recruitment Potential

Under Alternative 4, LWD recruitment potential in the U. Yakima Watershed would be essentially the same as under Alternative 2, with only slightly improved LWD recruitment potential along mountain slope channels. In the streams with fish habitat, Riparian Buffer condition and LWD recruitment potential would be the same as under Alternative 2. The percentage of non-natural Riparian Buffers in the Creek Run drainage (18.9 percent) would be reduced relative to Alternative 2 by about 10 percent due to revegetation of trails 55, 66, and 67, and by not constructing the Creek Run and Rampart trails and chairlift. The amount of stream length with management concerns in the Summit South drainage would decrease from 13.5 percent under Alternative 2 to 5.8 percent under Alternative 4. The reduced amount of modified stream and riparian condition could improve the presumed fish habitat in Hyak Creek, and potentially downstream in Coal Creek. Other drainages that would continue to exceed thresholds for modified Riparian Buffers and stream conditions would be the same as Alternative 2.

Sediment Yield

Under Alternative 4, sediment yield in the U. Yakima Watershed would be less than under any of the other alternatives. The reductions in sediment yield to Coal Creek for the Beaver and Ski Acres drainages would be the same as under Alternative 2, whereas sediment yield to Coal Creek would be the same as under Alternative 1 for the Creek Run and Summit South drainages. Sediment yield to Mill Creek would

be essentially the same as under Alternative 2. Altogether, sediment yield would be reduced by 11.65 tons/year for the U. Yakima Watershed from that under Alternative 2. The resulting beneficial impact on fish habitat compared to Alternative 2 would be limited, however, since fish habitat in or downstream of the Creek Run and Summit South drainages is limited.

Stormwater Pollution Potential

Under Alternative 4 stormwater pollution potential would be the same as described under Alternative 2.

Drainages of Particular Concern

Drainage conditions of parameters relative to fish habitat quality that would change in the U. Yakima Watershed under Alternative 4 are shown in Table 4.4.5-1. There would be no new thresholds exceeded under Alternative 4, however one parameter would fall below threshold.

- Beaver (modified channel length – 5.5 percent)

Table 4.4.5-1:
Summary of DPC Analysis of Fish Habitat Conditions for Alternative 4 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Upper Yakima River Watershed								
		L. Mill Creek	U. Mill Creek	Creek Run	Summit South	Hyak	Tunnel	Ski Acres	Beaver	Other
Drainage Area (acres)		395.67	33.22	220.24	223.89	192.70	134.41	358.08	171.38	155.63
Riparian Buffers in a Non-Natural Condition (% of total)	30.0	83.76	100.00	18.87	45.09	27.37	50.71	55.21	59.34	44.52
Change from Alternative 1 (% of total)		0.59	0.00	0.00	0.03	0.00	8.71	2.43	2.96	0.00
Stream Length w/ Management Concerns (% of total)	10.0	7.34	18.33	1.73	5.78	5.81	37.32	45.19	27.98	32.40
Change from Alternative 1 (% of total)		-0.44	0.00	-0.16	-0.81	0.00	10.09	0.72	-20.65	0.00
Road Density (miles/square mile)	3.0	7.43	2.90	2.25	5.08	2.78	11.77	8.80	7.68	1.66
Change from Alt. 1 (miles/square mile)		0.00	0.00	-0.27	-0.58	0.00	-0.57	-0.48	-0.97	0.00
Road Crossing Density (number/square mile)	6.0	29.13	0.00	17.44	8.58	9.97	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	-2.90	-5.71	0.00	4.80	0.02	-3.72	0.00
Modified Channel Length (% of total)	8.0	0.00	0.00	0.00	1.69	0.00	5.61	12.65	5.48	0.00
Change from Alternative 1 (% of total)		0.00	0.00	0.00	0.00	0.00	0.01	-0.03	-4.97	0.00
Parameters over Threshold		**3**	**2**	**1**	**3**	**1**	**4**	**5**	**4**	**2**
Change from Alternative 1		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-1**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

The density of road crossings would decrease by approximately 3 crossings per square mile in each of the Creek Run, Summit South, and Hyak drainages compared to Alternative 2, but would continue to exceed the threshold of concern and could only indirectly affect fish habitat.

Under Alternative 4, Summit South would continue to exceed the threshold for non-natural Riparian Buffers condition, however, the amount of stream length with management concerns in this drainage would decrease from 6.6 percent to 5.8 percent. The reduced amount of modified stream and riparian condition could improve the presumed fish habitat in Hyak Creek, and potentially downstream in Coal Creek. Other drainages that would continue to exceed thresholds for modified Riparian Buffers and stream conditions would be the same as Alternative 2.

4.4.5.2 South Fork Snoqualmie River Watershed

Project elements proposed under Alternative 4 are shown in Figures 2.3.5-1, Alternative 4 Proposed Action – The Summit and 2.3.5-2, Alternative 4 Proposed Action – Alpental. Projects and impact mechanisms within the S.F. Snoqualmie Watershed for Alternative 4 are as discussed for Alternative 2, with the following exceptions:

- Existing Alpental Road would be re-routed outside of Riparian Reserves between the existing bridge to Parking Lot 6
- Parking Lots 4, 5, and 6 at Alpental would be reduced as a result of the Alpental road reroute
- Parking Lot 7 at Alpental would be removed and revegetated
- The existing Edelweiss ski patrol duty station would not be replaced

Relocation of a portion of Alpental Road and reduction or removal of Parking Lots and restoration of the former roadway would improve the Riparian Buffer condition along the S.F. Snoqualmie River. As riparian trees in this area mature, shade would increase and LWD recruitment potential would increase. The result would be an improved riparian condition from that found under any of the other alternatives. Otherwise, fish impacts in the S.F. Snoqualmie Watershed would be essentially the same under Alternative 4 as under Alternative 2.

Stream and Road Crossings

Under Alternative 4, road crossing impacts in the S.F. Snoqualmie Watershed would be as described under Alternative 2.

Road Density

Under Alternative 4, Alpental Road would be relocated away from the S.F. Snoqualmie River. The former road location would be revegetated, providing a functioning Riparian Buffer that, as planted trees mature would provide increasing shade, LWD recruitment, and sediment filtration. All of these functions would

contribute to improved aquatic habitat in the S.F. Snoqualmie River. Relocating the road and revegetating the site would result in a slight reduction in the road density in the Nacrinomical drainage.

Riparian Buffer Condition and LWD Recruitment Potential

Under Alternative 4, Riparian Buffer condition and LWD recruitment potential in the S.F. Snoqualmie Watershed would be as described under Alternative 2. Relocating the road and revegetating parking lot 7 would result in a slight reduction in the amount of modified stream length in the Nacrinomical drainage.

Sediment Yield

Under Alternative 4, sediment yield in the S.F. Snoqualmie Watershed would be similar to the conditions described under Alternative 2. However, the Alpental Road relocation and revegetation would likely reduce sediment delivery from the road to the S.F. Snoqualmie River.

Stormwater Pollution Potential

Under Alternative 4 stormwater pollution potential would be reduced from that under Alternative 2, since the area of parking lots at Alpental would be reduced. The Alpental road relocation and Riparian Buffer restoration would also provide improved stormwater filtration for runoff to the S.F. Snoqualmie River. This would be a long-term beneficial indirect impact to fish in the S.F. Snoqualmie River.

Drainages of Particular Concern

Drainage conditions of parameters relative to fish habitat quality that would change in the S.F. Snoqualmie Watershed under Alternative 4 are shown in Table 4.4.5-2. There would be one new parameter that exceeds threshold under Alternative 4.

- Upper Alpental (Riparian Buffers in a non-natural condition – 31.96 percent)

Table 4.4.5-2:
Summary of DPC Analysis of Fish Habitat Conditions for Alternative 4 in the South Fork Snoqualmie Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	S. Fork Snoqualmie River Watershed					
		Northside	Summit North	Interna-tional	Upper Alpental	Nacrino-mical	Other
Drainage Area (acres)		**49.04**	**72.11**	**270.19**	**89.37**	**318.76**	**214.67**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.13	94.17	41.49	31.96	40.35	11.36
Change from Alternative 1 (% of total)		1.66	10.27	0.37	4.74	1.38	0.05
Stream Length with Management Concerns (% of total)	10	6.02	75.50	2.97	3.89	22.51	3.99
Change from Alternative 1 (% of total)		6.02	25.74	0.53	0.00	1.11	0.01
Road Density (miles/square mile)	3	5.48	7.02	0.50	0.68	1.62	2.35
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.00	-0.08	0.00
Road Crossing Density (number/square mile)	6	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Modified Channel Length (% of total)	8	0.00	76.34	1.96	0.00	22.20	5.50
Change from Alternative 1 (% of total)		0.00	-12.08	0.00	0.00	-2.97	0.01
Parameters over Threshold		**2**	**5**	**1**	**2**	**4**	**1**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

The number of road crossings would continue to exceed the threshold of concern in all drainages except Northside and International under Alternative 4. Relocating the road and revegetating parking lot 7 would result in a slight reduction in the amount of modified stream length in the Nacrinomical drainage. However, the 22.5 percent of modified stream condition would still exceed the threshold value of 10 percent for this parameter.

4.4.5.3 Proposed, Endangered, Threatened and Sensitive Species

Under Alternative 4, there would be no in-stream work in fish-bearing streams (see Sections 4.4.5.1 – Upper Yakima River Watershed and 4.4.5.2 – South Fork Snoqualmie River Watershed). Therefore, potential impacts to fish are only those related to work in the terrestrial environment that could affect water quality or quantity, and impacts in non-fish bearing stream segments upstream of fish habitat. Impacts to fish under Alternative 4 would be slightly less than as described under Alternative 2 because it

would not include development within Section 16. As described for each watershed, proposed activities have to potential to indirectly impact fish and fish habitat through increased road crossing density, increased development within Riparian Buffers, and increased sediment generation. The incorporation of Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2) would reduce potential impacts to fish under Alternative 4. Table 4.4 FEIS-1 presents the determination of effect to Proposed, Endangered and Threatened species as a result of Alternative 4. Table 4.4-FEIS-2 presents the determination of effect for USFS Sensitive Species as a result of Alternative 4. Impacts to EFH would be as described for Alternative 2.

4.4.6 Impacts – Modified Alternative 5

Projects associated with implementation of Modified Alternative 5 include actions discussed in Section 4.4.3 – Impacts – Alternative 2 (Proposed Action) as well as additional projects unique to Modified Alternative 5 (as discussed below). These additional projects are located on public land and are the focus of the range of alternatives analyzed in this EIS.

Modified Alternative 5 differs from Alternative 2 only in the U. Yakima Watershed.

Summary comparisons of alternatives over the MDP Study Area, MDP management area, and Mill Creek Sub-watershed portion of the Study Area are shown in Tables 4.4.3-1, 4.4.3-2, and 4.4.3-3.

4.4.6.1 Upper Yakima River Watershed

Project elements proposed under Modified Alternative 5 are shown in Figure 2.3.6-1, Modified Alternative 5 Proposed Conditions – The Summit. The impacts of Modified Alternative 5 on fish and fish habitat would be essentially the same as under Alternative 2 (Section 4.4.3 – Impacts – Alternative 2 [Proposed Action]). Differences include:

- Reduced trail development in the Creek Run and Rampart pods.
- The Mill Creek Land Donation would occur under Modified Alternative 5 as under Alternative 3.

The potential impacts of Modified Alternative 5 in the U. Yakima Watershed are very similar to Alternative 2. Trails 55A and 55B would be gladed only under Modified Alternative 5 compared to Full Clearing under Alternative 2, the area of clearing and grading would be reduced from what would occur under Alternative 2. The potential for sediment impacts to non-fish bearing streams in the Creek run drainage would be slightly reduced compared to Alternative 2.

The Mill Creek Land Donation would occur under Modified Alternative 5. The Mill Creek Land Donation would not have a direct impact on fish or fish habitat. More stringent riparian management requirements would be put into effect under USFS management. Eventually this change could mean improved stream shade, LWD recruitment, and channel stability. However, since the area that would be donated is currently forested with sapling sized trees, it would be many years before this benefit would be realized. As a result

of the Land Donation, the donated lands would be managed by the USFS. This would result in an increase in regulated Riparian Buffer area, since the USFS regulates a wider Riparian Buffer than Kittitas County. This change can be seen in the "road length in Riparian Buffers" and the acres of "land cover types within Riparian Buffers" and "total Riparian Buffers" parameters shown in Table 4.4.3-3. Table 4.4.3-1 shows just the MDP area and Table 4.4.3-2 shows just the Mill Creek area. So, while Modified Alternative 5 would result in an increased area managed as Riparian Buffers, and the length of roads in Riparian Buffers would increase in the Study Area (see Table 4.4.3-3), the road length in Riparian Buffers would be unchanged in the MDP area (see Table 4.4.3-1).

At the Study Area scale, several parameters that can affect fish habitat would be the same as Alternative 2; culverted stream length, road density and LWD recruitment in valley bottoms. The amount of non-natural Riparian Buffers would be approximately the same as under Alternative 2. However, the amount of mature forest in Riparian Buffers would be approximately 19 acres greater than Alternative 2 because of the reduced trail development associated with Creek Run and Rampart pods. Revegetation of decommissioned roads would also improve riparian conditions over time.

Road Crossings

Under Modified Alternative 5, road and road crossing impacts in the U. Yakima Watershed would be as described under Alternative 2.

Road Density

Under Modified Alternative 5, road related impacts in the U. Yakima Watershed would be as described under Alternative 2.

Riparian Buffer Condition and LWD Recruitment Potential

Under Modified Alternative 5, slightly less non-fish bearing stream length (0.05 mile) would have modified Riparian Buffer condition than under Alternative 2, due to the reduced trail development in the Creek Run drainage. It is unlikely that this small change would affect LWD recruitment, or any aspect of fish habitat, the closest of which is located in Coal Creek, about 0.8 mile downstream.

Under Modified Alternative 5, LWD recruitment potential in the U. Yakima Watershed would be essentially the same as under Alternative 2, with only slightly improved LWD recruitment potential along mountain slope channels. In the streams with presumed fish habitat, Riparian Buffer condition and LWD recruitment potential would be the same as under Alternative 2. Stream length and Riparian Buffers in modified conditions would decrease in the Creek Run and Summit South drainages. The percent of modified Riparian Buffers in the Creek Run drainage would be reduced by about 2 percent to 25.6 percent due to the reduced trail development in the Creek Run and Rampart pods. The amount of modified stream length in the Summit South drainage would be slightly less than under Alternative 2 (13.1 percent under Modified Alternative 5 compared to 13.5 percent under Alternative 2).

Sediment Yield

Under Modified Alternative 5, sediment yield to Coal Creek would be very slightly less than under Alternative 2 due to the reduced clearing in the Creek Run drainage. The difference in sediment yield between Modified Alternative 5 and Alternative 2 (0.31 ton/year) would not be noticeable in Coal Creek, the nearest downstream fish-bearing stream.

Sediment yield to Mill Creek would be as described under Alternative 2.

Stormwater Pollution Potential

Under Modified Alternative 5 stormwater pollution potential from parking and maintenance areas would be as described under Alternative 2.

Drainages of Particular Concern

Drainage conditions of parameters relative to fish habitat quality that would change in the U. Yakima Watershed under Modified Alternative 5 are shown in Table 4.4.6-1. Under Modified Alternative 5 there would be one new threshold exceedance compared to Alternative 1.

- Summit South (Stream length with management concerns – 13.1 percent)

Additionally, there would be one parameter that drops below threshold as a result of restoration activities.

- Beaver (Modified channel length – 5.5 percent)

Table 4.4.6-1:
Summary of DPC Analysis of Fish Habitat Conditions for Modified Alternative 5 in the Upper Yakima Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	Upper Yakima River Watershed								
		L. Mill Creek	U. Mill Creek	Creek Run	Summit South	Hyak	Tunnel	Ski Acres	Beaver	Other
Drainage Area (acres)		**395.67**	**33.22**	**220.24**	**223.89**	**192.70**	**134.41**	**358.08**	**171.38**	**155.63**
Riparian Buffers in a Non-Natural Condition (% of total)	30.0	80.34	99.86	25.58	63.79	28.26	51.03	55.29	59.34	44.52
Change from Alternative 1 (% of total)		-2.83	-0.14	6.71	18.73	0.89	9.03	2.51	2.96	0.00
Stream Length w/ Management Concerns (% of total)	10.0	8.37	18.33	3.08	13.12	5.34	34.11	45.19	27.98	32.40
Change from Alternative 1 (% of total)		0.59	0.00	1.19	6.53	-0.47	6.88	0.72	-20.65	0.00
Road Density (miles/square mile)	3.0	7.48	2.89	2.24	5.61	2.79	11.77	8.80	7.70	1.65
Change from Alternative 1 (miles/square mile)		0.05	-0.01	-0.28	-0.05	0.01	-0.58	-0.48	-0.95	-0.02
Road Crossing Density (number/square mile)	6.0	29.13	0.00	20.35	11.44	13.29	90.51	50.07	29.89	4.11
Change from Alternative 1 (number/square mile)		1.63	0.00	0.01	-2.85	3.33	4.80	0.02	-3.72	0.00
Modified Channel Length (% of total)	8.0	0.00	0.00	0.00	1.69	0.00	5.61	12.65	5.48	0.00
Change from Alternative 1 (% of total)		0.00	0.00	0.00	0.00	0.00	0.01	-0.03	-4.97	0.00
Parameters over Threshold		**3**	**2**	**1**	**4**	**1**	**4**	**5**	**4**	**2**
Change from Alternative 1		**0**	**0**	**0**	**1**	**0**	**0**	**0**	**-1**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

Under Modified Alternative 5, road and road crossing impacts in the U. Yakima Watershed would be as described under Alternative 2. The number of road crossings would continue to exceed the threshold for this parameter in all drainages except Upper Mill Creek and Other Yakima.

Although Summit South would continue to exceed the threshold for modified Riparian Buffers condition, the amount of modified stream length in this drainage would be slightly less than under Alternative 2 (13.1 percent under Modified Alternative 5 compared to 13.5 percent under Alternative 2). However, this is above the threshold of concern of 10 percent. Other drainages that would continue to exceed thresholds for Riparian Buffers in a non-natural condition would be the same as Alternative 2.

4.4.6.2 South Fork Snoqualmie River Watershed

Under Modified Alternative 5, all potential impacts to fish and fish habitat in the S.F. Snoqualmie Watershed would be as described under Alternative 2. Project elements proposed under Modified

Alternative 5 in the S.F. Snoqualmie Watershed are the same as Alternative 2 (see Section 4.4.3 – Impacts – Alternative 2 [Proposed Action]) and are shown in Figures 2.3.6-1, Modified Alternative 5 Proposed Conditions – The Summit and 2.3.6-2, Modified Alternative 5 Proposed Conditions - Alpental.

Drainages of Particular Concern

Under Modified Alternative 5, there would be two new parameters that exceeds threshold.

- Northside (Stream length with management concerns – 33.7 percent)
- Upper Alpental (Riparian Buffers in a non-natural condition – 31.96 percent)

Under Modified Alternative 5, the Northside, Summit North, International, Upper Alpental and Nacrinomical drainages would exceed thresholds of concern for Riparian Buffers in a non-natural condition. Drainages exceeding thresholds for stream length with management concerns as described for Alternative 2. (Environmental parameters for the S.F. Snoqualmie watershed would be the same as those in Table 4.4.3-5.) Stream length in a modified condition and the density of road crossings would exceed threshold values for the S.F. Snoqualmie watershed with Summit North and Nacrinomical as the primary drainages where these conditions would occur.

Table 4.4.6-2:
Summary of DPC Analysis of Fish Habitat Conditions for Modified Alternative 5 in the South Fork Snoqualmie Watershed Portion of The Summit-at-Snoqualmie Study Area[a]

Parameter	Threshold	S. Fork Snoqualmie River Watershed					
		Northside	Summit North	Inter-national	Upper Alpental	Nacri-nomical	Other
Drainage Area (acres)		**49.04**	**72.11**	**270.19**	**89.37**	**318.76**	**214.67**
Riparian Buffers in a Non-Natural Condition (% of total)	30	83.13	94.17	43.72	31.96	40.33	11.36
Change from Alternative 1 (% of total)		1.66	10.27	2.60	4.74	1.36	0.05
Stream Length with Management Concerns (% of total)	10	33.68	75.50	4.44	3.89	23.19	3.99
Change from Alternative 1 (% of total)		33.68	25.74	2.00	0.00	1.79	0.01
Road Density (miles/square mile)	3	5.48	7.01	0.50	0.72	1.71	2.36
Change from Alternative 1 (miles/square mile)		0.60	0.00	0.00	0.04	0.01	0.01
Road Crossing Density (number/square mile)	6	0.00	26.64	4.76	7.16	14.06	11.93
Change from Alternative 1 (number/square mile)		0.00	0.01	0.00	0.00	2.01	0.01
Modified Channel Length (% of total)	8	0.00	76.34	1.96	0.00	22.20	5.50
Change from Alternative 1 (% of total)		0.00	-12.08	0.00	0.00	-2.97	0.01
Parameters over Threshold		**3**	**5**	**1**	**2**	**4**	**1**
Change from Alternative 1		**1**	**0**	**0**	**1**	**0**	**0**

[a] The value stated for each drainage is in terms of the metric used to compare to the threshold. A complete breakdown of the DPC analysis can be found in Appendix I – Physical and Biological Resource Data Tables and includes the area of impact and analysis area for each DPC parameter.

4.4.6.3 Proposed, Endangered, Threatened and Sensitive Species

Under Modified Alternative 5, there would be no in-stream work in fish-bearing streams (see Sections 4.4.6.1 – Upper Yakima River Watershed and 4.4.6.2 – South Fork Snoqualmie River Watershed). Therefore, potential impacts to fish are only those related to work in the terrestrial environment that could affect water quality or quantity, and impacts in non-fish bearing stream segments upstream of fish habitat. Impacts to fish under Modified Alternative 5 would be similar to Alternative 2. As described for each watershed, proposed activities have to potential to indirectly impact fish and fish habitat through increased road crossing density, increased development within Riparian Buffers, and increased sediment generation. The incorporation of Mitigation Measures, Management Requirements, and Other Management Provisions (see Table 2.4-2) would reduce potential impacts to fish under Alternative 2. Table 4.4 FEIS-1 presents the determination of effect to Proposed, Endangered and Threatened species as a result of Modified Alternative 5. Table 4.4-FEIS-2 presents the determination of effect for USFS

Sensitive species as a result of Modified Alternative 5. Impacts to EFH would be as described for Alternative 2.

4.4.7 Cumulative Effects

Cumulative effects on fisheries resources include those impacts associated with The Summit-at-Snoqualmie MDP, and other past, present, and reasonably foreseeable projects identified in the U. Yakima and S.F. Snoqualmie Watersheds. Table 4.4.7-1 and Table 4.4.7-3 list these projects and summarize their potential impact. The effects of past, present, and reasonably foreseeable projects at The Summit-at-Snoqualmie include areas developed in the SUP and on private lands for recreational facilities and related infrastructure (see Tables 4.4.7-2 and 4.4.7-4 for the U. Yakima and S.F. Snoqualmie Watersheds respectively). Tables 4.4.7-2 and 4.4.7-4 show the cumulative effects of the project alternatives at a scale where differences could be discernable (i.e., impacts to stream channels are compared to the total stream length of the 5th field). This is necessarily at smaller scale than some of the actions listed in Tables 4.4.7-1 and 4.4.7-3. The baseline conditions described in Chapter 3 include the effects of the past projects associated with the development, operation, and maintenance of The Summit and Alpental facilities that are listed as Alternative 1 in Tables 4.4.7-2 and 4.4.7-4.

Cumulative effects include projects that could result in long-term disturbance to fish habitat. Short-term impacts are typically associated with projects may cause a brief period of turbidity in streams after the project is completed and are not considered in this analysis. Examples include culvert replacements, installing bridge footings, or minor disturbance to streambank vegetation associated with stream habitat enhancements. Long-term impacts include those that result in a removal or alteration of aquatic habitat that would not be recovered during the life of the MDP.

The Action Alternatives would be expected to have a negligible affect on fish habitat within the U. Yakima and S.F. Snoqualmie watersheds. The number of fish bearing streams that would be crossed does not change in the MDP and there would be a small amount of instream work proposed in the Study Area. There would be a small area of affected habitat compared to the larger 5th field watershed scale. The larger land management activities that could occur from those reasonably foreseeable projects would result in greater impacts, beneficial or otherwise, than would be created by the Proposed Action.

4.4.7.1 Upper Yakima Watershed

Projects considered in the cumulative effects analysis for the U. Yakima Watershed projects are shown in Table 4.4.7-1.

Projects Associated with The Summit-at-Snoqualmie

Culvert replacements would be an ongoing management need at The Summit-at-Snoqualmie. These replacements typically would be done to correct culvert problems and prevent failures and excessive erosion or mass wasting. When culverts on perennial streams would be replaced, there would be an

unavoidable release sediment downstream, increasing turbidity. However, USFS and WDFW requirements for culvert replacement include practical measures to reduce this impact. Over the long-term, this activity would minimize serious erosion and water quality impacts that could have an adverse impact on fish.

Land use has a greater effect on sediment loading overall, and modified areas contribute more sediment to streams through surface erosion than forested areas. Under Alterative 2, sediment loading to the U. Yakima Watershed from the Study Area would increase to approximately 1,044.63 tons per year (see Table 4.4.7-2), slightly higher than under any of the other alternatives. Additionally, impacts to Riparian Buffers in the watershed would potentially affect fish habitat. Approximately 0.57 to 0.75 percent of the total acreage of Riparian Buffers within the U. Yakima watershed would be impacted under the Action Alternatives due to projects associated with The Summit-at-Snoqualmie (see Table 4.4.7-2).

Projects not Associated with The Summit-at-Snoqualmie

Of the projects listed in Table 4.4.7-1, the projects not associated with Summit at Snoqualmie include large-scale management activities (including the Plum Creek Road Restoration, I-90 Land Exchange, land acquisitions, Plum Creek HCP, and other restoration projects) that generally would improve fish habitat conditions at the U. Yakima watershed scale. Each of these large-scale management plans allows activities with the potential for short-term, local (stream-reach scale) adverse impacts to aquatic habitat, such as timber harvest and road construction, maintenance, and obliteration. However, they also include mitigation measures and long-term management strategies that are intended to improve aquatic habitat conditions at the drainage and 5th field watershed scale including protection of riparian areas, road obliteration (beneficial to aquatic habitat over the long-term) and management of certain areas to increase forest age and hydrologic maturity.

Several of the smaller scale projects listed in Table 4.4.7-1 would have no impact on fish. Several projects have the potential to affect fish habitat in the watershed, including the I-90 improvements project and the I-90 maintenance project. I-90 maintenance has been the largest sediment source to Coal Creek, and has had a negative impact on Coal Creek for many years. While Coal Creek appears to have reached equilibrium, transporting sediment to Keechelus Lake during high flow events, additional sediment from the Study Area would be added to an already overburdened stream. Use of chemical de-icer/ice-inhibitors in place of traction sand would reduce sediment loading to streams and be beneficial to fish habitat as long as the chemical de-icer/ice-inhibitors are applied at a rate that would not increase chloride concentrations in streams above state water quality standards. WSDOT is proposing to use chemical de-icer/ice-inhibitors in place of traction sand on I-90 in the future, although elimination of road sanding has not been verified for the upcoming winter (see Section 3.4.1.3 – Fish Habitat). This change in highway management is expected to reduce the sediment load to Coal Creek (as would paving parking lots at The Summit-at-Snoqualmie), improving habitat conditions in Coal Creek. I-90 improvements could add more road area to treat, and could also create additional road crossings in the watershed.

Land management actions described in Table 4.4.7-1 that result in removing roads, infrastructure, and improving forest conditions would contribute to the improvement of fish habitat in the Study Area and the surrounding upper U. Yakima Watersheds. Removing sediment sources and managing forests for late-successional habitat or multi-age forests would improve watershed conditions that could benefit fish bearing streams. Other projects that remove forest to construct roads or developments would contribute to the environmental factors that can impact fish habitat. Proposed projects that would directly affect fish habitat with in-stream work include replacement of culverts that would be designed to improve fish passage, and I-90 modifications that would impact some seasonal fish habitat on Keechelus Lake.

Table 4.4.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field Upper Yakima River Watershed on Fisheries Resources

Project Name	Project Summary	Cumulative Effects to Fisheries
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last five years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately two per year.	The replacement and repair of culverts at The Summit-at-Snoqualmie overlaps spatially and temporally with the MDP at the site scale. Approximately 0.01 acre around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would be beneficial (i.e., reduced sediment delivery, erosion and improved fish habitat), and would, as a whole, improve aquatic habitat at the site scale. As the culverts occupy several hundred square feet within the watershed, they would directly contribute to improved sediment and fish habitat conditions downstream.
Projects Not Associated with The Summit-at-Snoqualmie		
Kachess Vegetation Management	Hazard trees were identified in the Kachess Lake Campground through an exhaustive survey. All identified trees are scheduled to be removed by the winter of 2004. The campground contains old growth trees suffering from various stages of root rot. A small amount of timber would be sold as merchantable, the rest would be disposed of through firewood sales, lop and scatter, or burned.	The removal of hazard trees has reduced the canopy cover within the treated areas of the campground. Implementation of the vegetation management plan resulted in localized soil disturbance and related impacts to fish habitat associated with tree removal, yarding, lopping/scattering, and burning. Spatially, the disturbance was limited to the campground site, and did not overlap with the MDP or other identified cumulative effects at the site scale. Temporally, the work has been completed and would not overlap with the MDP. As a result, no cumulative effect to fish has been identified. As this project is assumed to have stabilized, no measurable impacts to fisheries resources are expected to have occurred at the 5th field scale.

Table 4.4.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field Upper Yakima River Watershed on Fisheries Resources

Project Name	Project Summary	Cumulative Effects to Fisheries
Plum Creek Road Restoration	The Cle Elum Ranger District is performing a road analysis covering approximately 50-70 miles of harvest roads on 65,000 acres of land acquired in the last five years from Plum Creek Timber lands. Currently, approximately 18 miles of roads that were acquired and deemed to be unsafe or were already closed have been decommissioned by the Forest Service. Under the Proposed Action, approximately 30.57 miles of road would be decommissioned.	Currently, approximately 26.2 acres roads have been decommissioned within the watershed. Both spatially and temporally, this road decommissioning would overlap with the road obliteration, and other restoration projects identified in the MDP alternatives at the 5th field scale. As a result, the road obliteration under the MDP and the Cle Elum Roads Analysis would cumulatively reduce the available road mileage and resulting sediment yield from roads, resulting in an improvement of fish habitat at the 5th field scale.
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	Depending on which alternative is selected, approximately 50.9 acres of disturbance would take place for road expansions. This project would directly overlap with the MDP in both space and time at the site and 5th field scales. Alternative 2 and Modified Alternative 5 would increase detrimental soil conditions in the Study Area, cumulatively increasing the potential for sediment yield, and reduced fish habitat in streams in the vicinity of Snoqualmie Pass. Alternatives 3 and 4 would reduce detrimental soil conditions through proposed restoration projects, thereby improving sediment and related fish habitat.
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	In the Yakima watershed, the acquired lands would be managed under the SPAMA allocation with a late-seral habitat emphasis. The management of these acquired lands would spatially and temporally overlap with the MDP at the 5th field scale, resulting in cumulative benefits to watershed and fish habitat conditions under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions would contribute to overall improvement in watershed and fish habitat conditions at the 5th field scale.

Table 4.4.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field Upper Yakima River Watershed on Fisheries Resources

Project Name	Project Summary	Cumulative Effects to Fisheries
Keechelus Dam Repairs	The Keechelus Lake dam was repaired in 2003. The existing dam was rebuilt in place to correct structural problems. The project has been completed. Approximately 70 acres of vegetation was cleared to provide a work corridor. The project impacted 3.8 acres of wetlands.	While the dam replacement did not overlap in time with the MDP, stabilization (i.e., "grow-in") of the site is projected to overlap with the MDP in both space (at the 5th field scale) and time. Cumulatively, stabilization of 70 acres of vegetation removal would contribute to reduced soil erosion in the U. Yakima watershed. As Lake Keechelus serves as a sink for sediment, the downstream effects to the Yakima River are not measurable. Due to the location of the project at Lake Keechelus, sediment impacts are not expected to cumulatively affect fish habitat, because the lake interrupts downstream transport of sediment to habitat lower in the U. Yakima Watershed.
Gold Creek Pond Trail Development	A native surface foot trail, approximately 100 feet long was constructed. This project was completed in 2001.	Temporary impacts to 0.005 acre occurred during trail construction. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space (at the 5th field scale) or time with any projected fish habitat impacts under the Action Alternatives.
U.S. West Telephone line	Installation of an underground telephone line in old road prism. This project was completed in 2001.	Temporary impact of 1.82 acres to install an underground line created disturbance to an already modified soil profile in the road prism. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space (at the 5th field scale) or time with any projected fish habitat impacts under the Action Alternatives.
WSDOT I-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical de-icer/ice-inhibitors to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile are applied to I-90 within the Snoqualmie Pass area (WSDOT 1999, 2001).	I-90 Maintenance would overlap with the MDP in both space and time at the site and 5th field scales. Increases in detrimental soil conditions and sediment yield would occur under the Action Alternatives (Alternative 2 being the largest impact and Alternative 4 being the lowest of the Action Alternatives). When added to the possible I-90 widening, repairs to the Keechelus dam and private land development, cumulative effects on soils affect the sediment regime, and therefore fish habitat in Coal Creek. Approximately 380 tons of sand reach Coal Creek each year from I-90 sanding operations alone.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	The recent purchase of Sections 5, 17, and 25 of Township 21N Range 11E occur within portions of the Yakima River Watershed. These acquired lands would be allocated to the SPAMA and managed with an emphasis for late-seral habitat preservation. The management of these acquired lands would spatially (at the 5th field scale) and temporally overlap with the MDP, resulting in cumulative benefits to fish habitat conditions under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions would also contribute to overall improvement in fish habitat conditions at the 5th field scale.

Table 4.4.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field Upper Yakima River Watershed on Fisheries Resources

Project Name	Project Summary	Cumulative Effects to Fisheries
Plum Creek Cascade Habitat Conservation Plan	A HCP was developed for the Plum Creek Timber Company to manage timber harvest and protect wildlife habitat over several 5th field watersheds in the vicinity of Snoqualmie Pass.	Approximately 52,100 acres of land is managed under the HCP. Protection of wildlife habitat would temporally and spatially overlap at the 5th field scale with the MDP resulting in cumulative benefits to watershed and fish habitat resources under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), lands managed under the HCP, combined with private land acquisitions would contribute to overall improvement in watershed and fish habitat conditions at the 5th field scale.
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of the Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in both space at the site scale and time with the MDP development. Alternative 2 and Modified Alternative 5 would increase detrimental soil conditions at the site scale, and in conjunction with the private land developments and other ground disturbing activities, would cumulatively affect sediment yield and fish habitat conditions in Mill Creek.
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the Upper Yakima River watershed. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	A total of 210 acres of forest would be commercially thinned to accelerate the development of late-successional forest structure. Short-term impacts resulting in soil disturbance would occur, some of which would overlap in space (at the 5th field scale) and time with the MDP implementation. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Protection of wildlife habitat under the Plum Creek HCP would also temporally and spatially (at the 5th field scale) overlap with the MDP resulting in cumulative benefits to soil productivity, sediment yield and resulting fish habitat under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek HCP and private land acquisitions would contribute to overall improvement in fish habitat conditions at the 5th field scale.

Table 4.4.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field Upper Yakima River Watershed on Fisheries Resources

Project Name	Project Summary	Cumulative Effects to Fisheries
Snoqualmie Pass AMA Plan	Land management plan for the AMA emphasizing late successional habitat maintenance and enhancement	The management of lands to emphasize late-successional habitat would overlap spatially and temporally with the MDP at the site and 5th field scales. The management of lands under the SPAMA would result in cumulative benefits to fish habitat under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek HCP and private land acquisitions would contribute to overall improvement in fish habitat at the 5th field scale.
Cle Elum RD roads analysis	Analysis of road system to determine long-term need. Implementation is expected in 2010.	The analysis of road systems and implementation of the plan would overlap spatially (at the 5th field scale) and temporally with the MDP. In conjunction with the Implementation, Operations, Restoration and Management Plan for the Summit-at-Snoqualmie MDP (see Appendix F), the roads analysis would improve road and trail management in the U. Yakima Watershed. The result will be a cumulative benefit to the sediment regime and resulting fish habitat in the 5th field scale with improved road and trail management under both plans.
WSDOT road de-icing	Application of sand and chemical de-icer/ice-inhibitors to roadway surfaces	Deicing of roadways would overlap spatially, at the site and 5th field scales, and temporally with the MDP. Impacts to sediment regime and fish habitat would result due to road maintenance from sanding operations. Coupled with the Action Alternatives and other road maintenance projects, this project could affect the sediment regime and fish habitat in Coal Creek.
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the Okanogan-Wenatchee National Forest Land and Resource Management Plan.	The study of lands to determine suitability for preservation as wilderness would overlap spatially (at the 5th field scale) and temporally with the MDP. If lands are re-allocated to Wilderness under this project, cumulative benefits to sediment regime and fish habitat would result. Coupled with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisitions, this project would contribute to overall improvement in fish habitat conditions at the 5th field scale.
Pro Guiding Service Area Expansion	Pro Guiding has requested expansion of their area of operation to include the Cascade crest area from Kendall Lakes to Mt. Daniel, plus the Alta Mountain area. They are not requesting an increase in number of service days.	The expansion of Pro Guiding's area of operation would overlap spatially (at the 5th field scale) and temporally with the MDP. No impacts to fish habitat are expected from this project.

Table 4.4.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field Upper Yakima River Watershed on Fisheries Resources

Project Name	Project Summary	Cumulative Effects to Fisheries
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (W. Keechelus subwatershed). The proposed project includes thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	The thinning of forests to accelerate late-successional habitat structure and restore ecological conditions would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in changes to the sediment regime and resulting fish habitat could occur during thinning operations. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Combined with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisition projects, this project would result in cumulative benefits to sediment regime and fish habitat conditions. Under Alternatives 2 and 4 (with no land donation), this project and the other private land acquisitions would contribute to overall improvement in fish habitat conditions at the 5th field scale.
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (E. Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and fish passage improvements, and other restoration projects.	The thinning of forests to accelerate late-successional habitat structure and restore ecological conditions would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in changes in sediment regime and resulting fish habitat would occur during thinning operations. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Combined with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisition projects, this project would result in cumulative benefits to sediment regime and fish habitat. Under Alternatives 2 and 4 (with no land donation), this project and the other private land acquisitions would contribute to overall improvement in fish habitat conditions at the 5th field scale.

As shown in Table 4.4.7-2, implementation of the MDP would result in impacts to 0.38 to 0.41 percent of the 5th field U. Yakima Watershed. When combined with the past, present, and reasonably foreseeable projects listed in the table above, implementation of the MDP would result in short and long-term cumulative effects to 5.06 to 5.09 percent of the 5th field U. Yakima Watershed.

The largest source of sediment to the U. Yakima Watershed would continue to be maintenance and winter sanding of I-90. Implementation of the MDP, coupled with the cumulative effects projects, would increase sediment loading from the Study Area to the U. Yakima River to 1044.63 tons/year, an increase of approximately 0.02 percent as compared to Alternative 1. This increase in sediment loading is unlikely to cumulatively affect fisheries resources due to the minimal increase in sediment and the size of the 5th field watershed.

Table 4.4.7-2:
Cumulative Acreage of Effects on Fisheries Resources from Past, Present and Reasonably Foreseeable Projects within the 5th Field Upper Yakima River Watershed

Impact Type	Alt. 1a		Alt. 2		Alt. 3		Alt. 4		Mod. Alt. 5	
	Impacts	% 5th	Impacts	% 5th	Impacts	% 5th	Impacts	% 5th	Impacts	% 5th
The Summit-at-Snoqualmie Projects										
Summit At Snoqualmie Impacts (acres)[b]	168.22	0.36	192.25	0.41	178.18	0.38	177.11	0.38	181.61	0.39
Impacts Not Associated with The Summit-at-Snoqualmie										
Long-Term Impacts (acres)[c]	50.90	0.07	50.90	0.07	50.90	0.07	50.90	0.07	50.90	0.07
Short-Term Impacts (acres)	2126.34	2.86	2126.34	2.86	2126.34	2.86	2126.34	2.86	2126.34	2.86
Total Long-Term and Short-Term Impacts (acres)	2177.24	2.92	2177.24	2.92	2177.24	2.92	2177.24	2.92	2177.24	2.92
Beneficial Impacts (acres)[d]	2023.12	2.72	2023.12	2.72	2023.12	2.72	2023.12	2.72	2023.12	2.72
Total Impacts (acres)	**2345.46**	**5.04**	**2369.49**	**5.09**	**2355.42**	**5.06**	**2354.35**	**5.06**	**2358.85**	**5.07**
Impacts to Stream Channels										
Impacts from The Summit-at-Snoqualmie (miles)[e]	4.14	0.35	4.26	0.36	4.19	0.35	4.06	0.34	4.14	0.35
Impacts to Flow										
Average Annual Discharge (cubic feet/second)[f]	62.8	1.76	63.2	1.78	63.1	1.77	63.0	1.77	63.2	1.77
Impacts to Water Quality										
Average Annual Sediment Loading (tons/year)[g]	1035.76	1.86	1044.63	1.88	1041.16	1.87	1033.09	1.86	1044.33	1.88

[a] The impacts associated with ongoing, maintenance related activities at The Summit-at-Snoqualmie are displayed in Alternative 1 (the No Action Alternative), since these activities would occur under all alternatives, they have been added to the impacts for Alternatives 2 through Modified Alternative 5.
[b] Summit-at-Snoqualmie impacts to watershed resources is calculated through impacts to Riparian Buffers. Total Riparian Buffers in the Upper Yakima Watershed in 46,564 (USFS 1997).
[c] Long Term, but non-quantifiable, impacts occur to the watershed as a result of winter sanding and deicing operations on I-90.
[d] Beneficial, but non-quantifiable, impacts occur to the watershed as a result of land acquistions that change land management practices from timber harvest to NFSL practices.
[e] The total drainage network within the U. Yakima Watershed is 1183 miles (USFS 1997)
[f] An average annual flow of 3,560 cubic feet per second for the U. Yakima River was used as the 5th field scale comparison. Flows listed in the Table indicate the amount contributed by the Study Area.
[g] An average annual sediment load for the U. Yakima River of 55,670.8 tons/year was used as the 5th field scale comparison (USFS 1997). Sediment loading indicated in the Table are estimated sediment contributions from the Study Area.
Note- This tables does not include Mill Creek acreage.

4.4.7.2 Upper South Fork Snoqualmie River Watershed

Table 4.4.7-3 lists the S.F. Snoqualmie Watershed projects considered in the cumulative effects analysis and describes their impacts on fisheries resources.

Projects Associated with The Summit-at-Snoqualmie

Culvert replacements at the Alpental ski area are necessary to prevent culvert failures, erosion and mass wasting. While they may include temporary impacts to water quality, these are typically localized and would have little effect on fish in the S.F. Snoqualmie River. Replacement of the Alpental bridge should not have an impact on fish since it spans the entire channel, and would replace a bridge that was in the same location, resulting in no additional clearing. This action along with the proposed MDP would result in negligible cumulative effects on fish habitat in the larger S.F. Snoqualmie Watershed.

Decreased sediment loading within the watershed would be a potential beneficial impact. Under all Action Alternatives, sediment loading decreases as a result of restoration projects and paving gravel parking lots (see Table 4.4.7-4). Decreased sediment in the watershed would potentially create more spawning habitat, and improve water quality.

Projects Not Associated with The Summit-at-Snoqualmie

Because fish habitat in the MDP Study Area is isolated from other populations, the effects of watershed scale management programs and the MDP actually have little chance of a cumulative effect on fish. Barriers to passage isolate populations such that the management of one watershed has no effect on the populations in other sub-watersheds. One project where there is the chance of a cumulative impact is the WSDOT I-90 maintenance. Road sanding is a sediment source to the S.F. Snoqualmie River. Reductions in sediment yield associated with the MDP Action Alternatives would provide benefits to local stream habitat in the drainages of the S.F. Snoqualmie Watershed, but would only offset the total amount of sediment delivered to the S.F. Snoqualmie River in the larger S.F. Snoqualmie Watershed by a fraction. Development of land associated with PUD projects could have a greater cumulative impact, depending on how and where PUD projects are developed. Projects that could have a greater cumulative effect and beneficial impact, are the land exchange, donation and acquisition projects that could improve forest conditions by managing for late-successional age forest, and by instituting more protective riparian conservation measures. Where forests are managed for multi-age conditions, seedling/sapling age forest areas would mature. Older age forests would improve riparian conditions through increased LWD recruitment potential, stream shading, and land cover that results in a more mature hydrologic condition. Greater Riparian Buffer widths would also improve the stream shade, LWD recruitment, and sediment filtering functions of those Riparian Buffers.

Overall, the projects identified in Table 4.4.7-3 should have a beneficial cumulative effect on fish and aquatic habitat.

Table 4.4.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Fisheries
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last five years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately two per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	Approximately 0.01 acre around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would likely be beneficial (i.e., reduced sediment delivery and erosion), resulting in improvements to fish habitat. These culvert replacements would overlap spatially (at the site scale) and temporally with the MDP, and would, as a whole, improve the culvert conditions throughout the Study Area. As the culverts occupy several hundred square feet within the watershed, this project would directly contribute to improved sediment conditions downstream.
Alpental Covered Bridge Replacement	The existing covered footbridge at Alpental washed out during a storm in 2003. The Summit-at-Snoqualmie replaced the bridge in 2005.	No new permanent impacts occurred as the new bridge was placed within the footprint of the old bridge. Temporary soil disturbance occurred during construction and riparian vegetation was re-established in 2006. While the bridge replacement overlaps spatially with the MDP at the site scale, the re-establishment of riparian vegetation, and stabilization will not overlap in time with the MDP and therefore would not cumulatively affect sediment yield or fish habitat.
Cave Ridge Land Donation	The Summit-at-Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	The land donation would overlap spatially (at the site and 5th field watershed scales) and temporally with the MDP. Up to 100 acres would be added to Wilderness, and the remainder would continue to be managed in its current unroaded character. This project would not cumulatively affect fisheries resources at the site or 5th field watershed scale.
Projects Not Associated with The Summit-at-Snoqualmie		
FS Road 58 Bridge Replacement	An existing steel bridge over the South Fork Snoqualmie River was replaced on Forest Service Road 58 due to structural problems. The new bridge was expanded from one to two lanes with upgraded load capacity. Construction of the bridge was completed in spring 2005.	Approximately 0.05 acre was graded to provide an expanded roadway approach. Bridge footings were installed below the ordinary high water mark and required temporary flow diversion structures to create a dry work zone. With completion of the project in 2005, the bridge replacement does not overlap with the MDP in either space or time. Thus the bridge replacement would not cumulatively affect fish or fish habitat at the 5th field scale.

Table 4.4.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Fisheries
Huckleberry Land Exchange	Exchange of NFSL for Weyerhaeuser Lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	Approximately 6,798 acres of Weyerhaeuser land was received by the Forest Service. Approximately 702 acres are managed as Late Successional Reserves. The management of these acquired lands would spatially (at the 5th field scale) and temporally overlap with the MDP, resulting in cumulative benefits to fish habitat conditions under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions contribute to a cumulative improvement in fish habitat conditions at the 5th field scale.
WSDOT 1-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical de-icer/ice-inhibitors to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile is applied to I-90 within the Snoqualmie Pass area.	Approximately 294 tons of sand reach the South Fork Snoqualmie River each year from I-90 sanding operations. I-90 Maintenance would overlap with the MDP in both space and time at both the site and 5th field scale. Increases in detrimental soil conditions and sediment yield under the Action Alternatives (Alternative 2 being the largest impact and Alternative 4 being the lowest of the Action Alternatives) would cumulatively affect soil productivity, sediment yield and resulting fish habitat.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The recent purchase of Section 19 of Township 22N Range 11E occurs within portions of the South Fork Snoqualmie River Watershed, and its management overlaps spatially (in the 5th field scale) and temporally with the MDP. These lands will be allocated to Late Successional Reserve. Coupled with other land acquisitions in the Snoqualmie Pass area, cumulative fish habitat conditions would improve at the 5th field scale, with a greater improvement under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation).
U.S. West Telephone line	Installation of an underground telephone line in the I-90 corridor	Temporary impacts to sediment regime occurred during installation of an underground line, which created disturbance to an already modified soil profile in the road prism. This project is assumed to have been stabilized as of 2005, and therefore does not overlap spatially or temporally with any projected fisheries impacts under the MDP.
WSDOT road de-icing	Application of sand and chemical de-icer/ice-inhibitors to roadway surfaces	Deicing and maintaining roadways during the winter overlaps spatially and temporally with the MDP at the site and 5th field scales. Increases in sediment yield and impacts to fish habitat under the Action Alternatives and other soil disturbing projects, combined with roadway deicing, would cumulatively affect sediment regime and fish habitat in the S.F. Snoqualmie River.

Table 4.4.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Fisheries
BPA Proposed Additional Power Lines	Supplemental DEIS to examine development of an additional powerline. Options include adding lines to existing towers or adding new towers.	The construction of additional power lines would overlap spatially (in the 5th field scale) and temporally with the MDP. This project, coupled with other soil-disturbing activities and the Action Alternatives, could result in cumulative effects to sediment yield and fish habitat if new towers are constructed.
McClellan Butte Trail Reconstruction Project	The project will relocate approximately 1.5 miles of trail to newly constructed trail or old road bed, abandon 1.5 miles of trail, and rehabilitate tread, drainage and switchbacks as required along the remainder of the 4.4-mile trail.	Temporary impacts along 5.9 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected fisheries impacts under the MDP.
Bandera Mountain/Mason Lake Trail Relocation Project	Project reorganized trail access to Mason Lake and Bandera Mountain in order to minimize social and resource impacts associated with the existing trails. The project involved construction of 1.5 miles of new trail, reconstructing 2.0 miles of existing trail and decommissioning 2.3 miles of existing trail.	Temporary impacts along 3.5 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected fisheries impacts under the MDP.
High Lakes Trail #1012 and Snow Lake Trail #1013 Reconstruction	This project repaired seven switchbacks on the Snow Lake Trail and reconstructed 2 miles on the High Lakes Trail from Snow to Gem Lake.	Temporary impacts along 3.5 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected fisheries impacts under the MDP.

Table 4.4.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Fisheries
South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project	Reduce the maintenance level (ML) on 11 roads (26.3 miles). 19.4 miles would be reduced to ML 1 (closed to motorized access) and utilized as loop and destination trail routes; 2.7 miles would be closed - placed in storage for future forest management; 1.1 miles would be removed from the transportation system and converted to trail; approximately 22.2 miles of spur roads mostly associated with roads proposed for reduction to ML 1 would be closed and removed from the Forest Road Transportation System.	The road decommissioning and maintenance level reductions would overlap spatially (in the 5th field scale) and temporally with the MDP. Road closure and decommissioning would decrease the road network and sediment yield at road crossings. Coupled with the Implementation, Restoration, Operation, and Monitoring Plan (see Appendix F), the South Fork Access and Travel Management Plan and other road management projects, this project would result in cumulative benefits to sediment regime and fish habitat at the 5th field scale.
Denny Salvage	This project would salvage approximately 50 mbf of windblown trees utilizing a ground based logging system. All undamaged trees with secure root systems would be left.	The salvage of approximately 50 mbf would not overlap spatially (in the 5th field scale) or temporally with the MDP. Stabilization of the salvage area is expected to overlap temporally with implementation of the MDP at the 5th field scale. Short-term impacts resulting in increased soil erosion and subsequent sediment yield to streams and fish habitat would occur due to tree removal and logging equipment. Following the stabilization of disturbed areas, approximately two to three years, this project is not expected to contribute cumulative effects to fish habitat at the 5th field scale.
Annual Road Maintenance	Brushing/blading of roads on a rotating schedule as funds allow. Includes roads 55, 5510, 58, and road 9030 and 9031 systems.	Brusing and blading of roads would overlap spatially (at the 5th field scale) and temporally with the MDP. Increases in sediment yield, as well as effects to fish habitat would result from this project. Coupled with the Action Alternatives and other roadway projects, this project would cumulatively affect watershed conditions and sediment regime at the 5th field scale.

Table 4.4.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Fisheries in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Fisheries
Road 9020 ERFO Repair	The project proposes to either replace the culvert at Alice Creek or reduce the ML of Road 9020 pas Alice Creek to 1 (no motorized access).	The replacement of a culvert or closure of the road to motorized access would overlap spatially (at the 5th field scale) and temporally with the MDP. If the road is decommissioned, this project would result in an improvement in sediment regime and resulting fish habitat. If the culvert is replaced, this project would result in temporary increases in sedimend yield and short-term impacts to fish habitat. Long-term impacts of the culvert replacement would likely be beneficial, resulting in reduced sediment delivery and erosion, therefore improving fish habitat.
I-90 Corridor Thin	The project involves commercially thinning approximately 338 acres in the I-90 Corridor. About 4.3 mmbf would be thinned from 14 units.	The thinning of approximately 338 acres would overlap spatially (in the 5th field scale) and temporally with the MDP. The thinning project would result in short-term impacts to fish habitat due to soil disturbance and sediment yield increases.
Snoqualmie Pass Utility District Permit Amendment	The project would extend water and sewer lines along Forest Service Road 4832 from the I-90 Hyak interchange for approximately 3,000 feet. The new lines would stop before reaching Gold Creek. Lines would be laid within the existing road right of way.	Temporary impacts from extension of water and sewer lines within the previously disturbed soils of the road prism would overlap spatially (in the 5th field scale) and temporally with the MDP. Short-term impacts would result from soil disturbance and could, combined with other soil-disturbing activities including the Action Alternatives, result in impacts to the sediment regime, therefore affecting fish habitat at the 5th field scale.
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	The construction of a new trail and trailhead parking would overlap spatially (in the 5th field scale) and temporally with the MDP. Temporary impacts would result from trail and parking area construction. This project, coupled with other soil-disturbing activities and the Action Alternatives, would result in potential impacts to sediment regime and fish habitat at the 5th field scale.

As shown in Table 4.4.7-4, implementation of the MDP would result in impacts to 0.67 to 0.68 percent of the 5th field S.F. Snoqualmie Watershed. When combined with the past, present, and reasonably foreseeable projects listed in the table above, implementation of the MDP would result in short and long-term cumulative effects to 2.69 to 2.70 percent of the 5th field S.F. Snoqualmie Watershed.

The largest source of sediment to the S.F. Snoqualmie Watershed would continue to be maintenance and winter sanding of I-90. However, implementation of the MDP, coupled with the cumulative effects

projects, would decrease sediment loading from the Study Area to the S.F. Snoqualmie River to 664.65 tons/year, a decrease of approximately 0.03 percent as compared to Alternative 1, due to restoration projects, paving of parking lots, and land management projects.

Table 4.4.7-4:
Cumulative Acreage of Effects to Fisheries Resources from Past, Present, and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed

Impact Type	Alt. 1[a]		Alt. 2		Alt. 3		Alt. 4		Mod. Alt. 5	
	Impact	% 5th	Impact	% 5th	Impact	% 5th	Impact	% 5th	Impact	% 5th
Summit-at-Snoqualmie Projects										
Impacts from The Summit-at-Snoqualmie (acres)[b]	110.82	0.65	116.42	0.68	115.11	0.67	114.87	0.67	116.42	0.68
Impacts Not Associated with The Summit-at-Snoqualmie										
Long-Term Impacts (acres)	0.26	0.00	0.26	0.00	0.26	0.00	0.26	0.00	0.26	0.00
Short-Term Impacts (acres)	346.55	1.17	346.55	1.17	346.55	1.17	346.55	1.17	346.55	1.17
Total Long-Term and Short-Term Impacts (acres)	346.82	1.17	346.82	1.17	346.82	1.17	346.82	1.17	346.82	1.17
Beneficial Impacts (acres)	7167.88	24.26	7167.88	24.26	7167.88	24.26	7167.88	24.26	7167.88	24.26
Total Cumulative Effects (acres)	**457.64**	**2.67**	**463.24**	**2.70**	**461.93**	**2.69**	**461.69**	**2.69**	**463.24**	**2.70**
Impacts to Stream Channels[c]										
Impacts from The Summit-at-Snoqualmie (miles)[d]	1.26	0.38	1.54	0.47	1.48	0.45	1.40	0.42	1.50	0.45
Impacts to Flow										
Average Annual Discharge (cubic feet/second)[e]	33.70	6.17	33.83	6.20	33.80	6.19	33.83	6.20	33.83	6.20
Impacts to Water Quality										
Average Annual Sediment Loading (tons/year)[f]	682.81	1.34	664.65	1.31	664.65	1.31	664.52	1.31	664.65	1.31

[a] The impacts associated with ongoing, maintenance related activities at The Summit-at-Snoqualmie are displayed in Alternative 1 (the No Action Alternative), since these activities would occur under all Alternatives, they have been added to the impacts for Alternatives 2 through Modified Alternative 5.
[b] Summit-at-Snoqualmie impacts to watershed resources is calculated through impacts to Riparian Buffers (Riparian Buffers in a developed of modified condition).
[c] Impacts to stream channels are measured as the total length of modified channels and the total length of channels that are culverted.
[d] The total drainage network within the S.F. Snoqualmie Watershed is 329.9 miles (USFS 1995)
[e] An average annual flow of 546 cubic feet per second for the S.F. Snoqualmie River was used as the 5th field scale comparison. Flows listed in the Table indicate the amount contributed by the Study Area.
[f] An average annual sediment load for the S.F. Snoqualmie River of 50,880 tons/year was used as the 5th field scale comparison (USFS 1995). Sediment loading indicated in the Table are estimated sediment contributions from the Study Area.

4.4.8 Irretrievable and Irreversible Commitment of Resources

An irreversible commitment of fish resources would be a loss that could not be reclaimed, such as the extirpation of a fish population. An irretrievable commitment of fish resources would be a loss that would continue as long as the action is in effect, but one that could be reversed. For example, running a formerly fish-bearing segment of stream through a culvert would be an irretrievable loss of stream habitat for as long as the culvert is in place. Removal of the culvert and restoration of the stream channel would be possible; therefore the loss from the culvert would be irretrievable but not irreversible. There are no anticipated irretrievable or irreversible effects associated with implementation of any of the Action Alternatives. No new culverts are proposed for fish bearing stream segments.

4.5 VEGETATION

This section describes the potential effects of the MDP Alternatives on vegetation within the Study Area. The Study Area has been defined and used to quantitatively discuss impacts associated with each Action Alternative. Additional impact analyses are qualitatively discussed, as appropriate, outside the Study Area boundary, within the larger South Fork Snoqualmie and Upper Yakima River watersheds.

A description of the existing vegetation conditions within the Study Area is provided in Section 3.5.1 – Summary of Existing Conditions. The MBSNF and OWNF Forest Plans direct that the existing conditions are the basis by which management actions are evaluated.

Issues addressed in this section include:

- The amount of vegetation disturbance that would occur from construction and operation of proposed MDP projects in the Study Area.
- Potential impacts of the proposed MDP on mature forest communities.
- Potential impacts of the proposed MDP on plants species that are considered to be special-status plants.

Cumulative effects are the combined effects of all direct impacts with detrimental and beneficial effects identified not only within the Study Area, but the entire Upper Yakima River and South Fork Snoqualmie River watersheds. Cumulative effects for vegetation are discussed in Section 4.5.7 – Cumulative Effects.

4.5.1 Impact Mechanisms

The physical actions associated with any MDP project that results in impacts on vegetation are referred to as impact mechanisms. Impacts can be classified and discussed in many different ways. For the purposes of this EIS, impacts on vegetation will be discussed in terms of direct versus indirect and short versus long-term. Finally, MDP impacts can be evaluated at a larger scale (watershed), incorporating the incremental impacts of other past, present, and reasonably foreseeable project through a cumulative effects analysis.

Direct and indirect impacts on vegetation include the following:

Direct

Direct impacts would result from implementation of Action Alternatives, including short-term and long-term impacts on vegetation. These impacts would include permanent loss of vegetation, conversion of vegetation communities to another vegetation type, or a short-term loss of vegetation during a temporary construction and recovery time. Direct impacts on vegetation would result from the following proposed MDP actions:

- construction of roads and parking lots;
- construction of buildings;
- construction of chairlift terminals and towers;
- full clearing of forests without grading for chairlift corridors, and ski trails;
- full clearing of forests without grading for ski trails;
- full clearing of forests with grading or blasting for ski trails;
- partial clearing of forests without grading for gladed ski trails;
- construction of bridge footings; and
- construction of utility lines (i.e., power, water, sewer) by trenching and burying lines or building above ground self contained structures to protect utility lines (i.e., utilidors).

Impacts that result from clearing of vegetation or clearing of vegetation and/or the grading of soils to construct facilities are shown in Figures 4.5.1-1, Impacts to Vegetation Cover – Alternative 2 – The Summit and 4.5.1-2, Impacts to Vegetation Cover – Alternative 2 – Alpental. Figures referenced in Chapter 2 also show the locations of the different proposed projects that result in impacts.

Direct impacts would also occur from operational and maintenance activities that require removal or management of vegetation. Direct impacts would include cutting vegetation to maintain developed ski trails, maintaining vegetation clearance around above-ground utilidors, maintaining vegetation clearance along Nordic ski trails and summer hiking and biking trails, and maintaining vegetation as described in the Implementation, Operations, Restoration and Management Plan (Appendix F).

Some direct impacts result in beneficial impacts on vegetation resources such as the planting of trees along existing cleared ski trails, and implementing restoration projects that would increase the amount of native forest vegetation in and around streams, wetlands, or upland areas. Restoration projects that would result in beneficial impacts to vegetation include all projects associated with revegetation to abate erosion and sediment delivery to wetlands and streams. Proposed restoration projects that incorporate revegetation include the following:

- Plant tree islands consisting of Pacific silver fir (*Abies amabilis*) saplings at Summit West, Central, and East;
- Revegetate where existing lift terminals, lift towers, and lift structures would be removed under the Action Alternatives;
- Revegetate slopes adjacent to Road M5 at Summit East to address sediment source issues and stabilize slopes; close road M-5 (1,550 linear feet) and reseed/revegetate but continue to maintain as ski trail (upper portion of trail 55);

- Revegetate slopes adjacent to Roads TR-17, TR17-1, TR-3, and TR17-4 at Summit East to address sediment source issues and stabilize slopes in Lower Mill Creek drainage;
- Seed unused road perimeter in heavily used site near Silver Fir lower terminal and parking lot to reduce sediment yield to Tunnel and Hyak Creeks;
- Revegetate an area to control runoff halfway down Central Express chairlift in Ski Acres drainage.
- Improve vegetation cover along Road C at Summit West near Beaver Lake Creek to correct sediment source;
- Plant Pacific silver fir saplings and shrubs along Beaver Lake Creek from Beaver Lake to the PCT to improve stream conditions and reduce amount of modified riparian area in Beaver Lake drainage;
- Plant native vegetation in riparian zone on downcutting channel between two tubing areas at Summit Central;
- Restore two emergent wetlands in conjunction with planting tree islands at Summit Central and Summit West.

In addition to the above mentioned restoration projects, revegetation would also occur in conjunction with reestablishing vegetation in the disturbed perimeters of construction projects associated with the proposed MDP.

Indirect

Some proposed MDP actions might have the potential to cause indirect impacts to vegetation in the future. Indirect impacts on vegetation could potentially result from proposed MDP actions that result in:

- disturbed soil sites that provide opportunity for noxious weed establishment,
- larger areas of cleared ski trails that increase potential for windthrow of trees at or near the forest edge,
- compaction of soils that limit establishment or health of plants growing in the soil, and
- potential damage of roadside vegetation from application of chemical de-icer/ice-inhibitors such as magnesium chloride for winter road traction.

Short and long-term impacts on vegetation include the following:

Short-Term

Short-term vegetation impacts are those direct impacts that would persist for at least several years after the action occurs as vegetation reestablishes to preconstruction conditions. Short-term impacts include:

- removal of ground or shrub layer to dig trenches and install utility lines, and
- removal or disturbance of vegetation adjacent to newly constructed roads, parking lots, buildings, and ski facilities and infrastructure (lift terminals) before revegetation occurs.

Long-Term

Long-term impacts include those activities that result in a conversion of an existing vegetation community to another type and the permanent loss of vegetation from construction of MDP projects. Long-term impacts may also include the loss of potential habitat or locations of species that are considered special-status botanical species from construction of MDP projects. Projects associated with long-term impacts are listed above for direct impacts (except for the activities described under Short-Term Impacts).

4.5.2 Impacts – Alternative 1 (No Action Alternative)

Under Alternative 1, there would be no additional effects on vegetation resulting from the construction of new facilities. Existing impacts to vegetation communities, as discussed in Section 3.5.1 – Summary of Existing Conditions, would continue and are summarized in this section.

Existing vegetation communities mapped throughout the Study Area for this analysis are presented below in Tables 4.5.2-1A through 4.5.2-1C under Alternative 1. These acreages reflect the current condition of vegetation communities already influenced and modified through historic and ongoing land management activities, including the operation of recreational facilities at The Summit and Alpental. Under Alternative 1, only previously approved restoration projects would occur. Any future restoration projects would require project-specific approval from the USFS.

Because the Study Area includes both areas involved in the MDP as well as in the Mill Creek Land Donation parcel (Alternative 3 and Modified Alternative 5), the impacts to vegetation are shown separately for the MDP area (see Table 4.5.2-1A) and the Mill Creek area (see Table 4.5.2-1B). For convenience, a summary of totals is also shown (see Table 4.5.2-1C). In this way, differences between Alternatives can more easily be discerned between the alternatives that include the Land Donation (Alternative 3 and Modified Alternative 5) and those that do not (Alternatives 1, 2, and 4).

Table 4.5.2-1A:
MDP Summary of Impact Acreage for Land Cover Types within the Study Area by Alternative[a]

Land Cover Type[b]	Alternative 1 (Existing Landcover)	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
	(acres)	(acres)	(acres)	(acres)	(acres)
Mixed Conifer – Western hemlock					
Mature	27.16	0.00	0.00	0.00	0.00
Immature	96.18	0.20	0.20	0.08	0.20
Mixed Conifer – Pacific silver fir					
Mature	756.40	48.03	25.87	15.60	40.05
Immature	187.69	22.71	20.66	19.52	22.84
Sapling	44.16	5.24	3.95	3.41	5.79
Mixed Conifer – Mountain hemlock					
Mature	224.61	6.64	0.78	2.42	5.16
Immature	0.00	0.00	0.00	0.00	0.00
Shrub					
Natural	103.17	2.25	1.97	1.31	2.12
Modified	326.63	31.96	25.33	27.78	31.95
Herbaceous					
Natural	14.77	0.45	0.26	0.18	0.48
Modified	415.83	51.20	48.67	50.90	51.03
Lakes/Open Water	1.34	0.00	0.00	0.00	0.00
Unvegetated Rock Outcrops/Talus	224.58	5.46	2.42	5.46	5.45
Developed Land	87.77	22.99	24.09	21.61	22.97
Totals (acres)	**2,510.31**	**197.14**	**154.20**	**148.28**	**188.05**

[a] Includes both long-term impacts and short-term impacts.
[b] Includes Wetland and Lake landcover types.
Note: This table does not include the Mill Creek portion of the Study Area.

Table 4.5.2-1B:
Mill Creek Summary of Impact Acreage for Land Cover Types within the Study Area by Alternative[a]

Land Cover Type[b]	Alternative 1 (Existing Landcover)	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
	(acres)	(acres)	(acres)	(acres)	(acres)
Mixed Conifer – Western hemlock					
Mature	20.55	0.00	0.00	0.00	0.00
Immature	0.00	0.00	0.00	0.00	0.00
Mixed Conifer – Pacific silver fir					
Mature	24.39	0.00	0.00	0.00	0.00
Immature	46.99	0.00	0.00	0.00	0.00
Sapling	241.05	0.00	0.00	0.00	0.00
Mixed Conifer – Mountain hemlock					
Mature	0.00	0.00	0.00	0.00	0.00
Immature	0.00	0.00	0.00	0.00	0.00
Shrub					
Natural	4.90	0.00	0.00	0.00	0.00
Modified	15.38	0.00	0.00	0.00	0.00
Herbaceous					
Natural	0.00	0.00	0.00	0.00	0.00
Modified	18.32	0.00	0.00	0.00	0.00
Lakes/Open Water	0.00	0.00	0.00	0.00	0.00
Unvegetated Rock Outcrops/Talus	10.68	0.00	0.00	0.00	0.00
Developed Land	6.82	0.00	0.00	0.00	0.00
Totals (acres)	**389.05**	**0.00**	**0.00**	**0.00**	**0.00**

[a] Includes both long-term impacts and short-term impacts.
[b] Includes Wetland and Lake landcover types.
Note: This table includes only the Mill Creek portion of the Study Area.

Table 4.5.2-1C:
Total Summary of Impact Acreage for Land Cover Types within the Study Area by Alternative[a]

Land Cover Type[b]	Alternative 1 (Existing Landcover)	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
	(acres)	(acres)	(acres)	(acres)	(acres)
Mixed Conifer – Western hemlock					
Mature	47.71	0.00	0.00	0.00	0.00
Immature	96.18	0.20	0.20	0.08	0.20
Mixed Conifer – Pacific silver fir					
Mature	780.79	48.03	25.87	15.60	40.05
Immature	234.68	22.71	20.66	19.52	22.84
Sapling	285.21	5.24	3.95	3.41	5.79
Mixed Conifer – Mountain hemlock					
Mature	224.61	6.64	0.78	2.42	5.16
Immature	0.00	0.00	0.00	0.00	0.00
Shrub					
Natural	108.04	2.25	1.97	1.31	2.12
Modified	342.01	31.96	25.33	27.78	31.95
Herbaceous					
Natural	14.77	0.45	0.26	0.18	0.48
Modified	434.15	51.20	48.67	50.90	51.03
Lakes/Open Water	1.34	0.00	0.00	0.00	0.00
Unvegetated Rock Outcrops/Talus	235.26	5.46	2.42	5.46	5.45
Developed Land	94.59	22.99	24.09	21.61	22.97
Totals (acres)	**2,899.36**	**197.14**	**154.20**	**148.28**	**188.05**

[a] Includes both long-term impacts and short-term impacts.
[b] Includes Wetland and Lake landcover types.
Note: This table includes the Mill Creek portion of the Study Area.

Forested Communities

Several historic natural and management-related landscape disturbances have influenced the vegetation communities within the Study Area. Natural disturbances include natural wildfire, mass wasting events (e.g., rockfall, debris avalanches, debris flows), windthrow (blowdown), snow avalanches (i.e., Alpental), floods, insects, and diseases that affect forest trees. Most of these disturbances have had local effects on vegetation patterns throughout the Study Area and would continue to occur as natural events under the No Action Alternative.

Under Alternative 1, existing vegetation communities would continue to be influenced by the management related disturbances resulting from the various federal, private, and other government land ownerships. Under the No Action Alternative, forests located in the Study Area within the U. Yakima Watershed would remain as such, managed under the Northwest Forest Plan (USDA and USDI 1994) for late successional habitat. Forests located within the Study Area within the S.F. Snoqualmie Watershed would continue to be managed as under current operational and maintenance activities under the SUP administered by the MBSNF. Vegetation communities located on private lands within the Study Area could potentially be subject to future development under private ownership. Development of private land would be subject to local King or Kittitas County codes. Presently, there are approximately 1,507 acres of forest and natural plant communities and 1,061 acres of modified vegetation within the Study Area.

Under the No Action Alternative (see Tables 4.5.2-1A through 4.5.2-1C), approximately 1,053 acres of mixed conifer forests dominated by western hemlock (*Tsuga heterophylla*), Pacific silver fir, and mountain hemlock (*Tsuga mertensiana*) would remain as mature forest. Approximately 616 acres of immature forest dominated by Pacific silver fir and western hemlock would continue to develop into more mature stands. Of the 616 acres of immature forest, approximately 285 acres of Pacific silver fir saplings would continue to mature, primarily on previously harvested private land in the Mill Creek drainage (Section 21), and in the SUP area at Summit East within Section 16.

Approximately 123 acres of natural shrub and herbaceous communities would remain as natural plant communities under Alternative 1. Shrub communities in a natural state are generally associated with natural clearings in forested areas, or along streams or lakes, or on avalanche chutes on steeper slopes. The most common shrubs in these areas are described in Section 3.5 – Vegetation. Natural herbaceous communities are most commonly palustrine emergent wetlands. Both of these plant community types are situated away from recreational skiing activities and would not be subjected to operational or maintenance activities.

Approximately 776 acres of modified shrub and herbaceous communities would remain as modified vegetation under current management associated with the on-going operation and maintenance of the ski trail network and existing infrastructure. Vegetation located within ski trails and adjacent to buildings would require brushing or mowing in shrubby areas to maintain safe skiing conditions and access to facilities. In addition, herbaceous and shrub vegetation adjacent to roads and parking lots would continue to be subjected to potential burial from sanding operations implemented during winter road conditions.

Within the Study Area, operational activities would continue for trail maintenance associated with cross-country skiing (i.e., Nordic trails), road and culvert maintenance, vegetation maintenance within the powerline corridors to maintain access to the Bonneville Power Administration transmission lines and towers, and backcountry recreational activities (e.g., mountain biking and hunting).

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special Status Species

Under Alternative 1, there would be no impacts to USFS or Washington State sensitive vascular plants or botanical species as no MDP projects would be implemented. Any future projects proposed in potential habitat not already surveyed for special-status botanical species would require surveys. No operational impacts on sensitive botanical species are anticipated under Alternative 1. Maintenance of existing trails would not affect mature forest where associated vascular and nonvascular botanical species may occur. Known locations of special-status vascular plants and USFS sensitive botanical species would not be affected by current operational activities.

Noxious Weeds

Various non-native plant species, some of which are designated as noxious weeds by King and Kittitas Counties, and recognized by the USFS, have established in the Study Area. Under current management, these plant species would continue to establish in exposed soils and disturbed sites.

4.5.2.1 Upper Yakima River Watershed

The Summit and private land within Section 21 are located in the U. Yakima Watershed. Under the No Action Alternative, Ski Lifts, Inc. would continue to operate recreational ski facilities at The Summit. Public lands located on the OWNF would continue to be managed under the Wenatchee alternative. The Summit would continue operation of its facilities on public lands under the SUP administered by the MBSNF. Vegetation communities within the Study Area in the U. Yakima Watershed would continue to be managed as under current operational and maintenance activities. Existing acreages for vegetation communities and other land cover types mapped in the Study Area within the U. Yakima Watershed are presented in Section 3.5 - Vegetation.

Mature mixed conifer forest (574.26 acres) dominated by western hemlock, Pacific silver fir, and mountain hemlock is the dominant forest type at The Summit and would remain as mature forest under Alternative 1. The majority (394.50 acres) of mature forest is located on public land. Approximately 593 acres of immature forest, dominated by Pacific silver fir (496.53 acres) and western hemlock (96.18 acres), would continue to mature under Alternative 1. Stands of western hemlock, located on the lower slopes, were impacted historically when railway and road construction occurred. Current land management activities would not affect these now immature western hemlock forests.

Of the 497 acres of immature Pacific silver fir forest, approximately 268 acres dominated by Pacific silver fir saplings are located on private land within the Mill Creek drainage (Section 21). Under Alternative 1, these stands would continue to reestablish after historic timber harvest activities and develop into more mature forest. The private holdings within Mill Creek are currently managed for timber harvest

production. Under the No Action Alternative, the Land Donation proposed under Alternatives 3 and 5 to offset impacts to Section 16 would not occur. The approximately 17 acres of Pacific silver fir saplings located in Section 16 on public land would also continue to mature into the immature forest type under the No Action Alternative.

Modified shrub and herbaceous communities located at The Summit would continue to be maintained for ski operations, as described above. Modified shrub and herbaceous communities located in the Mill Creek drainage would continue to mature under current conditions. Shrub and herbaceous areas may succumb to conifer seedling establishment while palustrine emergent and scrub-shrub wetlands would likely remain as such.

4.5.2.2 Upper South Fork Snoqualmie River Watershed

Under the No Action Alternative, Ski Lifts, Inc. would continue to operate recreational ski facilities at Alpental and the portion of The Summit within the S.F. Snoqualmie Watershed. Alpental would continue operation of its facilities under the SUP administered by the MBSNF. Vegetation communities within the Study Area would continue to be managed as under current operational and maintenance activities. Existing acreages for vegetation communities and other land cover types mapped in the Study Area within the upper S.F. Snoqualmie Watershed are presented in Section 3.5 - Vegetation.

Mature mixed conifer forest (478.86 acres) dominated by Pacific silver fir and mountain hemlock is the dominant forest type in the Study Area within the S.F. Snoqualmie Watershed and would remain as mature forest under Alternative 1. The majority (407.31 acres) is located on public land and would continue to be managed under the SUP. Mature and immature forest (68.34 acres and 12.73 acres, respectively) located on private land could be subject to future management by the landowners. There would be no loss of forested acreage within the SUP due to current management activities under the No Action Alternative. A total of 179.97 acres of modified shrub and herbaceous vegetation found on ski trails and in the base area would continue to be directly impacted by operational and maintenance activities. These activities include cutting shrubs and saplings on ski trails and in lift corridors to maintain safe skiing conditions and clearance for operation of the ski lifts. Vegetation in areas modified for access to base area facilities would also continue to be maintained.

Due to its more rugged terrain, much of the upper portion of Alpental has been left in its natural state. Significant areas of talus and rock outcrops (213.28 acres), interspersed with areas of scattered mountain hemlock, would remain in its current condition. Vegetation in these areas would continue to be subject to avalanche control activities associated with the ski resort.

4.5.3 Impacts – Alternative 2 (Proposed Action)

Projects associated with implementation of Alternative 2 include all actions discussed in Section 4.0.2 – Summary of Projects Analyzed in this EIS.

Construction of the MDP projects would result in impacts to vegetation communities and special-status plants as described in the following sections. Although impacts would occur to vegetation communities, all current vegetation types identified in Section 3.5.1 – Summary of Existing Conditions would continue to exist in the Study Area. Overall, there would be a total of approximately 169 acres of vegetation disturbed within the Study Area under Alternative 2. Both long-term (121.97 acres) and short-term (46.72 acres) impacts would occur to vegetation communities under the implementation of Alternative 2. Long- and short-term impacts are described above in Section 4.5.1 - Impact Mechanisms.

Tables 4.5.3-1, and 4.5.3-2, presented below, show the acreages of long-term and short-term impacts associated with all Alternatives, respectively, on vegetation communities and land cover types according to land ownership.

A total of 70.49 acres of disturbance to vegetation communities would occur on public land and 49.59 acres of disturbance would occur on private land under Alternative 2. Acreages were calculated based on the total impacts to specific vegetation communities. Mitigation measures used to minimize impacts on vegetation from short-term and long-term impacts are presented in Table 2.4-2.

Impact acreages discussed in this chapter do not include impacts that would occur to the land cover types Lakes/Open Water, Unvegetated Rock Outcrops/Talus, and Developed Land. It is recognized, however, that sparse vegetation does occur within areas of rock and talus, and is noted below in Section 4.5.3.2 – Upper South Fork Snoqualmie River Watershed. In addition, revegetation efforts would be implemented on previously developed land where existing structures are removed, as well as on other areas that have been affected by either natural or human influences.

Table 4.5.3-1:
Long-Term Impact Acreage for Land Cover Types within the Study Area by Alternative[a]

Land Cover Type[b]	Land Ownership	Alt 1 (Existing Landcover)	Alt 2 Impacts	Alt 3 Impacts	Alt 4 Impacts	Mod Alt 5 Impacts
		Total (acres)	Total (acres)	Total (acres)	Total (acres)	Total (acres)
Mixed Conifer – Western hemlock						
Mature	Public	23.48	0.00	0.00	0.00	0.00
	Private	24.23	0.00	0.00	0.00	0.00
Immature	Public	95.76	0.11	0.11	0.00	0.11
	Private	0.42	0.00	0.00	0.00	0.00
Mixed Conifer – Pacific silver fir						
Mature	Public	556.93	36.29	14.44	5.24	28.52
	Private	223.87	6.21	6.18	6.01	6.22

Table 4.5.3-1:
Long-Term Impact Acreage for Land Cover Types within the Study Area by Alternative[a]

Land Cover Type[b]	Land Ownership	Alt 1 (Existing Landcover)	Alt 2 Impacts	Alt 3 Impacts	Alt 4 Impacts	Mod Alt 5 Impacts
		Total (acres)	Total (acres)	Total (acres)	Total (acres)	Total (acres)
Immature	Public	103.98	6.46	4.67	4.24	6.60
	Private	130.71	12.37	12.12	11.68	12.37
Sapling	Public	16.96	1.63	0.34	0.00	2.17
	Private	268.25	2.95	2.95	2.75	2.95
Mixed Conifer – Mountain hemlock						
Mature	Public	221.40	5.06	0.72	1.34	3.58
	Private	3.21	0.00	0.00	0.00	0.00
Immature	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Shrub						
Natural	Public	64.70	1.85	1.65	1.06	1.78
	Private	43.34	0.13	0.13	0.13	0.13
Modified	Public	200.63	15.49	13.46	12.49	15.48
	Private	141.39	1.77	1.77	1.36	1.77
Herbaceous						
Natural	Public	7.22	0.35	0.16	0.07	0.38
	Private	7.55	0.08	0.08	0.08	0.08
Modified	Public	205.50	19.39	18.22	19.22	19.26
	Private	228.65	11.82	11.82	11.76	11.82
Lakes/Open Water	Public	0.00	0.00	0.00	0.00	0.00
	Private	1.34	0.00	0.00	0.00	0.00
Unvegetated Rock Outcrops/Talus	Public	220.18	3.91	1.93	3.94	3.93
	Private	15.09	0.00	0.00	0.00	0.00
Developed Land	Public	35.94	17.42	17.40	16.01	17.41
	Private	58.64	2.39	3.67	2.38	2.39
Totals (Acres)		**2,899.36**	**145.69**	**111.81**	**99.77**	**136.93**

[a] Includes all impacts EXCEPT for utility line installation and perimeter construction impacts around buildings, parking lots, roads, and lift terminals.
[b] Includes Wetland and Lake landcover types.
Note: This table includes the Mill Creek portion of the Study Area.

Table 4.5.3-2:
Short-term Impact Acreage for Land Cover Types within the Study Area by Alternative[a]

Land Cover Type[b]	Land Ownership	Alt 1 (Existing Landcover)	Alt 2 Impacts	Alt 3 Impacts	Alt 4 Impacts	Mod Alt 5 Impacts
		Total (acres)	Total (acres)	Total (acres)	Total (acres)	Total (acres)
Mixed Conifer – Western hemlock						
Mature	Public	23.48	0.00	0.00	0.00	0.00
	Private	24.23	0.00	0.00	0.00	0.00
Immature	Public	95.76	0.09	0.09	0.08	0.09
	Private	0.42	0.00	0.00	0.00	0.00
Mixed Conifer – Pacific silver fir						
Mature	Public	556.93	3.21	2.93	2.11	3.00
	Private	223.87	2.31	2.31	2.24	2.31
Immature	Public	103.98	2.09	2.09	2.00	2.09
	Private	130.71	1.79	1.79	1.59	1.79
Sapling	Public	16.96	0.00	0.00	0.00	0.00
	Private	268.25	0.66	0.66	0.66	0.66
Mixed Conifer – Mountain hemlock						
Mature	Public	221.40	1.58	0.06	1.09	1.58
	Private	3.21	0.00	0.00	0.00	0.00
Immature	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Shrub						
Natural	Public	64.70	0.26	0.18	0.12	0.21
	Private	43.34	0.01	0.01	0.01	0.01
Modified	Public	200.63	12.03	7.44	11.39	12.03
	Private	141.39	2.66	2.66	2.54	2.66
Herbaceous						
Natural	Public	7.22	0.02	0.02	0.02	0.02
	Private	7.55	0.02	0.02	0.02	0.02
Modified	Public	205.50	12.44	11.08	12.33	12.41
	Private	228.65	7.55	7.55	7.58	7.55

Table 4.5.3-2:
Short-term Impact Acreage for Land Cover Types within the Study Area by Alternative[a]

Land Cover Type[b]	Land Ownership	Alt 1 (Existing Landcover)	Alt 2 Impacts	Alt 3 Impacts	Alt 4 Impacts	Mod Alt 5 Impacts
		Total (acres)	Total (acres)	Total (acres)	Total (acres)	Total (acres)
Lakes/Open Water	Public	0.00	0.00	0.00	0.00	0.00
	Private	1.34	0.00	0.00	0.00	0.00
Unvegetated Rock Outcrops/Talus	Public	220.18	1.55	0.49	1.52	
	Private	15.09	0.00	0.00	0.00	0.00
Developed Land	Public	35.94	1.75	1.57	1.76	1.74
	Private	58.64	1.44	1.44	1.46	1.44
Totals (Acres)		**2,899.36**	**51.46**	**42.39**	**48.51**	**51.11**

[a] Short-term impacts include those associated with utility line installation and perimeter construction impacts around buildings, parking lots, roads, and lift terminals.
[b] Includes Wetland and Lake landcover types.
Note: this table includes the Mill Creek portion of the Study Area.

Forested Communities

Permanent vegetation loss would result from the construction of the proposed project facilities (buildings, parking lots, new roads, lift terminals and towers, bridges and bridge footings), and the conversion of forested vegetation to shrub and herbaceous covered lift corridors and ski trails. Of the 121.97 acres of direct, long-term impacts, 86.63 acres would occur on public land and 35.33 acres would occur on private land (see Table 4.5.3-1). The approximately 122 acres of permanent loss represents approximately 4 percent of the Study Area. The greatest amount of acreage affected by construction activities would be herbaceous communities in a modified condition (i.e., existing maintained ski trails) (51.20 acres) and mature Pacific silver fir forest (48.03 acres).

Approximately 113 acres of vegetation communities would incur long-term impacts from lift corridor and trail development under Alternative 2. Development of new ski trails, lifts, and lift line corridors would require removal of trees. A total of 71.08 acres of long-term impacts would occur on forest in both mature (47.56 acres) and immature and sapling dominated (23.52 acres) stands. The forested vegetation community in the proposed trail corridors would be converted to one dominated by and maintained as herbaceous plants and low shrubs. Development of new trails would include those utilizing existing contours and not requiring any ground disturbance, and those requiring re-contouring of existing grades. Impacts on mature forest are discussed below for the U. Yakima and S.F. Snoqualmie watersheds. Figures 4.5.1-1, Impacts to Vegetation Cover – Alternative 2 – The Summit and 4.5.1-2, Impacts to

Vegetation Cover – Alternative 2 – Alpental show areas where vegetation would be gladed or cleared with and without grading for ski trail development, and clearing and grading required for construction of recreational facilities and infrastructure.

The long-term loss of forested vegetation affected would be several acres less following construction, when construction areas surrounding completed structures would be revegetated (see Management Requirement MR29 and Other Management Provision OMP31 in Table 2.4-2) and/or allowed to naturally regenerate with native trees and shrubs species. In addition, restoration projects would be implemented in both watersheds.

Of the 46.72 acres of short-term impacts on vegetation communities, 31.72 acres would occur on public land and 15.00 acres would occur on private lands. Short-term impacts on vegetation include installation of utilities (e.g., water, sewer, and power) and temporary disturbance to perimeter areas around buildings, parking lots, roads, and terminals during construction activities. Digging of trenches and grading activities would remove the shrub and herbaceous layer. Most short-term impacts would occur in existing modified herbaceous communities that are dominated by a mix of non-native and native plant species in already disturbed sites. Areas temporarily disturbed by trenching or construction activities would have the topsoil salvaged and would be revegetated with native seed or plants or erosion control seed mixes approved by the USFS (see Management Requirement MR29 and Other Management Provision OMP31 in Table 2.4-2).

Short-term impacts in forested areas would be minimized, avoiding tree removal wherever possible. Revegetation would be required because of the loss of understory cover. Excavated soil would be temporarily stored and replaced back into trenches. Replanting would be required in areas presently dominated by a dense layer of shrubs and where the understory vegetation is sparse and the forest floor is predominately a layer of duff. If tree removal cannot be avoided, the impact to the forest would be a long-term impact since replanted trees would not grow a great deal during the 10 year life of the MDP.

Under Alternative 2, The Summit-at-Snoqualmie would implement portions of the *Upper South Fork Snoqualmie River and Coal Creek Watershed Condition Assessment Report* (Jones & Stokes 2001) in order to restore disturbed areas and maintain or improve environmental conditions in the Study Area within the U. Yakima and S.F. Snoqualmie watersheds. A complete list of specific watershed restoration projects is presented in Section 2.3.3-11 - Restoration. Many of the projects contain revegetation as an important element to abate erosion and sediment delivery to streams.

As part of the Alternative 2 road maintenance activities, chemical de-icer/ice-inhibitors would be used for winter road traction. Indirect impacts on roadside vegetation could occur if the applications exceed recommended application rates. Based on applications of magnesium chloride at other Washington ski areas, use of chemical de-icer/ice-inhibitors has not elevated chloride concentrations in soil or water beyond state water quality standards or vegetation thresholds (SE GROUP 2002). Studies have shown that

magnesium chloride can have adverse environmental effects, particularly to vegetation along roadsides (D'Itri 1992; Lewis 1999). However, as mentioned above, monitoring of other sites in Washington has not detected water quality standards or soil thresholds have been exceeded.

Other impacts on vegetation include the ongoing maintenance activities on ski trails that would occur from mowing ski trails. Non-native grasses and forbs as well as native herbaceous plants and shrubs would be mowed on a periodic basis to maintain vegetation at a height that does not interfere with winter activities. Management Requirement MR30 (see Table 2.4-2), which specifies use of the Implementation, Operations, Restoration, and Management Plan (see Appendix F) would apply to provide guidance on methods to maintain vegetation.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special-Status Plants

There are no potential impacts to federally listed, proposed, or candidate vascular plant species under Alternative 2. *Gentiana douglasiana*, a USFS and State listed sensitive vascular plant species, is located in an emergent wetland in the Study Area in a location that will not be directly affected by construction activities under Alternative 2. Management Requirements MR23 - 26 and Other Management Provisions OMP27 - 29 (see Table 2.4-2) would avoid and minimize potential indirect impacts on this species to maintain the viability of the species in this location.

Potential impacts to *Schistostega pennata* and *Hypogymnia duplicata* under Alternative 2 are not considered to affect the viability of the species by implementing mitigation measures described above. More detail regarding the potential impacts to special status plant species are discussed below for the U. Yakima and S.F. Snoqualmie watersheds and in Appendix C – Botanical Technical Report.

Noxious Weeds

Ten noxious weed species, identified by the Washington State Noxious Weed Control Board and recognized by the MBSNF and OWNF, have been identified in the Study Area (see Section 3.5.1.5 – Noxious Weeds). Potential impacts from noxious weeds would result from (1) the introduction of noxious weeds from outside sources (e.g., construction equipment, straw bales used for erosion control, recreationists) or (2) the establishment of species that are currently present in the Study Area such as diffuse knapweed (*Centaurea diffusa*) and orange hawkweed (*Hieracium auranitiacum*). Establishment of noxious plant species would most likely occur when soil is exposed during construction, thereby providing conditions suitable for weed germination. The construction of ski trails and roads increases the potential for noxious weed transport and establishment into these areas.

Establishment of noxious weeds would be reduced by the use of BMPs to minimize the introduction and establishment of noxious weeds (see Management Requirement MR28 in Table 2.4-2). BMPs utilized by

the MBSNF are identified in the *Environmental Assessment for Noxious Weed Management on the Mt. Baker-Snoqualmie National Forest* (USFS and MBSNF 1999). Relevant BMPs from the *Noxious Weed EA* are contained in the Summit at Snoqualmie MDP – Implementation, Operation, Restoration and Monitoring Plan (Appendix F). Examples include washing construction equipment, tools, and gear before entering the project area; using USFS approved weed free straw bales; and using seed for erosion control or other plant establishment that is certified as meeting the requirement of the Federal Seed Act and state seed law for Washington. These BMPs would be implemented during construction of MDP projects.

Under Alternative 2 there would be a total of approximately 197 acres of disturbance from construction activities. Containment, gradual reduction, and prevention of further spread of noxious weeds would be primary management goals. Specific measures for limiting the distribution of known noxious and other invasive weed species in the Study Area would be implemented in cooperation with both King and Kittitas County Weed Control Boards.

4.5.3.1 Upper Yakima River Watershed

Forested Communities

Under Alternative 2, a total of approximately 158 acres of vegetation would be affected in the Study Area within the U. Yakima Watershed. These impacts include both long-term and short-term impacts. See Table 4.5.3-FEIS 1 and Table 4.5.3-FEIS 2 for a summary of long-term and short-term impacts, respectively, on vegetation associated with the implementation of Alternative 2. Acreages were calculated based on the total impacts to specific vegetation communities.

Table 4.5.3-FEIS-1:
Long-Term Impact Acreage for Land Cover Types within the Upper Yakima Watershed by Alternative[a]

Land Cover Type[b]	Land Ownership	Alt 1 Existing Landcover (acres)	Alt 2 Impacts (acres)	Alt 3 Impacts (acres)	Alt 4 Impacts (acres)	Mod Alt 5 Impacts (acres)
Mixed Conifer – Western hemlock						
Mature	Public	23.48	0.00	0.00	0.00	0.00
	Private	24.23	0.00	0.00	0.00	0.00
Immature	Public	95.76	0.11	0.11	0.00	0.11
	Private	0.42	0.00	0.00	0.00	0.00
Mixed Conifer – Pacific silver fir						
Mature	Public	317.26	33.95	12.23	2.89	26.17
	Private	155.53	6.18	6.15	5.98	6.18
Immature	Public	93.35	6.46	4.67	4.24	6.60
	Private	117.97	12.37	12.11	11.68	12.37
Sapling	Public	16.96	1.63	0.34	0.00	2.17
	Private	268.25	2.95	2.95	2.75	2.95
Mixed Conifer – Mountain hemlock						
Mature	Public	53.76	4.14	0.42	0.42	2.66
	Private	0.00	0.00	0.00	0.00	0.00
Immature	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Shrub						
Natural	Public	2.09	0.79	0.59	0.00	0.72
	Private	12.46	0.13	0.13	0.13	0.13
Modified	Public	107.69	7.47	6.69	4.52	7.46
	Private	139.10	1.77	1.77	1.36	1.77
Herbaceous						
Natural	Public	6.17	0.35	0.16	0.07	0.38
	Private	7.17	0.08	0.08	0.08	0.08
Modified	Public	125.33	16.76	16.44	16.44	16.59
	Private	224.07	11.82	11.82	11.76	11.82
Lakes/Open Water	Public	0.00	0.00	0.00	0.00	0.00
	Private	1.34	0.00	0.00	0.00	0.00
Unvegetated Rock Outcrops/Talus	Public	11.28	0.00	0.00	0.00	0.00
	Private	10.70	0.00	0.00	0.00	0.00
Developed Land	Public	17.06	11.66	11.67	11.47	11.64
	Private	53.77	2.39	3.67	2.38	2.39
Totals (acres)		**1885.21**	**121.00**	**92.00**	**76.16**	**112.18**

[a] Includes all impacts EXCEPT for utility line installation and perimeter construction impacts around buildings, parking lots, roads, and lift terminals.
[b] Includes Wetland and Lake landcover types.
Note: This table includes the Mill Creek portion of the Study Area.

Table 4.5.3-FEIS-2:
Short-Term Impact Acreage for Land Cover Types within the Upper Yakima Watershed by Alternative[a]

Land Cover Type[b]	Land Ownership	Alt 1 Existing Landcover (acres)	Alt 2 Impacts (acres)	Alt 3 Impacts (acres)	Alt 4 Impacts (acres)	Mod Alt 5 Impacts (acres)
Mixed Conifer – Western hemlock						
Mature	Public	23.48	0.00	0.00	0.00	0.00
	Private	24.23	0.00	0.00	0.00	0.00
Immature	Public	95.76	0.09	0.09	0.08	0.09
	Private	0.42	0.00	0.00	0.00	0.00
Mixed Conifer – Pacific silver fir						
Mature	Public	317.26	2.63	2.36	1.53	2.42
	Private	155.53	1.95	1.95	1.88	1.95
Immature	Public	93.35	2.09	2.09	2.00	2.09
	Private	117.97	1.79	1.79	1.59	1.79
Sapling	Public	16.96	0.00	0.00	0.00	0.00
	Private	268.25	0.66	0.66	0.66	0.66
Mixed Conifer – Mountain hemlock						
Mature	Public	53.76	0.50	0.00	0.00	0.50
	Private	0.00	0.00	0.00	0.00	0.00
Immature	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Shrub						
Natural	Public	2.09	0.13	0.05	0.00	0.07
	Private	12.46	0.01	0.01	0.01	0.01
Modified	Public	107.69	4.82	4.82	4.38	4.82
	Private	139.10	2.50	2.50	2.38	2.50
Herbaceous						
Natural	Public	6.17	0.02	0.02	0.02	0.02
	Private	7.17	0.02	0.02	0.02	0.02
Modified	Public	125.33	9.85	9.85	9.82	9.85
	Private	224.07	7.46	7.46	7.50	7.46
Lakes/Open Water	Public	0.00	0.00	0.00	0.00	0.00
	Private	1.34	0.00	0.00	0.00	0.00
Unvegetated Rock Outcrops/Talus	Public	11.28	0.00	0.00	0.00	0.00
	Private	10.70	0.00	0.00	0.00	0.00
Developed Land	Public	17.06	1.41	1.41	1.25	1.41
	Private	53.77	1.38	1.38	1.39	1.38
Totals (Acres)		**1885.21**	**37.30**	**36.45**	**34.51**	**37.03**

[a] Short-term impacts include those associated with utility line installation and perimeter construction impacts around buildings, parking lots, roads, and lift terminals.
[b] Includes Wetland and Lake landcover types.
Note: This table includes the Mill Creek portion of the Study Area.

A total of 106.96 acres of vegetation would be permanently removed to construct parking lots, new roads, buildings, lift terminals and towers, bridges and bridge footings. This acreage includes impacts to vegetation that would also be removed to develop lift corridors and ski trails. These long-term impacts on vegetation would occur on both public (71.66 acres) and private (35.30 acres) land. The greatest acreage of long-term impact on vegetation would occur to mature Pacific silver fir forest (40.13 acres), with the majority located on public land.

Long-term impacts would occur on a total of approximately 68acres of forest within the Study Area within the U. Yakima Watershed. Of this, 40.13 acres of impact would occur to mature forest dominated by Pacific silver fir and mountain hemlock, primarily located at Summit East in Section 16, where the proposed *Creek Run* and *Rampart* pods would be constructed. A total of 23.5 acres of impact would occur to immature stands dominated by western hemlock (0.11 acre) and Pacific silver fir (18.8 acres), and 4.6 acres of impact to forest dominated by Pacific silver fir saplings. Impacts to immature forest are associated with the proposed ski trail development of the *Mill Creek* pod at Summit East, and the widening of ski trails in the Summit Central area. There would be a total loss of 0.20 acre of immature mountain hemlock forest under Alternative 2.

Under Alternative 2 in the U. Yakima Watershed, there would be 0.92 acre of direct, long-term impact to natural shrub communities and 0.43 acre of impact to natural herbaceous communities. Long-term impacts to natural shrub and herbaceous communities would occur from construction of the proposed *Silver Fir Parking Lot 4*.

Long-term impacts would occur on a total of 37.82 acres of existing modified shrub and herbaceous plant communities, primarily for construction of the proposed guest services building, base lodge, parking lots, and for ski trail development in the base areas.

Short-term impacts on vegetation communities would occur on approximately 35 acres in the Study Area within the U. Yakima Watershed. The greatest acreage of short-term impact occurs on existing modified herbaceous communities on both public (9.85 acres) and private (7.46 acres) land. Short-term impacts would occur on a total of 9.71 acres of forest within the U. Yakima Watershed. Short-term impacts on vegetation include installation of utilities (e.g., water, sewer, and power) and temporary disturbance to perimeter areas around buildings, parking lots, roads, and terminals during construction activities that would later be revegetated with native seed or plants. Proposed alignments for these utilities would follow existing and proposed lift corridors, existing ski trails, and existing and proposed roads. As discussed in Chapter 3, Section 3.5.1.2 - Existing Vegetation Communities, a mix of native and non-native herbaceous plants and shrub vegetation dominate the vegetation on ski trails.

All revegetation efforts would be a beneficial impact to vegetation resources within the Study Area. Of the 42.75 acres of restoration efforts that would be implemented under Alternative 2, 42.54 acres would occur at The Summit, the majority (28.03 acres) is revegetation associated with planting tree islands at

Summit West and Summit Central and revegetation where existing lift terminals, lift towers, and lift structures would be removed and revegetated with shrub or herbaceous plant communities. The remaining 14 acres of restoration include revegetation that would occur in association with road decommissioning, and at streams and wetlands, where cut banks and slopes would be stabilized. Native plants and seed mixes originating from the local area, along with USFS approved erosion control mixes, would be used.

A total of 49.35 acres of mature mixed conifer forest dominated by Pacific silver fir and mountain hemlock would be disturbed under Alternative 2. Understory within these forests is commonly dominated by huckleberry. Of the 49.35 acres of impact, 44.27 acres of mature forest would be affected by long-term impacts, mostly on public land (38.09 acres) at Summit East in Section 16. Of the 44.27 acres, 29.35 acres of mature Pacific silver fir forest and 3.12 acres of mature mountain hemlock forest would be cleared and another 9.10 acres would be gladed. Direct impacts are primarily associated with the proposed development of the *Creek Run* and *Rampart* ski pods at Summit East in Section 16. Trees would be removed to construct the proposed lifts, lift corridors, and associated trails as well as proposed *Trails 49* and *71*. Most tree removal would be by clearing with no grading. Glading would occur to the north of the proposed *Creek Run* lift along *Trails 55A* and *55B* in mature forest, mostly dominated by Pacific silver fir. Glading would reduce the amount of impact to mature forest and maintain higher levels of canopy cover and potential habitat for special-status botanical species, especially where tree removal is selective during trail construction.

The 44.27 acres of mature forest that would be permanently removed represents a loss of 4 percent of the mature forest community type identified within the Study Area. There would be no impacts to mature forest dominated by western hemlock from implementation of the proposed MDP under Alternative 2.

A total of 5.02 acres of mature forest would be temporarily impacted, primarily in Pacific silver fir forest where utility line installation would occur. Shrubs and herbaceous cover, primarily huckleberry, would be cleared within the forest understory. Removal of mature trees would be avoided to the extent possible. Topsoils would be salvaged and returned to the trench. Herbaceous and woody vegetation would be allowed to grow over the utility lines after installation. Exposed soils would be reseeded or replanted with USFS approved seed and plants.

The 44.27 acres of forest cleared for chairlifts and ski trail development in Section 16 under Alternative 2, mostly at Summit East, would indirectly impact the adjacent undisturbed mature forest by increasing the windthrow (tree blowdown) potential. The windthrow potential would be reduced, however because all trail clearing treatments under Alternative 2 include forest edge feathering and scalloping (Rowan et al. 2003). Due to the specialized trail clearing treatments (windfirming techniques) and the relatively open and uneven nature of the existing forest communities in Section 16, the amount of windthrow is expected to remain minimal, similar to current conditions. In mature forest, where the USFS may have concerns for windthrow potential, a USFS botanist or equivalent specialist would approve windfirming techniques, prior to proposed trail clearing. Management Requirements MR31 – 32 and Other Management

Provisions OMP30 and 34 – 37 (see Table 2.4-2) would reduce impacts to forest vegetation during construction activities.

Special-Status Plants

There are no potential impacts to federally listed, proposed, or candidate vascular plant species under Alternative 2. *Gentiana douglasiana*, a USFS and State listed sensitive vascular plant species, is located in an emergent wetland at Summit West in an area that will not be directly affected by construction activities under Alternative 2. However, this location of plants is located approximately 100 feet from the edge of an area proposed for clearing with no grading that would remove a small area (approximately 1 acre) of mature Pacific silver fir forest to construct a proposed lift terminal.

Although the plants could potentially be affected indirectly if there are changes to the vegetation surrounding the wetland, it is not considered likely. The light regime for the plants would not be altered since the trees that would be removed by the proposed construction lie to the north of the *G. douglasiana*. In addition, wetland hydrology is supported by subsurface discharge and some surface runoff and would not be impacted by removing trees that do not intercept these sources of water. The trees are also located far enough out of the wetland area to not be a significant source of nutrient input (litterfall). Monitoring by a USFS botanist, or equivalent specialist, would be implemented to evaluate potential indirect impacts to this species from implementation of Alternative 2 (see Management Requirement MR24 in Table 2.4-2). Management Requirements MR25 – 26 and Other Management Requirements OMP27 – 29 (see Table 2.4-2) would also avoid impacts on this species to maintain the viability of the species in this location.

Hypogymnia duplicata, a rare and uncommon species, occurs on tree boles and large branches within Section 16. Surveys conducted by the USFS noted numerous locations of *H duplicata* within the 116-acre survey area (see Appendix C – Botanical Technical Report). Proposed development of the *Rampart* and *Creek Run* lift and trails would potentially impact *H. duplicata* through the removal of trees with known occurrences of *H. duplicata*. These actions would impact individuals, but would not impact the larger populations of *H. duplicata* within Section 16.

Potential impacts to *H. duplicata* under Alternative 2 are not considered to affect the viability of the species by implementing mitigation measures presented in Table 2.4-2. As discussed in Section 3.5.1 - Summary of Existing Conditions and Appendix C, a potential habitat analysis was conducted for the range of *H. duplicata* habitat in Washington (Lesher 2005 pers. comm.). Data from this model was used to classify habitat for the Study Area and the larger area (5-mile radius) beyond the Study Area (see Appendix C – Botanical Technical Report). The analysis indicates that nearly 1,051 acres of high to moderate potential habitat exists in the Study Area for *H. duplicata*, and that as much as 21,164 acres of high to moderate potential habitat exists within the large area (5-mile radius) evaluated. It should also be noted that the Study Area is located at the limits of known distribution of *H. duplicata* in Washington. In

this area of its range, the presence *H. duplicata* is more closely related to microsite habitat conditions which are not predicted by the model (Lesher 2005 pers. comm.).

A state sensitive species, *Schistostega pennata*, (a moss species generally associated with late-successional forest), was observed in 17 locations within the Study Area at Summit East (Section 16). Under Alternative 2, three known locations of *S. pennata* could potentially be removed by full clearing with no grading for development of the upper portions of Trail 66 and 67 of the proposed *Creek Run* pod. *S. pennata* occurs on mineral soil in shaded pockets of overturned tree roots. At the site-scale, direct impacts may be avoided or reduced by leaving in-place a downed tree supporting a known location if the root wad is at the edge of the proposed ski trail and would not interfere with skiers on the trail. A USFS botanist, or equivalent specialist, would be present during trail construction to assist with field fitting the trail to avoid locations of *S. pennata* where possible (see Management Requirement MR27 and Other Management Provision OMP26 in Table 2.4-2). Mitigation Measure MM1, Management Requirements MR3 and 26, and Other Management Provisions OMP25 and 27 – 28 (see Table 2.4-2) would avoid or reduce impacts to this species to maintain the viability of the species in the Study Area.

S. pennata requires high humidity and densely shaded micro-sites (USFS and BLM 1996). Indirect impacts could occur to known locations of *S. pennata* where overstory trees are removed and microsite conditions would no longer be maintained. This includes exposure to sunlight and/or wind that may alter temperature and moisture regimes that sustain the moss. A goal of the MDP is to encourage development of and to sustain a minimum canopy cover of 70 percent within Section 16. Under the Implementation, Operations, Restoration and Management Plan (Appendix F), tree removal would be selective (field-fitted in cooperation with a USFS botanist or equivalent specialist) during construction to maintain 70 percent cover where it currently exists and to field-fit around *S. pennata* locations. Maintaining the canopy cover in these areas would benefit known locations of *S. pennata* by maintaining existing forest conditions. Conversely, if natural blowdown occurs, it would also benefit the moss, providing potential substrate for the moss to colonize. *S. pennata* is a species that can readily colonize mineral soils in new sites of exposed mineral soil (Lesher 2005 pers. comm.).

Potential impacts to *S. pennata* under Alternative 2 are not considered to affect the viability of the species by implementing mitigation measures presented in Table 2.4-2. As discussed in Section 3.5.1 - Summary of Existing Conditions, a potential habitat analysis was conducted by the USFS for *S. pennata* (Henderson and Lesher 2004) for the Study Area and the larger area (5-mile radius) beyond the Study Area. The analysis indicates that nearly 2,366 acres of potential habitat exists in the Study Area for *S. pennata*, and that as much as 71,555 acres of potential habitat exists within the large area (5-mile radius) evaluated. At the site scale, 14 of the 17 sites observed at Summit East would not be affected.

4.5.3.2 Upper South Fork Snoqualmie River Watershed

Table 4.5.3-FEIS-3 and Table 4.5.3-FEIS-4, below, present long- and short-term impacts, respectively, on vegetation communities for the S.F. Snoqualmie Watershed under Alternative 2. Acreages presented in this section include the affected acreage in the portion of The Summit that is in the S.F. Snoqualmie Watershed.

Forested Communities

Impact to natural shrub vegetation would total 1.2 acres of impact. The greatest amount of impact to vegetation under Alternative 2 would occur to shrub (15.23 acres) and herbaceous (5.22 acres) plant communities located on public land and already in a modified condition.

Table 4.5.3-FEIS-3:
Long-Term Impact Acreage for Land Cover Types within the South Fork Snoqualmie by Alternative[a]

Land Cover Type[b]	Land Ownership	Alt 1 Existing Landcover (acres)	Alt 2 Impacts (acres)	Alt 3 Impacts (acres)	Alt 4 Impacts (acres)	Mod Alt 5 Impacts (acres)
Mixed Conifer – Western hemlock						
Mature	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Immature	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Mixed Conifer – Pacific silver fir						
Mature	Public	239.67	2.35	2.21	2.35	2.35
	Private	68.34	0.04	0.04	0.04	0.04
Immature	Public	10.62	0.00	0.00	0.00	0.00
	Private	12.73	0.00	0.00	0.00	0.00
Sapling	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Mixed Conifer – Mountain hemlock						
Mature	Public	167.64	0.92	0.31	0.92	0.92
	Private	3.21	0.00	0.00	0.00	0.00
Immature	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Shrub						
Natural	Public	62.61	1.06	1.06	1.06	1.06
	Private	30.88	0.00	0.00	0.00	0.00
Modified	Public	92.94	8.02	6.77	7.96	8.02
	Private	2.28	0.00	0.00	0.00	0.00
Herbaceous						
Natural	Public	1.05	0.00	0.00	0.00	0.00
	Private	0.38	0.00	0.00	0.00	0.00
Modified	Public	80.17	2.63	1.78	2.78	2.66
	Private	4.58	0.00	0.00	0.00	0.00
Lakes/Open Water	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Unvegetated Rock Outcrops/Talus	Public	208.89	3.91	1.93	3.94	3.93
	Private	4.39	0.00	0.00	0.00	0.00
Developed Land	Public	18.89	5.76	5.73	4.55	5.77
	Private	4.87	0.00	0.00	0.00	0.00
Totals (acres)		**1014.15**	**24.68**	**19.81**	**23.60**	**24.74**

[a] Includes all impacts EXCEPT for utility line installation and perimeter construction impacts around buildings, parking lots, roads, and lift terminals.
[b] Includes Wetland and Lake landcover types

Table 4.5.3-FEIS-4:
Short-Term Impact Acreage for Land Cover Types
Within the South Fork Snoqualmie Watershed - by Alternative[a]

Land Cover Type[b]	Land Ownership	Alt 1 Existing Landcover (acres)	Alt 2 Impacts (acres)	Alt 3 Impacts (acres)	Alt 4 Impacts (acres)	Mod Alt 5 Impacts (acres)
Mixed Conifer – Western hemlock						
Mature	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Immature	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Mixed Conifer – Pacific silver fir						
Mature	Public	239.67	0.58	0.58	0.57	0.58
	Private	68.34	0.36	0.36	0.36	0.36
Immature	Public	10.62	0.00	0.00	0.00	0.00
	Private	12.73	0.00	0.00	0.00	0.00
Sapling	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Mixed Conifer – Mountain hemlock						
Mature	Public	167.64	1.09	0.06	1.09	1.09
	Private	3.21	0.00	0.00	0.00	0.00
Immature	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Shrub						
Natural	Public	62.61	0.14	0.14	0.12	0.14
	Private	30.88	0.00	0.00	0.00	0.00
Modified	Public	92.94	7.21	2.62	7.01	7.21
	Private	2.28	0.16	0.16	0.16	0.16
Herbaceous						
Natural	Public	1.05	0.00	0.00	0.00	0.00
	Private	0.38	0.00	0.00	0.00	0.00
Modified	Public	80.17	2.59	1.23	2.50	2.56
	Private	4.58	0.08	0.08	0.08	0.08
Lakes/Open Water	Public	0.00	0.00	0.00	0.00	0.00
	Private	0.00	0.00	0.00	0.00	0.00
Unvegetated Rock Outcrops/Talus	Public	208.89	1.55	0.49	1.52	1.52
	Private	4.39	0.00	0.00	0.00	0.00
Developed Land	Public	18.89	0.34	0.16	0.51	0.32
	Private	4.87	0.07	0.07	0.07	0.07
Totals (acres)		**1014.15**	**14.17**	**5.95**	**14.00**	**14.09**

[a] Short-term impacts include those associated with utility line installation and perimeter construction impacts around buildings, parking lots, roads, and lift terminals.
[b] Includes Wetland and Lake landcover types.

There would be a total of 0.21 acre of restoration under Alternative 2. Revegetation would occur at sites where existing lift terminals, lift towers, and lift structures would be removed and replaced with shrub or herbaceous plant communities.

Under Alternative 2, a total of 5.34 acres of disturbance would occur to mixed conifer forest dominated by either Pacific silver fir or mountain hemlock. These impacts would primarily be associated with the full clearing with no grading to construct the proposed Pulse Gondola from Alpental's base area to the summit and the International chairlift.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special-Status Plants

No Special-Status plant species have been identified during surveys conducted in the Study Area within the S.F. Snoqualmie Watershed (see Appendix C – Botanical Technical Report). Therefore, no impacts to Special-Status plant species are anticipated.

4.5.4 Impacts – Alternative 3

Projects associated with implementation of Alternative 3 include actions discussed in Section 4.5.3 – Impacts - Alternative 2 (Proposed Action) as well as additional projects unique to Alternative 3 (as discussed below). These additional projects are located on public land and are the focus of the range of alternatives analyzed in this EIS. Impact numbers referenced in this section include impacts common to all alternatives as well as impacts unique to Alternative 3.

Forested Communities

Impacts on plant communities would be similar to those described under Alternative 2, except 41 fewer acres would be disturbed. A total of 127.71 acres of vegetation would be disturbed. The primary reason for the reduced impact on vegetation under this alternative is that the *Creek Run* chairlift and associated ski trails would not be developed. Impacts on the plant communities for both watersheds are discussed below. Measures discussed in Table 2.4-2 would apply to impacts on vegetation from Alternative 3.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special-Status Plants

Impacts to USFS and State sensitive vascular plants would be the same as those described under Alternative 2. No impacts to other special status plant species are anticipated under Alternative 3 because the *Creek Run* chairlift and associated trails at Summit East in Section 16 would not be constructed.

Noxious Weeds

Impacts of noxious weeds would be similar to those described under Alternative 2. There would be a reduced opportunity for noxious weeds to establish in the Study Area under Alternative 3, as there would be 42.94 acres less ground disturbed by construction activities.

4.5.4.1 Upper Yakima River Watershed

Projects and impact mechanisms within the U. Yakima Watershed for Alternative 3 are as discussed for Alternative 2, with the following exceptions:

- The Creek Run chairlift and associated road to the upper terminal at Summit East would not be constructed.
- Existing Trails 55, 66, and 67 would be revegetated.
- Land Donation to offset impacts to Section 16 is proposed.

Forested Communities

Impacts on plant communities would be similar to those described under Alternative 2, except approximately 31 fewer acres would be disturbed. A total of 110.3 acres of vegetation would be disturbed (see Tables 4.5.2-1A through 4.5.2-1C). The reduced impact on vegetation would occur primarily within mature forest where the *Creek Run* pod and associated road would not be constructed. Of the 110.3 acres, there would be 76.66 acres of long-term impacts and 16.32 acres of short-term impacts on vegetation communities (see Tables 4.5.3-1 and 4.5.3-2). These impacts would occur on both public (60.93 acres) and private (49.4 acres) land. Short-term impacts would be similar to those described under Alternative 2, with the majority (15.41 acres) due to utility line installation associated with new chairlift alignments proposed under this alternative. Acreages were calculated based on the total impacts to specific vegetation communities.

Impacts from operation and maintenance activities would be similar to those described under Alternative 2, except approximately 34 fewer acres of ski trails and lift corridors would require periodic maintenance to manage shrub/tree growth.

Of the 52.78 acres of restoration efforts that would be implemented in the U. Yakima Watershed under Alternative 3, 38.40 acres of revegetation would occur at The Summit. Revegetation would be similar to that described under Alternative 2, except there would be 10.24 additional acres of revegetation at Summit East. This includes 9.53 acres of revegetation where existing *Trails 55*, *66*, and *67* would be revegetated to reduce fragmentation within Section 16 and 0.71 acre of restoration associated with a wetland.

A total of 23.11 acres of mature forest would be disturbed under Alternative 3, less than half the impact described under Alternative 2 (see Tables 4.5.2-1A through 4.5.2-1C). Approximately 26 fewer acres of

impact would occur within mixed conifer forest dominated by Pacific silver fir and mountain hemlock because the *Creek Run* pod and associated road would not be developed at Summit East within Section 16. In addition, full clearing with no grading would not occur for construction of proposed *Trail 49*. Of the 23.11 acres of impact to mature forest under Alternative 3, the majority occurs to forest dominated by Pacific silver fir (14.59 acres) on public land. Of the 23.11 acres, 4.31 acres of short-term impacts would occur on mature forest dominated by Pacific silver fir, and would be similar to those described under Alternative 2.

Under Alternative 3, approximately 440 acres of private land within Section 21 would be purchased by Ski Lifts, Inc. to offset impacts to mature forest in Section 16. Of the 440 acres, approximately 50 acres would be retained by Ski Lifts, Inc. to encompass the proposed *Mill Creek* pod (see Figure 2.3.4-3, Existing and Proposed Land Trade). The remaining 390 acres would be donated to the USFS to be managed as Late Successional Habitat (see Chapter 3.6 – Wildlife for a discussion of Late Successional Habitat and wildlife connectivity). Immature Pacific silver fir, mostly dominated by saplings growing on previously harvested land, would be allowed to develop into mature forest under this alternative. Natural herbaceous (e.g., wetlands) and shrub communities would continue in their natural condition, and in some cases, develop into forest where regeneration of Pacific silver fir and mountain hemlock would occur naturally downslope of more mature forest stands.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special-Status Plants

Impacts to special-status vascular plants would be as described under Alternative 2. Impacts to non-vascular special status plant would be avoided under Alternative 3 because development of the *Creek Run* pod would not occur.

4.5.4.2 Upper South Fork Snoqualmie River Watershed

Projects and impact mechanisms within the S.F. Snoqualmie Watershed for Alternative 3 are as discussed for Alternative 2, with the following exceptions:

- The *Pulse Gondola* and mountain-top restaurant (including ADA facilities) at Alpental would not be constructed.
- The existing *Edelweiss* ski patrol duty station would not be replaced

Under Alternative 3 impacts on plant communities would be similar to those described under Alternative 2, except approximately 10 fewer acres would be disturbed. A total of 17.4 acres would be disturbed. The primary reason for the reduced impact on vegetation under this alternative is the mountain-top restaurant would not be constructed, and therefore, the utilidor associated with it would not be installed in the modified shrub communities along *Armstrong Express*. Table 4.5.3-1 and Table 4.5.3-2, above, present

the long- (12.71 acres) and short-term (5.23 acres) impacts, respectively, on vegetation communities for the S.F. Snoqualmie Watershed under Alternative 3. The approximately 17 acres of impact would occur almost exclusively on public land.

Operation and maintenance activities would be similar to those described under Alternative 2, except 4.81 fewer acres of ski trails and lift corridors would require periodic maintenance of shrub/trees growth.

Restoration under Alternative 3 would be as described under Alternative 2.

Forested Communities

Impacts on mature forest would be similar to those described under Alternative 2, except approximately 2 fewer acres would be disturbed, in forest dominated by mountain hemlock, where the Pulse Gondola lift corridor would not be constructed. A total of 3.56 acres would be disturbed. Impacts to mature forest under Alternative 3 are primarily in mixed conifer forest dominated by Pacific silver fir and are associated with construction of the lift corridors for the proposed *International* and *Sessel* chairlifts. There is also the potential for a few individuals of mature mountain hemlock, scattered amongst rock outcrop and talus, to be removed where blasting is proposed for *Trail 20*. However, there would be 3.04 fewer acres of blasting under Alternative 3.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special-Status Plants

Impacts to special-status plants would be as described under Alternative 2.

4.5.5 Impacts – Alternative 4

Projects associated with implementation of Alternative 4 include actions discussed in Section 4.5.3 – Impacts - Alterative 2 (Proposed Action) as well as additional projects unique to Alternative 4 (as discussed below). These additional projects are located on public land and are the focus of the range of Alternatives analyzed in this EIS. Impact numbers referenced in this section include impacts common to all Alternatives as well as impacts unique to Alternative 4.

Forested Communities

Impacts on plant communities would be similar to those described under Alternative 2, except approximately 47 fewer acres would be disturbed. A total of 121.21 acres of vegetation would be disturbed. The primary reason for the reduced impact on vegetation under this alternative is that there would be no development within mature forest at Summit East within Section 16. Impacts on the plant communities for both watersheds are discussed below. Mitigation measures discussed in Alternative 2 would apply to impacts on vegetation from Alternative 4.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special-Status Plants

Impacts to special status vascular plants would be the same as those described under Alternative 2. No impacts to special status nonvascular plant species are anticipated under Alternative 4 because no development is proposed at Summit East in Section 16.

Noxious Weeds

Impacts of noxious weeds would be similar to those described under Alternative 2. There would be a reduced opportunity for noxious weeds to establish in the Study Area under Alternative 4, as there would be 48.86 acres less ground disturbed by construction activities.

4.5.5.1 Upper Yakima River Watershed

Projects and impact mechanisms within the U. Yakima Watershed for Alternative 4 are as discussed for Alternative 2, with the following exceptions:

- The Creek Run and Rampart chairlifts and associated roads at Summit East would not be constructed.

Forested Communities

Impacts on plant communities would be similar to those described under Alternative 2, except approximately 47 fewer acres would be disturbed. A total of 94.19 acres of vegetation would be disturbed under Alternative 4. The primary reason for the reduced impact on vegetation under this alternative is that the *Creek Run* and *Rampart* chairlifts and associated ski trails at Summit East would not be developed. Tables 4.5.3-1 and 4.5.3-2 present the acres of long-term (62.32 acres) and short-term (31.87 acres) impacts by ownership, respectively, on vegetation communities under Alternative 4. These impacts would occur on both public (46.41 acres) and private (47.78 acres) land. Acreages were calculated based on the total impacts to specific vegetation communities.

Impacts on immature forest would be similar to those described under Alternative 2, except there would be approximately 5 fewer acres disturbed. A total of 23.0 acres of disturbance would occur under Alternative 4 to immature forest, primarily immature and sapling Pacific silver fir.

Impacts from operation and maintenance activities would be similar to those described under Alternative 2, except approximately 43 fewer acres of ski trails and lift corridors would require periodic maintenance to manage shrub/tree growth.

Restoration under Alternative 4 would be similar to that described for Alternative 2, with a total of 24.88 acres of beneficial impacts to vegetation from revegetation efforts, primarily at Summit West and Summit

Central. There would also be revegetation associated with restoration projects to stabilize slopes and streambanks, decommission roads, and enhance wetland buffers.

Under Alternative 4, a total of 12.64 acres of impact would occur to mature forest, mostly Pacific silver fir (12.22 acres), within the U. Yakima Watershed. There would be approximately 37 fewer acres impacted under Alternative 4 than under Alternative 2. There would be no development in Section 16 at Summit East. To reduce impacts to riparian corridors, late-successional habitat, and wildlife connectivity, the *Creek Run* and *Rampart* pods and associated infrastructure would not be constructed. No new connector trails would be developed between Summit Central and Summit East.

Short-term impacts within mature forest would be similar to those described under Alternative 2, except 1.17 fewer acres would be disturbed. Of the total 12.7 acres of disturbance, a total of 3.41 acres of mature forest would be temporarily impacted, primarily in Pacific silver fir forest where lift terminal construction and utility line installation would occur.

In addition, approximately 17 acres of mature forest, mostly mature mountain hemlock situated along Hyak Creek, would be added to the Study Area where the SUP boundary would be adjusted.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special-Status Plants

Impacts to special-status vasuclar plants would be as described under Alternative 2. Impacts to non-vascular special status plant would be avoided under Alternative 4 because development of the *Creek Run* and *Rampart* pods would not occur.

4.5.5.2 Upper South Fork Snoqualmie River Watershed

Projects and impact mechanisms within the S.F. Snoqualmie Watershed for Alternative 4 are as discussed for Alternative 2, with the following exceptions:

- Existing Alpental Road would be re-routed between the existing bridge to Parking Lot 6.
- Parking Lots 4, 5, and 6 at Alpental would be reduced in size as a result of the Alpental road reroute.
- Parking Lot 7 at Alpental would be removed.
- The existing Edelweiss ski patrol duty station would not be replaced.

Forested Communities

Impacts on plant communities would be similar to those described under Alternative 2, except 0.25 acre less would be disturbed. A total of 27.0 acres of vegetation would be disturbed under Alternative 4.

Impacts on forests are the same as under Alternative 2. The difference in impact acreage is due to a slight decrease in impact to modified shrub communities while a slight increase in impact on modified herbaceous communities.

Impacts from operation and maintenance activities would be the same as those described under Alternative 2.

The restoration program under Alternative 4 would be as described under Alternative 2, except an additional 3.08 acres of revegetation would occur. Revegetation would be associated with restoring Riparian Reserve associated with the realignment of the existing Alpental Road and revegetation of Parking Lot 7. The road would be re-located further away from the Upper South Fork of the Snoqualmie River between the existing bridge to Parking Lot 6.

There would be a total of 3.32 acres disturbed of mature mixed conifer forest dominated by Pacific silver fir and 2.01 acres of impact to mature mixed conifer forest dominated by mountain hemlock under Alternative 4 in the S.F. Snoqualmie Watershed (see Tables 4.5.2-1A through 4.5.2-1C), which is the same as that described under Alternative 2.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special-Status Plants

Impacts to special-status plants would be as described under Alternative 2.

4.5.6 Impacts – Modified Alternative 5

Projects associated with implementation of Modified Alternative 5 include actions discussed in Alternative 2 as well as additional projects unique to Modified Alternative 5 (as discussed below). These additional projects are located on public land and are the focus of the range of Alternatives analyzed in this EIS. Impact numbers referenced in this section include impacts common to all Alternatives as well as impacts unique to Modified Alternative 5.

Forested Communities

Impacts on plant communities would be similar to those described under Alternative 2, except approximately 9 fewer acres would be disturbed. A total of 159.63 acres of vegetation would be disturbed. The reduced impact on vegetation under this alternative is due to reduced trail development within the proposed *Creek Run* and *Rampart* pods, and glading only north of the *Creek Run* lift line. Impacts on the plant communities for both watersheds are discussed below. Mitigation measures discussed in Alternative 2 would apply to impacts on vegetation from Modified Alternative 5.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.9-1.

Special-Status Plant Species

Impacts to special status vascular plants would be the same as those described under Alternative 2. Impacts to special status nonvascular plant species are discussed below for the U. Yakima and S.F. Snoqualmie Watersheds.

Noxious Weeds

Impacts of noxious weeds would be very similar to those described under Alternative 2. There would be slightly reduced opportunity for noxious weeds to establish under Modified Alternative 5, as there would be 9.06 acres less ground disturbed by construction activities.

4.5.6.1 Upper Yakima River Watershed

Projects and impact mechanisms within the U. Yakima Watershed for Modified Alternative 5 are as discussed for Alternative 2, with the following exceptions:

- Reduced trail development within the proposed Rampart and Creek Run pods.
- Glading-only north of the Creek Run chairlift centerline.
- Land Donation parcel to offset impacts to Section 16.

Forested Communities

Impacts on plant communities would be similar to those described under Alternative 2 except approximately 9 fewer acres would be disturbed. A total of 132.4 acres of vegetation would be disturbed under Modified Alternative 5 (see Tables 4.5.2-1A through 4.5.2-1C). Acres of long-term (82.72 acres) and short-term (49.69 acres) impacts on vegetation communities under Modified Alternative 5 are presented, respectively, by ownership in Table 4.5.3-1 and Table 4.5.3-2. These impacts would occur on both public (98.16 acres) and private (34.25 acres) land. Acreages were calculated based on the total impacts to specific vegetation communities.

Short-term impacts are similar to those described under Alternative 2, except 0.27 acre less would be temporarily disturbed. Impacts from operation and maintenance activities would be similar to those described under Alternative 2, except approximately 9 fewer acres of ski trails and lift corridors would require periodic maintenance to manage shrub/tree growth.

Restoration under Modified Alternative 5 would be similar to that described for Alternative 2, with a total of 29.89 acres of beneficial impacts to vegetation from revegetation efforts, primarily at Summit West and Summit Central.

Under Modified Alternative 5, there would be reduced trail development in mature forest in Section 16 for the proposed *Creek Run* and *Rampart* pods. Clearing would be reduced by at least 50 percent, and greater than 50 percent where glading only is proposed north of the proposed *Creek Run* chairlift (including Trail 49). In addition, there would be reduced grading along Trails 60 and 61 within the *Rampart* pod. Trail 71 would be constructed to a 12-foot width, narrower than proposed under Alternative 2. As a result, a total of 39.82 acres of disturbance would occur to mature forest under Modified Alternative 5, which is 9.46 acres less than under Alternative 2. The majority of impact would be to mature forest dominated by Pacific silver fir (36.67 acres), with some disturbance to mountain hemlock (3.15 acres). Of the 39.82 acres of disturbance, 4.81 acres of short-terms impacts would occur, which is the same as that described under Alternative 2.

Under Modified Alternative 5, approximately 390 acres of private land within Section 21 (see Figure 2.3.4-3, Existing and Proposed Land Trade) would be donated to the USFS to be managed for Late-Successional Habitat to offset impacts to mature forest in Section 16 (see Section 3.6 - Wildlife for a discussion of Late-Successional Habitat and wildlife connectivity). Beneficial impacts to forest, shrub, and herbaceous plant communities would be the same as described under Alternative 3.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special-Status Plant Species

Under Modified Alternative 5, two known locations of a state sensitive moss species, *S. pennata*, could potentially be affected by development at Summit East within Section 16. However, both direct and indirect impacts to *S. pennata* would be reduced from those described under Alternative 2 due to the comparatively reduced level of development (glading versus full clearing). Potential impacts would be reduced due to trail modification and reduction of *Trail 66* within the *Creek Run* pod. One location could be removed by full clearing with no grading for development of the upper portion of *Trail 67*. Also, a second location could be indirectly affected by glading of *Trail 49*. As described under Alternative 2, root wads supporting known locations of *S. pennata* and tree removal would be field-fit in cooperation with a USFS botanist or equivalent specialist to avoid or reduce the potential for impact to this species.

Impacts to *H. duplicata* would be as described under Alternative 2.

4.5.6.2 Upper South Fork Snoqualmie River Watershed

Forested Communities

Projects and impact mechanisms within the S.F. Snoqualmie Watershed for Modified Alternative 5 do not include anything beyond the projects common to all action Alternatives. Impact acreages to all plant communities within the S.F. Snoqualmie Watershed for Modified Alternative 5 are identical to those identified for Alternative 2.

Restoration under Modified Alternative 5 would be the same as that described for Alternative 2, with a total of 0.21 acre of beneficial impact to vegetation from restoration efforts.

A detailed discussion of the AMA Standards and Guidelines can be found in Section 4.6 – Wildlife in Table 4.6.2-1.

Special-Status Plants

Impacts to special-status plants would be as described under Alternative 2.

4.5.7 Cumulative Effects

Cumulative effects on vegetation resources include those impacts associated with The Summit-at-Snoqualmie MDP, and other past, present, and reasonably foreseeable projects identified in the U. Yakima and S.F. Snoqualmie watersheds. Table 4.5.7-1 and Table 4.5.7-3 list these projects and summarize their potential impact. The effects of past projects at The Summit-at-Snoqualmie include areas developed in the SUP and on private lands for recreational facilities and related infrastructure. The baseline conditions described in Chapter 3 include the effects of the past projects associated with the development, operation, and maintenance of The Summit and Alpental facilities.

Cumulative effects include projects that result in short or long-term disturbance to vegetation. Short-term impacts are typically associated with projects, and may persist for several years following construction. Examples include burying of utility lines or minor disturbance to vegetation that can recover throughout the growing season. Long-term impacts include those that result in a removal of vegetation or conversion of a vegetation type that would not be recovered during the life of the MDP.

Impacts are analyzed as the resulting cover of modified shrub and herbaceous communities. Under Alternative 1, the existing acreage of modified shrub and herbaceous communities are listed and compared to the 6th and 5th field watershed areas to obtain a baseline percentage. Tables 4.5.7-3 and 4.5.7-4 display the resulting amount of modified shrub and herbaceous land cover and the percentage of the 5th field watersheds that would result under each Alternative.

4.5.7.1 Upper Yakima River Watershed

Projects Associated with The Summit-at-Snoqualmie

Culvert replacements that would occur over time would contribute to the short-term loss of vegetation during construction to replace the culverts. Over the long-term the culvert replacement projects would likely increase the amount of streamside vegetation in the watershed. Although these projects would improve conditions at the site specific location it would not have a measureable effect on vegetation at the larger 5th field U. Yakima Watershed scale. The proposed MDP projects and the proposed culvert replacements would contribute to the long-term improvements of vegetation in the Yakima watershed and would be negligible at the larger Yakima watershed scale.

Projects Not Associated With The Summit-at-Snoqualmie

The majority of the projects in Tables 4.5.7-1 that are not associated with The Summit-at-Snoqualmie would result in either a long-term loss of forest vegetation or are land management decisions that would ultimately result in an increase of the amount of forested lands. Approximately 11 percent of the watershed is in a non-forest or seedling/sapling forest condition as reported in the Yakima watershed analysis (USFS 1997). Specific projects that remove forest and other plant communities such as road improvements, dam maintenance, or development activities would contribute to the amount of natural land cover already in a modified condition. Past activities that have occurred in the watershed, creating these modified conditions, include the loss of vegetation from development of rail, utility, and vehicle corridors, timber harvest, recreation facilities, and urban development. Agricultural uses such as grazing and pastureland have contributed to the current condition of vegetation in the watershed. Natural disturbances such as fire have also contributed to changes in vegetation conditions.

Construction of the proposed projects in Table 4.5.7-1 would increase the amount of non-forested land, but the incremental increase would be small compared to the size of the watershed. Impacts would occur on tree species occupying the overstory and shrubs and herbaceous species in the understory would likely be permanently lost to construct the projects. Functions associated with forest communities such as habitat for native plants and animals, soil productivity or stabilization, and stream health and habitat structure would be reduced at the site specific locations where the project activities occur. Short-term vegetation impacts would be associated with installation of utility lines that require some vegetation to be disturbed during installation, but would be revegetated.

Beneficial impacts on vegetation would occur through implementation of the restoration projects (e.g., culvert replacements), land acquisitions (e.g., Plum Creek Land Exchange) and site-specific land management plans (e.g., Plum Creek HCP) in Table 4.5.7-1. Projects that are associated with improving watershed conditions, such as road obliteration and culvert replacement, would result in an increase in vegetated areas. There may be an immediate short-term impact on vegetation associated with road obliteration or culvert replacements. Forest roads may be deep-ripped to decrease soil compaction to enhance natural or planted revegetation efforts. If road cut and fill slopes are re-shaped to more natural contours, some herbaceous, shrub, and small trees currently growing on those road slopes would be lost; however, planting would occur to revegetate these areas. Some vegetation would be removed to replace and install new culverts to improve fish passage. Soil disturbed from culvert replacements would be revegetated to maintain or improve riparian vegetation conditions. Activities such as these to improve watershed conditions would increase the area of native vegetation that is currently unvegetated, or in a modified condition.

In addition, approximately 420,000 acres of forest land would be managed to improve forest conditions either through management of NFSL for late-successional habitat and multi-age forest, or land to be managed under a Habitat Conservation Plan on private lands. Land management activities that result in

lands previously managed for timber production and have been, or would be, transferred to the USFS for ownership and management, would contribute to these beneficial impacts, including MDP Alternative 3 and Modified Alternative 5 (which include a 390-acre land donation).

Table 4.5.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Vegetation

Project Name	Project Summary	Cumulative Effects to Vegetation
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last 5 years at the Summit at Snoqualmie. Generally, culverts are replaced at a rate of approximately 2 per year.	The replacement and repair of culverts at The Summit-at-Snoqualmie overlaps spatially and temporally with the MDP at the site scale. Approximately 0.01 acre of vegetation around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would likely be beneficial (i.e., reduced sediment delivery and erosion would allow for maintenance/re-establishment of vegetation along streams). The replacement of culverts, combined with the Action Alternatives, would directly contribute to improved sediment conditions, and therefore, vegetation conditions downstream.
Projects Not Associated with The Summit-at-Snoqualmie		
Kachess Vegetation Management	Hazard trees were identified in the Kachess Lake Campground through an exhaustive survey. All identified trees are scheduled to be removed by the winter of 2004. The campground contains old growth trees suffering from various stages of root rot. A small amount of timber would be sold as merchantable, the rest would be disposed of through firewood sales, lop and scatter, or burned.	The removal of hazard trees has reduced the canopy cover within the treated areas of the campground. Spatially, the vegetation removal was limited to the campground site, and did not overlap with the MDP or other identified cumulative effects at the site scale. Temporally, the work has been completed and would not overlap with the MDP. This project, combined with the Action Alternatives, contributed to a cumulative loss of vegetation at the 5th field scale.
Plum Creek Road Restoration	The Cle Elum Ranger District is performing a road analysis covering approximately 50-70 miles of harvest roads on 65,000 acres of land acquired in the last 5 years from Plum Creek Timber lands. Currently, approximately 18 miles of roads that were acquired and deemed to be unsafe or were already closed have been decommissioned by the Forest Service. Under the Proposed Action, approximately 30.57 miles of road would be decommissioned.	Currently, approximately 26.2 acres of roads have been decommissioned within the watershed. Both spatially and temporally, this road decommissioning would overlap with the road obliteration, and other restoration projects identified in the MDP alternatives at the 5th field scale. As a result, the road obliteration under the MDP and the Cle Elum Roads Analysis would cumulatively reduce the available road mileage in the U. Yakima 5th field watershed. The reduction in road mileage would improve downstream riparian vegetation and allow for the re-establishment of vegetation on the obliterated roads.

Table 4.5.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Vegetation

Project Name	Project Summary	Cumulative Effects to Vegetation
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	Depending on which alternative is selected, approximately 50.9 acres of soils/vegetation would be impacted by road expansions. This project would directly overlap with the MDP in both space and time at the site and 5th field scales. Alternative 2 and Modified Alternative 5 would increase detrimental soil conditions in the Study Area, cumulatively reducing the potential for establishment of vegetation in the vicinity of Snoqualmie Pass. Alternatives 3 and 4 would reduce detrimental soil conditions through proposed restoration projects, cumulatively improving the potential for the establishment of vegetation.
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	In the Yakima watershed, the acquired lands would be managed under the SPAMA allocation with a late-seral habitat emphasis. The management of these acquired lands would spatially and temporally overlap with the MDP at the 5th field scale, resulting in cumulative benefits to LSH under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions would contribute to overall improvement in LSH conditions at the 5th field scale.
Keechelus Dam Repairs	The Keechelus Lake dam was repaired in 2003. The existing dam was rebuilt in place to correct structural problems. The project has been completed. Approximately 70 acres of vegetation was cleared to provide a work corridor. The project impacted 3.8 acres of wetlands.	While the dam replacement did not overlap in time with the MDP, stabilization (i.e., "grow-in") of the site is projected to overlap with the MDP in both space (at the 5th field) and time. Cumulatively, the 70 acres of vegetation removal and subsequent re-vegetation would cumulatively alter riparian vegetation communities and reduce vegetation conditions at the 5th field scale.
Gold Creek Pond Trail Development	A native surface foot trail, approximately 100 feet long was constructed. This project was completed in 2001.	Temporary impacts to 0.005 acre occurred during trail construction. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space (at the 5th field scale) or time with any projected vegetation impacts under the Action Alternatives.
U.S. West Telephone line	Installation of an underground telephone line in old road prism. This project was completed in 2001.	Temporary impact of 1.82 acres to install an underground line created disturbance to an already modified road prism. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space (at the 5th field scale) or time with any projected vegetation impacts under the Action Alternatives.

Table 4.5.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Vegetation

Project Name	Project Summary	Cumulative Effects to Vegetation
WSDOT I-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical deicers to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile is applied to I-90 within the Snoqualmie Pass area (WSDOT 1999, 2001).	I-90 Maintenance would overlap with the MDP in both space and time at the site and 5th field scales. Increases in detrimental soil conditions would occur under the Action Alternatives (Alternative 2 being the largest impact and Alternative 4 being the lowest of the Action Alternatives). When added to the possible I-90 widening, repairs to the Keechelus dam and private land development, cumulative effects to vegetation would result due to increased detrimental soil conditions, and therefore vegetation establishment. Chemical de-icing may affect roadside vegetation if localized concentrations exceed plant tolerance, although such de-icing has been successfully implemented in the MBSNF and OWNF.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	The recent purchase of Sections 5, 17, and 25 of Township 21N Range 11E occur within portions of the Yakima River Watershed. These acquired lands would be allocated to the SPAMA and managed with an emphasis for late-seral habitat preservation. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP, resulting in cumulative benefits to vegetation communities under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions would also contribute to overall improvement in vegetation communities at the 5th field scale.
Plum Creek Cascade Habitat Conservation Plan	A HCP was developed for the Plum Creek Timber Company to manage timber harvest and protect wildlife habitat over several 5th field watersheds in the vicinity of Snoqualmie Pass.	Approximately 52,100 acres of land is managed under the HCP. Protection of wildlife habitat would temporally and spatially overlap at the 5th field scale with the MDP resulting in cumulative benefits to vegetation communities under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no Land Donation), lands managed under the HCP, combined with private land acquisitions would contribute to overall improvement in vegetation communities at the 5th field scale.

Table 4.5.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Vegetation

Project Name	Project Summary	Cumulative Effects to Vegetation
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of the Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in both space at the site scale and time with the MDP development. Alternative 2 and Modified Alternative 5 would increase detrimental soil conditions in the Study Area, and in conjunction with the private land developments and other ground disturbing activities, would cumulatively affect vegetation conditions.
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the Upper Yakima River watershed. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	A total of 210 acres of forest would be commercially thinned to accelerate the development of late-successional forest structure. Short-term impacts resulting in vegetation disturbance and removal would occur, some of which would overlap in space (at the 5th field) and time with the MDP implementation. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Protection of wildlife habitat under the Plum Creek HCP would also temporally and spatially (at the 5th field) overlap with the MDP resulting in cumulative benefits to vegetation communities and wildlife connectivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek HCP and private land acquisitions would contribute to overall improvement in vegetation communities and wildlife connectivity at the 5th field scale.
Snoqualmie Pass AMA Plan	Land management plan for the AMA emphasizing late-successional habitat maintenance and enhancement	The management of lands to emphasize late-successional habitat would overlap spatially and temporally with the MDP at the site and 5th field scales. The management of lands under the SPAMA would result in cumulative benefits to vegetation communities under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek HCP and private land acquisitions would contribute to overall improvement in vegetation communities at the 5th field scale.

Table 4.5.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Vegetation

Project Name	Project Summary	Cumulative Effects to Vegetation
Cle Elum RD roads analysis	Analysis of road system to determine long-term need. Implementation is expected in 2010.	The analysis of road systems and implementation of the plan would overlap spatially (at the 5th field) and temporally with the MDP. In conjunction with the Implementation, Operations, Restoration and Management Plan for the Summit-at-Snoqualmie MDP (see Appendix F), the roads analysis would improve road and trail management in the U. Yakima Watershed. The result will be a cumulative benefit to the vegetation community in the 5th field with improved road and trail management under both plans.
WSDOT road de-icing	Application of sand and chemical deicers to roadway surfaces	Deicing of roadways would overlap spatially, at the site and 5th field scales, and temporally with the MDP. Coupled with the Action Alternatives and other road maintenance projects, this project could affect soils and therefore vegetation. Impacts to vegetation communities could result due to road deicing, if localized concentrations exceel plant tolerance, although deicing has been successfully implemented in the MBSNF and OWNF.
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the Wenatchee National Forest Land and Resource Management Plan.	The study of lands to determine suitability for preservation as wilderness would overlap spatially (at the 5th field scale) and temporally with the MDP. If lands are re-allocated to Wilderness under this project, cumulative benefits to vegetation communities would result. Coupled with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisitions, this project would contribute to overall improvement in vegetation communities at the 5th field scale.
Pro Guiding Service Area Expansion	Pro Guiding has requested expansion of their area of operation to include the Cascade crest area from Kendall Lakes to Mt. Daniel, plus the Alta Mountain area. They are not requesting an increase in number of service days.	The expansion of Pro Guiding's area of operation would overlap spatially (at the 5th field scale) and temporally with the MDP. No impacts to vegetation are expected from this project.

Table 4.5.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Vegetation

Project Name	Project Summary	Cumulative Effects to Vegetation
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (W. Keechelus subwatershed). The proposed project includes thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	The thinning of forests to accelerate late-successional habitat structure and restore ecological conditions would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in changes to the vegetation community and soil disturbance could occur during thinning operations. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Combined with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisition projects, this project would result in cumulative benefits to vegetation communities and wildlife connectivity. Under Alternatives 2 and 4 (with no land donation), this project and the other private land acquisitions would contribute to overall improvement in vegetation communities and wildlife connectivity at the 5th field scale.
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (E. Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and fish passage improvements, and other restoration projects.	The thinning of forests to accelerate late-successional habitat structure and restore ecological conditions would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in changes in vegetation communities and soil disturbance would occur during thinning operations. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Combined with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisition projects, this project would result in cumulative benefits to vegetation communities and wildlife connectivity. Under Alternatives 2 and 4 (with no land donation), this project and the other private land acquisitions would contribute to overall improvement in vegetation communities and wildlife connectivity at the 5th field scale.

Clearing of vegetation for the Summit-at-Snoqualmie's MDP would likely have little cumulative effects to vegetation. The percentage of modified and developed vegetation would increase slightly under all Action Alternatives, between 0.90 (Alternative 1) and 1.11 percent (Alternative 2) of the 5th field watershed area (see Table 4.5.7-2). Proposed restoration and slope stabilization projects would benefit vegetation communities within the watershed.

Although implementation of the proposed MDP would contribute to the loss or conversion of vegetation types in the watershed, the effect would be minimal at the larger 5th field watershed scale. When coupled

with the past, present and reasonably foreseeable projects listed in the table above, implementation of the MDP would result in a cumulative effect to vegetation in 3.97 to 4.03 percent of the 5th field U. Yakima Watershed. These cumulative effects could be offset by the much larger amount of land to be managed to improve forest and related habitat conditions (see Beneficial Impacts in Table 4.5.7-2).

Table 4.5.7-2:
Cumulative Acreage of Effects on Vegetation from Past, Present, and Reasonably Foreseeable Projects within the 5th Field Upper Yakima River Watershed

Impact Type	Alt. 1[a]		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th
Summit-at-Snoqualmie Projects										
Long-Term Impacts	666.72	0.90	787.72	1.06	758.72	1.02	742.88	1.00	778.90	1.05
Short-Term Impacts	0	0	37.30	0.05	36.45	0.05	34.51	0.05	37.03	0.05
Impacts Not Associated with The Summit-at-Snoqualmie										
Long-Term Impacts	50.90	0.07	50.90	0.07	50.90	0.07	50.90	0.07	50.90	0.07
Short-Term Impacts	2126.34	2.86	2126.34	2.86	2126.34	2.86	2126.34	2.86	2126.34	2.86
Total Long-Term and Short-Term Impacts	2177.24	2.92	2177.24	2.92	2177.24	2.92	2177.24	2.92	2177.24	2.92
Beneficial Impacts	2023.12	2.72	2023.12	2.72	2023.12	2.72	2023.12	2.72	2023.12	2.72
Total Cumulative Effects	**2843.96**	**3.82**	**3002.25**	**4.03**	**2972.40**	**3.99**	**2954.63**	**3.97**	**2993.17**	**4.02**

[a] The impacts associated with ongoing, maintenance related activities at the Summit at Snoqualmie are displayed in Alternative 1 (the No Action Alternative), since these activities would occur under all alternatives, they have been added to the impacts for the Action Alternatives.

4.5.7.2 South Fork Snoqualmie River Watershed

Projects Associated with The Summit-at-Snoqualmie

Cumulative effects on the vegetation resources in the S.F. Snoqualmie Watershed would be similar to those described for the U. Yakima Watershed, with the additional site-specific impacts associated with replacing the Alpental footbridge. These projects are of small enough size that any short-term loss of vegetation that could occur during construction would not be measurable at the larger scale. Beneficial impacts from culvert replacements would occur over time, assuming riparian vegetation would be replanted as part of the project.

Clearing of vegetation for the Summit at Snoqualmie's MDP would likely have little cumulative effects to vegetation. The percentage of modified and developed vegetation would increase slightly under all Action

Alternatives, between 0.69 (Alternative 1) and 0.73 percent (Alternative 2 and Modified Alternative 5) of the entire watershed area (see Table 4.5.7-4). Proposed restoration and slope stabilization projects would benefit vegetation communities within the watershed.

Projects Not Associated with The Summit-at-Snoqualmie

Similar past impacts have occurred in the S.F. Snoqualmie Watershed as in the Yakima watershed. Timber harvest, transportation corridors, utility corridors, and development have removed forest vegetation or converted it to other modified conditions. Currently early, mid, and late-successional forest communities exist in the watershed as a result of these past actions. Implementation of the projects not associated with The Summit would result in a very small amount of vegetation associated with the FS Road 58 bridge replacement. This project would have a negligible amount of vegetation removed at the project site and the S.F. Snoqualmie Watershed scale. Much larger projects that would result in beneficial impacts are associated with potential land exchanges. The 6,798 acres of land received by the USFS in a land exchange would be managed as multi-age forest and would improve vegetation conditions in the long-term. Additional land that could be under USFS management would be managed to improve forest conditions.

Alternative 2 of the proposed MDP would result in approximately 75 acres of vegetation disturbance that would contribute to the loss of mature and immature forest, shrub, and herbaceous vegetation types in the watershed. Alternatives 3-5 would result in approximately 50-65 acres of disturbance. This amount of disturbance would be small compared to the larger watershed scale. Projects that propose to increase much larger acreages of land to be managed to multi-age or late-successional forest would result in beneficial impacts in the watershed relative to long-term removal of vegetation for development.

Table 4.5.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed On Vegetation

Project Name	Project Summary	Cumulative Effect on Vegetation
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last 5 years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately 2 per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	Approximately 0.01 acre of vegetation around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would likely be beneficial, as reduced sediment delivery and erosion would allow for maintenance and re-establishment of vegetation along streams. These culvert replacements would overlap spatially (at the site scale) and temporally with the MDP, and would, as a whole, improve the culvert conditions throughout the Study Area. As the culverts occupy several hundred square feet within the watershed, this project would directly contribute to improved sediment conditions downstream.

Table 4.5.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed On Vegetation

Project Name	Project Summary	Cumulative Effect on Vegetation
Alpental Covered Bridge Replacement	The existing covered footbridge at Alpental washed out during a storm in 2003. The Summit-at-Snoqualmie replaced the bridge in 2005.	No new permanent impacts occurred as the new bridge was placed within the footprint of the old bridge. Temporary soil disturbance occurred during construction and riparian vegetation was re-established in 2006. While the bridge replacement overlaps spatially with the MDP at the site scale, the re-establishment of riparian vegetation, and stabilization will not overlap in time with the MDP and therefore would not cumulatively affect vegetation communities.
Cave Ridge Land Donation	The Summit-at-Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	The land donation would overlap spatially (at the site and 5th field watershed scales) and temporally with the MDP. Up to 100 acres would be added to Wilderness, and the remainder would continue to be managed in its current unroaded character. This project would not cumulatively affect vegetation at the site or 5th field watershed scale.
Projects Not Associated with The Summit-at-Snoqualmie		
FS Road 58 Bridge Replacement	An existing steel bridge over the South Fork Snoqualmie River was replaced on Forest Service Road 58 due to structural problems. The new bridge was expanded from one to two lanes with upgraded load capacity. Construction of the bridge was completed in spring 2005.	Approximately 0.05 acre was graded to provide an expanded roadway approach. Bridge footings were installed below the ordinary high water mark and required temporary flow diversion structures to create a dry work zone. With completion of the project in 2005, the bridge replacement does not overlap with the MDP in either space or time. Thus the bridge replacement would not cumulatively affect vegetation at the 5th field scale.
Huckleberry Land Exchange	Exchange of NFSL for Weyerhaeuser Lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	Approximately 6,798 acres of Weyerhaeuser land was received by the Forest Service. Approximately 702 acres are managed as Late Successional Reserves. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP, resulting in cumulative benefits to vegetation communities under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions contribute to a cumulative improvement in vegetation communities at the 5th field scale.

Table 4.5.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed On Vegetation

Project Name	Project Summary	Cumulative Effect on Vegetation
WSDOT 1-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical deicers to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile is applied to I-90 within the Snoqualmie Pass area.	Approximately 294 tons of sand reach the South Fork Snoqualmie River each year from I-90 sanding operations. I-90 Maintenance would overlap with the MDP in both space and time at both the site and 5th field scale. Increases in detrimental soil conditions and sediment yield under the Action Alternatives (Alternative 2 being the largest impact and Alternative 4 being the lowest of the Action Alternatives) would cumulatively affect soil productivity and establishment/maintenance of vegetation. Chemical de-icing may affect roadside vegetation if localized concentrations exceed plant tolerance, although such de-icing has been successfully implemented in the MBSNF and OWNF.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The recent purchase of Section 19 of Township 22N Range 11E occurs within portions of the South Fork Snoqualmie River Watershed, and its management overlaps spatially (in the 5th field) and temporally with the MDP. These lands will be allocated to Late Successional Reserve. Coupled with other land acquisitions in the Snoqualmie Pass area, cumulative vegetation and habitat connectivity conditions would improve at the 5th field scale, with a greater improvement under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation).
U.S. West Telephone line	Installation of an underground telephone line in the I-90 corridor	Temporary impacts to sediment regime occurred during installation of an underground line, which created disturbance to an already modified soil profile in the road prism. This project is assumed to have been stabilized as of 2005, and therefore does not overlap spatially or temporally with any projected vegetation impacts under the MDP.
WSDOT road de-icing	Application of sand and chemical deicers to roadway surfaces	Deicing of roadways would overlap spatially and temporally with the MDP at the site and 5th field scales. Coupled with the Action Alternatives and other road maintenance projects, this project could affect soils and therefore vegetation. Impacts to vegetation communities could result due to road deicing, if localized concentrations exceed plant tolerance, although deicing has been successfully implemented in the MBSNF and OWNF.
BPA Proposed Additional Power Lines	Supplemental DEIS to examine development of an additional powerline. Options include adding lines to existing towers or adding new towers.	The construction of additional power lines would overlap spatially (in the 5th field) and temporally with the MDP. This project, if tree clearing is required to construct new towers, coupled with the Action Alternatives, would result in cumulative effects to vegetation communities.

Table 4.5.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed On Vegetation

Project Name	Project Summary	Cumulative Effect on Vegetation
McClellan Butte Trail Reconstruction Project	The project will relocate approximately 1.5 miles of trail to newly constructed trail orl old road bed, abandon 1.5 miles of trail, and rehabilitate tread, drainage and switchbacks as required along the remainder of the 4.4-mile trail.	Temporary impacts along 5.9 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected vegetation impacts under the MDP.
Bandera Mountain/Mason Lake Trail Relocation Project	Project reorganized trail access to Mason Lake and Bandera Mountain in order to minimize social and resource impacts associated with the existing trails. The project involved construction of 1.5 miles of new trail, reconstructing 2.0 miles of existing trail and decommissioning 2.3 miles of existing trail.	Temporary impacts along 3.5 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected vegetation impacts under the MDP.
High Lakes Trail #1012 and Snow Lake Trail #1013 Reconstruction	This project repaired seven switchbacks on the Snow Lake Trail and reconstructed 2 miles on the High Lakes Trail from Snow to Gem Lake.	Temporary impacts along 3.5 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected vegetation impacts under the MDP.
South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project	Reduce the maintenance level (ML) on 11 roads (26.3 miles). 19.4 miles would be reduced to ML 1 (closed to motorized access) and utilized as loop and destination trail routes; 2.7 miles would be closed - placed in storage for future forest management; 1.1 miles would be removed from the transportation system and converted to trail; approximately 22.2 miles of spur roads mostly associated with roads proposed for reduction to ML 1 would be closed and removed from the Forest Road Transportation System.	The road decommissioning and maintenance level reductions would overlap spatially (in the 5th field) and temporally with the MDP. Coupled with the Implementation, Restoration, Operation, and Monitoring Plan (see Appendix F), the South Fork Access and Travel Management Plan and other road management projects, this project would result in cumulative benefits to vegetation communities and soil conditions at the 5th field scale.

Table 4.5.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed On Vegetation

Project Name	Project Summary	Cumulative Effect on Vegetation
Denny Salvage	This project would salvage approximately 50 mbf of windblown trees utilizing a ground based logging system. All undamaged trees with secure root systems would be left.	The salvage of approximately 50 mbf would overlap spatially (in the 5th field) and temporally with the MDP. Short-term impacts to vegetation communities during the salvage would occur due to tree removal and logging equipment. The stabilization of the salvage area would overlap in time with the implementation of the MDP at the 5th field scale. When combined with the Implementation, Operations, Restoration, and Monitoring Plan under the Action Alternatives, revegetation of the salvage area would cumulatively add to beneficial impacts to vegetation communities.
Annual Road Maintenance	Brushing/blading of roads on a rotating schedule as funds allow. Includes roads 55, 5510, 58, and road 9030 and 9031 systems.	Brusing and blading of roads would overlap spatially (at the 5th field) and temporally with the MDP. However, no impacts to vegetation are expected as maintenance would occur along existing roads where the vegetation community has previously been altered during the initial road construction.
Road 9020 ERFO Repair	The project proposes to either replace the culvert at Alice Creek or reduce the ML of Road 9020 pas Alice Creek to 1.	The replacement of a culvert or closure of the road to motorized access would overlap spatially (at the 5th field) and temporally with the MDP. If the road is decommissioned, this project would result in an improvement in vegetation communities surrounding the road. If the culvert is replaced, this project would result in temporary impacts to riparian vegetation. Long-term impacts of the culvert replacement would likely be beneficial, as reduced sediment delivery and erosion would allow for maintenance and re-establishment of vegetation along streams.
I-90 Corridor Thin	The project involves commercially thinning approximately 338 acres in the I-90 Corridor. About 4.3 mmbf would be thinned from 14 units.	The thinning of approximately 338 acres would overlap spatially (in the 5th field) and temporally with the MDP. The thinning project would result in short-term impacts to vegetation communities.
Snoqualmie Pass Utility District Permit Amendment	The project would extend water and sewer lines along Forest Service Road 4832 from the I-90 Hyak interchange for approximately 3,000 feet. The new lines would stop before reaching Gold Creek. Lines would be laid within the existing road right of way.	Temporary impacts from extension of water and sewer lines within the previously disturbed soils of the road prism would overlap spatially (in the 5th field) and temporally with the MDP. No impacts to vegetation communities are expected due to this project, because construction activities will take place within the existing road prism at the 5th field scale.

Table 4.5.7-3:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed On Vegetation

Project Name	Project Summary	Cumulative Effect on Vegetation
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	The construction of a new trail and trailhead parking would overlap spatially (in the 5th field) and temporally with the MDP. Impacts to vegetation communities would result from trail, parking area construction, and new impervious surfaces. This project, coupled with the Action Alternatives, would result in impacts to vegetation communities and soil conditions due to clearing and modification of vegetation communities.

Table 4.5.7-4:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed On Vegetation

Impact Type	Alt. 1[a]		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th
Summit-at-Snoqualmie Projects										
Long-Term Impacts	203.73	0.69	228.41	0.77	223.54	0.76	227.33	0.77	228.47	0.77
Short-Term Impacts	0.00	0.00	14.17	0.05	5.95	0.02	14.00	0.05	14.09	0.05
Projects Not Associated with The Summit At Snoqualmie										
Long-Term Impacts[b]	0.26	0.00	0.26	0.00	0.26	0.00	0.26	0.00	0.26	0.00
Short-Term Impacts	346.21	1.17	346.21	1.17	346.21	1.17	346.21	1.17	346.21	1.17
Total Long-Term and Short-Term Impacts	346.47	1.17	346.47	1.17	346.47	1.17	346.47	1.17	346.47	1.17
Beneficial Impacts	7167.88	24.26	7167.88	24.26	7167.88	24.26	7167.88	24.26	7167.88	24.26
Total Cumulative Effects	**550.20**	**1.86**	**589.05**	**1.99**	**575.97**	**1.95**	**587.80**	**1.99**	**589.04**	**1.99**

[a] The impacts associated with ongoing, maintenance related activities at the Summit at Snoqualmie are displayed in Alternative 1 (the No Action Alternative), since these activities would occur under all alternatives, they have been added to the impacts for Alternatives 2 through 5.
[b] Long Term, but non-quantifiable, impacts occur to the watershed as a result of winter sanding and deicing operations on I-90.

4.5.8 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of vegetation resources are those that cannot be reversed. Irretrievable commitments of vegetation resources are those that are lost for a period of time and can be replaced over time. Implementation of the Proposed Action or of any of the Action Alternatives would result in the irretrievable commitment of approximately 148 (Alternative 4) to 197 acres (Alternative 2) of vegetated and non-vegetated landcover types (see Tables 4.5.2-1a through 4.5.2-1c) for the development develop ski trails and other facilities. Although the loss of forest vegetation would occur as ski trails are developed, forested habitats could reestablish if certain trails are closed and no longer used for skiing, or after the site is no longer used as a ski area. Replacement of immature forest could take up to 100 years

after a site is no longer used as a ski trail. Replacement of mature forest could take several hundred years after ski trails are no longer used. During the life of the ski trails and other facilities that replace native vegetation, the vegetation resource would be irretrievably lost. Upon closure of these ski trails and other facilities, it is possible that the areas could be reverted to a forest habitat type, thus the loss of forest under the Action Alternatives would be reversible.

4.6 WILDLIFE

This section describes the potential effects of the MDP alternatives on wildlife resources within the Study Area. The Study Area has been defined and used to quantitatively discuss impacts associated with each Action Alternative. Additional impacts are qualitatively discussed beyond the Study Area boundary, and within the larger South Fork Snoqualmie and Upper Yakima watersheds. This is done to address certain aspects of wildlife such as habitat connectivity that are better analyzed beyond the context of the Study Area. The quantitative impact analysis is based on a GIS database analysis comparing vegetation types between Alternatives.

A description of the existing wildlife, wildlife habitat, and wildlife habitat connectivity conditions within the Study Area is provided in Section 3.6 - Wildlife. The MBSNF and OWNF *Land and Resource Management Plans, as Amended*, direct that the existing conditions are the basis by which management actions are evaluated.

Issues addressed in this section include:

- Loss and or conversion of wildlife habitat;
- Disturbance to wildlife from noise, human activity (summer and winter), and night lighting;
- Impacts to wildlife habitat connectivity.

Cumulative effects are the combined effects of all direct and indirect impacts with detrimental and beneficial effects identified not only within the Study Area, but the entire Upper Yakima River and South Fork Snoqualmie River watersheds. Cumulative effects for wildlife will be discussed in Section 4.6.7 – Cumulative Effects.

4.6.1 Impact Mechanisms

The physical actions associated with any MDP project that results in impacts on wildlife or wildlife habitat are referred to as impact mechanisms. Impacts can be classified and discussed in many different ways. For the purposes of this EIS, impacts to wildlife will be discussed in terms of direct versus indirect and short versus long-term as defined in Section 4.0.1 – Definition of Impacts. Finally, MDP impacts can be evaluated at a larger scale (watershed), incorporating the incremental impacts of other past, present, and reasonably foreseeable projects through a cumulative effects analysis.

Activities leading to direct and indirect impacts to wildlife, wildlife habitat, and wildlife habitat connectivity include the following:

Direct

Implementation of the Action Alternatives would result in direct impacts, both long-term and short-term, to wildlife and wildlife habitat. These impacts include permanent and temporary habitat loss, conversion

of habitat from one type to another, habitat fragmentation, and disturbance to wildlife. Direct impacts to wildlife or wildlife habitat would result from the following proposed MDP actions:

- Road and parking lot construction.
- Building construction.
- Chairlift terminal construction and tower placement.
- Clearing with grading for lifts and ski trails.
- Clearing without grading for lifts and ski trails.
- Tree removal to create gladed ski trails.
- Bridge construction, particularly placement of footings.
- Utility line installation.
- Increase in area illuminated by night lighting.

Direct beneficial impacts include those restoration projects that reduce habitat fragmentation such as decommissioning and revegetating roads or planting trees along streams to improve riparian conditions. Revegetating ski trails with clusters of trees may also provide some benefit to smaller wildlife species such as birds and small mammals as resting or foraging habitat. There would be some time lag before these benefits would occur due to the time needed for trees and other vegetation to grow at the revegetation sites.

Indirect

Indirect impacts to wildlife and wildlife habitat potentially occurring as a result of MDP implementation include a potential increase in wind-throw leading to a potential increase in CWD (depending on how wind-throw is treated) and a potential decrease in large mature trees or snags; a decrease in the number of snags and dead or broken-topped trees; and a change in the native plant communities in the Study Area due to potential introduction of non-native plant species. MDP components potentially causing these types of impacts include:

- Road and parking lot construction.
- Clearing with grading for lifts and ski trails.
- Clearing without grading for lifts and ski trails.
- Tree removal to create gladed ski trails.
- Utility line installation.

Short and long-term impacts to wildlife and wildlife habitat include the following:

Short-Term

Short-term impacts include temporary habitat loss resulting from ground disturbing activities in areas which would subsequently be allowed to revegetate or would be revegetated with native plant species. Short-term impacts would also include temporary noise disturbance from construction activities. All previously listed activities have the potential to cause temporary noise disturbance. MDP components potentially resulting in short-term impacts to wildlife habitat include:

- Vegetation disturbance in buffer areas of road, parking lot, chairlift, and building construction.
- Clearing with grading for lifts and ski trails within areas containing modified herbaceous habitat.
- Clearing without grading for lifts and ski trails within areas containing modified herbaceous habitat.
- Utility line installation.

Long-Term

Long-term impacts include 1) the permanent loss or conversion of wildlife habitat, 2) fragmentation of wildlife habitat resulting in decreased connectivity and a decrease in travel habitat effectiveness; and 3) increased human use on a year-round basis making the habitat in the area less suitable for species that are sensitive to human presence. Long-term impacts on wildlife or wildlife habitat would result from the following proposed MDP actions:

- Road and parking lot construction.
- Building construction.
- Chairlift terminal construction and tower placement.
- Clearing with grading for lifts and ski trails.
- Clearing without grading for lifts and ski trails.
- Tree removal to create gladed ski trails.
- Bridge construction, particularly placement of footings.
- Utility line installation.
- Increase in area illuminated by night lighting.
- Disturbance to wildlife and habitat from operation and maintenance of new ski facilities during the permit period.

4.6.2 Impacts – Alternative 1 (No Action Alternative)

Under Alternative 1, there would be no effects on wildlife or wildlife habitat resulting from the construction of new facilities, however existing impacts to wildlife and wildlife habitat would continue and are summarized in this section.

The following sections describe impacts in the Study Area since habitats described in Section 3.6 are common to both the S.F. Snoqualmie and U. Yakima watersheds. However, the impact analysis does identify specific impacts in the two different watersheds as appropriate to help display the distribution of and impacts to the affected habitats.

4.6.2.1 Wildlife Habitats and Associated Species

Under the No Action Alternative, wildlife habitat conditions in the Study Area would continue as described in Section 3.6 - Wildlife, with changes in vegetation being driven primarily by natural causes. On public land, the amount and distribution of mature forest would continue but with occasional changes possible from wind-throw, avalanche, or wildfire. Mature forest on public lands would continue to be managed for late successional habitat and for habitat connectivity. No new impacts would occur within the mature forest habitat in Section 16 (Summit East). The existing crossover and other ski trails would remain in their current location and trail maintenance in forest habitat would continue. Any potential increases in disturbance to wildlife would be limited to increased use of existing facilities. Immature forest would continue to move toward mature forest, however over the life of the 10-year planning period, immature forest would remain in an immature stage.

Under Alternative 1, habitat within Riparian Buffers on public lands would continue to be managed according to the Standards and Guidelines for Riparian Buffers in the Forest Plan (USDA and USDI 1994) and habitat within Riparian Buffers on private lands would continue to be managed per King County or Kittitas County Code depending on location. There would be no increase in area included in Riparian Buffers under this Alternative and only previously approved restoration projects would occur under Alternative 1. Aquatic habitats would also remain largely unchanged under this Alternative. Parking lots would remain unpaved and the potential contribution of sediment to streams and wetlands in the Study Area would continue.

Cliff and talus habitat would remain unchanged under Alternative 1. The potential for disturbance impacts to species, particularly mountain goats, associated with this habitat type would continue. Any increase in disturbance to these species would occur as a result of increased use of existing facilities. There would be no change in herbaceous and shrub habitats under this Alternative.

Habitat for generalist species would also remain largely unchanged, with natural processes driving habitat changes. Potential disturbance from ongoing maintenance activities would continue in currently developed areas without seasonal restrictions, as would use of the current mountain bike trail system.

4.6.2.2 Habitat Connectivity

Under Alternative 1, existing habitat connectivity would be maintained, with no changes in the amount of connective habitat in Section 16 (Summit East) and no changes in either canopy cover or understory cover in this area except those caused by natural processes. Potential disturbance impacts from night lighting and grooming activities would continue in areas currently affected. Interstate 90 would continue to bisect connectivity habitat and to limit north-south movement of animals in the Snoqualmie Pass area.

4.6.2.3 Special Status Species

Table 4.6.3-8 presents the determination of effect to special status species potentially occurring within The Summit-at-Snoqualmie Study Area under all alternatives. A detailed analysis of potential impacts to these species can be found in the *Wildlife Resources Report for The Summit-at-Snoqualmie MDP* located in Appendix D.

4.6.3 Impacts – Alternative 2 (Proposed Action)

Projects associated with implementation of Alternative 2 include all projects components discussed in Section 2.3.3 – Alternative 2 - Proposed Action. The projects associated with this alternative are presented in Figures 2.3.3-1, Alternative 2 Proposed Conditions – The Summit and 2.3.3-2, Alternative 2 Proposed Conditions - Alpental.

4.6.3.1 Wildlife Habitats and Associated Species

Under Alternative 2, there would be changes in the amount of all vegetation types in the Study Area. Tables 4.6.3-1A, B, and C, presented below, show the amount of each vegetation and habitat type that would *remain* under each Alternative following implementation. These tables separate acreages in the MDP area from acreages in the Mill Creek area that would be donated to the Forest Service under Alternative 3 and Modified Alternative 5, and then provides a total of the MDP and donation parcel. For a breakdown of the actual amount of *impact* acres by MDP and the Mill Creek land donation parcel see Tables 4.5.2-1A, B, and C located in the Vegetation section.

Under this Alternative, there would be a loss of mature forest habitat and an increase in modified herbaceous and shrub habitats. Alternative 2 would result in the greatest change in vegetative types of all the action Alternatives. Vegetation types listed in Tables 4.6.3-1A, B, and C, are discrete types with the exception of riparian habitat which includes the subset of the vegetation types that occur only within either Riparian Reserves on public land or Riparian Buffers on private land. Hereafter, Riparian Reserves (public land) and Riparian Buffers (private land) will be referred to collectively as Riparian Buffers.

Table 4.6.3-1A:
MDP Habitat Types within The Summit-at-Snoqualmie Study Area by Alternative (acres)

Habitat Type	Alt 1 Existing (acres)	Alt 2 Impacts (acres)	Alt 3 Impacts (acres)	Alt 4 Impacts (acres)	Mod Alt 5 Impacts (acres)
Forested Habitat (acres)					
Western hemlock, mature	27.16	27.14	27.14	27.14	27.14
Western hemlock, immature	96.18	96.03	95.94	96.06	95.96
Mountain hemlock, mature	224.61	218.85	223.74	222.31	221.17
Pacific silver fir, mature	756.40	716.90	729.65	743.06	727.13
Pacific silver fir, immature/sapling	254.31	249.93	262.58	260.20	254.24
Riparian Habitat[a] (acres)					
Western hemlock, mature	15.44	15.43	15.44	15.43	15.44
Western hemlock, immature	16.36	16.30	16.23	16.30	16.23
Mountain hemlock, mature	23.87	22.16	23.65	23.16	23.07
Pacific silver fir, mature	273.16	253.37	258.38	265.75	258.79
Pacific silver fir, immature/sapling	29.49	28.59	36.78	32.22	30.39
Shrub, natural	42.91	41.02	41.10	42.06	40.72
Shrub, modified	101.24	105.55	96.67	95.91	100.85
Herbaceous, natural	13.77	13.19	13.55	13.69	13.62
Herbaceous, modified	146.29	157.70	144.75	150.51	146.43
Rock/Talus	13.48	14.01	15.67	14.01	15.38
Developed	28.80	35.57	33.94	33.84	35.27
Aquatic Habitats					
Ponds and Lakes	1.34	1.34	1.34	1.34	1.34
Wetlands	72.29	70.89	70.85	70.96	70.87
Streams[b] (miles)	25.14	24.89	24.90	24.90	24.90
Cliff and Talus Habitat					
Rock/Talus	224.58	223.99	225.08	224.00	224.01
Herbaceous and Shrub Habitat					
Shrub, natural	103.12	101.13	101.22	102.17	100.84
Shrub, modified	326.55	341.08	318.46	322.68	332.79
Herbaceous, natural	14.77	14.15	14.53	14.69	14.58
Herbaceous, modified	415.73	441.64	435.75	421.06	433.96

[a] Includes wetland and lake landcover types.
[b] Includes jurisdictional streams.
Note: This table does not include the Mill Creek portion of the Study Area.

Table 4.6.3-1B:
Mill Creek Habitat Types within The Summit-at-Snoqualmie Study Area by Alternative (acres)

Habitat Type	Alt 1 Existing (acres)	Alt 2 Impacts (acres)	Alt 3 Impacts (acres)	Alt 4 Impacts (acres)	Mod Alt 5 Impacts (acres)
Forested Habitat (acres)					
Western hemlock, mature	20.55	20.55	20.55	20.55	20.55
Western hemlock, immature	0	0	0	0	0
Mountain hemlock, mature	0	0	0	0	0
Pacific silver fir, mature	24.39	24.39	24.39	24.39	24.39
Pacific silver fir, immature/sapling	265.58	265.58	265.58	265.58	265.58
Riparian Habitat[a] (acres)					
Western hemlock, mature	7.04	7.04	18.43	7.04	18.43
Western hemlock, immature	0	0	0	0	0
Mountain hemlock, mature	0	0	0	0	0
Pacific silver fir, mature	0.06	0.06	5.11	0.06	5.11
Pacific silver fir, immature/sapling	70.43	70.29	128.69	70.29	128.69
Shrub, natural	0.25	0.25	0.34	0.25	0.34
Shrub, modified	15.32	15.38	15.38	15.38	15.38
Herbaceous, natural	0.00	0.00	0.00	0.00	0.00
Herbaceous, modified	0.00	0.00	12.21	0.00	12.21
Rock/Talus	0.00	0.00	0.00	0.00	0.00
Developed	1.58	1.58	2.64	1.58	2.64
Aquatic Habitats					
Ponds and Lakes	0	0	0	0	0
Wetlands	0	0	0	0	0
Streams[b] (miles)	4.33	4.33	4.33	4.33	4.33
Cliff and Talus Habitat					
Rock/Talus	10.68	10.68	10.68	10.68	10.68
Herbaceous and Shrub Habitat					
Shrub, natural	4.87	4.87	4.87	4.87	4.87
Shrub, modified	15.32	15.38	15.38	15.38	15.38
Herbaceous, natural	0.00	0.00	0.00	0.00	0.00
Herbaceous, modified	18.24	18.32	18.32	18.32	18.32

[a] Includes wetland and lake landcover types.
[b] Includes jurisdictional streams.
Note: This table includes only the Mill Creek portion of the Study Area.

Table 4.6.3-1C:
Total Habitat Types within The Summit-at-Snoqualmie Study Area by Alternative (acres)

Habitat Type	Alt 1 Existing (acres)	Alt 2 Impacts (acres)	Alt 3 Impacts (acres)	Alt 4 Impacts (acres)	Mod Alt 5 Impacts (acres)
Forested Habitat (acres)					
Western hemlock, mature	47.71	47.69	47.69	47.69	47.69
Western hemlock, immature	96.18	96.03	95.94	96.06	95.96
Mountain hemlock, mature	224.61	218.85	223.74	222.31	221.17
Pacific silver fir, mature	780.79	741.29	754.04	767.45	751.52
Pacific silver fir, immature/sapling	519.89	515.51	528.16	525.78	519.82
Riparian Habitat[a] (acres)					
Western hemlock, mature	22.48	22.47	33.87	22.47	33.87
Western hemlock, immature	16.36	16.3	16.23	16.3	16.23
Mountain hemlock, mature	23.87	22.16	23.65	23.16	23.07
Pacific silver fir, mature	273.22	253.43	263.49	265.81	263.90
Pacific silver fir, immature/sapling	99.92	98.88	165.47	102.51	159.08
Shrub, natural	43.16	41.27	41.44	42.31	41.06
Shrub, modified	116.56	120.93	112.05	111.29	116.23
Herbaceous, natural	13.77	13.19	13.55	13.69	13.62
Herbaceous, modified	146.29	157.7	156.96	150.51	158.64
Rock/Talus	13.48	14.01	15.67	14.01	15.38
Developed	30.38	37.15	36.58	35.42	37.91
Aquatic Habitats					
Ponds and Lakes	1.34	1.34	1.34	1.34	1.34
Wetlands	72.29	70.89	70.85	70.96	70.87
Streams[b] (miles)	29.47	29.22	29.23	29.23	29.23
Cliff and Talus Habitat					
Rock/Talus	235.26	234.67	235.76	234.68	234.69
Herbaceous and Shrub Habitat					
Shrub, natural	107.99	106	106.09	107.04	105.71
Shrub, modified	341.87	356.46	333.84	338.06	348.17
Herbaceous, natural	14.77	14.15	14.53	14.69	14.58
Herbaceous, modified	433.97	459.96	454.07	439.38	452.28

[a] Includes wetland and lake landcover types.
[b] Includes jurisdictional streams.
Note: This table includes the Mill Creek portion of the Study Area.

Forested Habitat and Associated Species

Impacts to mature forest habitat would be greatest under Alternative 2 compared to the other Action Alternatives. Mature forest would be cleared at Alpental for construction of the proposed new *Internationale* chairlift and the realignment of the existing *Sessel* and *St. Bernard* chairlifts; at Summit Central in the Silver Fir pod, at the base of *Easy Street* chairlift, and in the area of the expanded Silver Fir parking lot 2; and at Summit East for construction of the proposed *Creek Run* and *Rampart* chairlifts and associated trails (see Figures 2.3.3-1, Alternative 2 Proposed Conditions – The Summit and 2.3.3-2, Alternative 2 Proposed Conditions - Alpental).

Under this Alternative the amount of mature forest habitat in the Study Area would be reduced from 1,053.11 acres to 1,007.83 acres for a loss of 45.28 acres. The greatest amount of mature forest habitat removal would occur within the mature forest in Section 16 (Summit East). Important functions of mature forest that may be impacted include CWD and snag recruitment, habitat for species described in Chapter 3, and habitat connectivity.

Under this Alternative, 2.75 acres of mature forest understory would be modified by installation of utilities. Another 4.36 acres of mature forest clearing would occur in areas adjacent to buildings, parking lots, roads, and lift terminals. These areas would be allowed to revegetate. However revegetation of mature forest is a long-term process and this would not occur within the timeframe of the MDP. Options for reducing impacts to mature forest adjacent to construction areas would be identified and implemented where possible, as described in Other Management Provision OMP39 (see Table 2.4-2).

In addition to mature forest clearing, there would be 9.10 acres of glading under Alternative 2. Glading would be designed to maintain over-story canopy at a minimum of 70 percent in areas where it is currently above 70 percent. No reduction in mature forest over-story canopy would occur in areas where canopy coverage is currently below 70 percent. Glading would remove under-story trees and shrubs and would change the conditions within these areas although they would still be considered mature forest habitat.

Removal of individual trees in mature forest for glading would reduce the basal area of mature trees in the Study Area. Data on existing basal area was not collected during field surveys for this project, however data on canopy cover was collected and is used in this analysis as a threshold, with glading that maintains a canopy cover of 70 percent or greater in areas that currently have canopy cover of 70 or greater and that maintains existing canopy cover in areas canopy cover is less than 70 percent being defined as being neutral or beneficial to mature forest.

Clearing of mature forest would reduce the number of snags currently available and would reduce the area available for short-term snag and CWD recruitment. Clearing of immature forest would reduce the area available for long-term snag and CWD recruitment in the future. In order to minimize impacts to CWD recruitment, Other Management Provision OMP40 (see Table 2.4-2), would be implemented.

Clearing of mature forest for ski trails, lift alignments, parking lots, and roads would affect not only the area cleared but also a parallel band of remaining forest edge. As part of operational and maintenance activities, hazard trees would likely be felled in the adjoining forest surrounding the facilities. This would increase the long-term impacts on snag recruitment by removing hazard trees that could potentially develop into snags. The impact would be roughly proportional to the acreage of mature forest cleared under this Alternative. Where feasible, hazard trees would be felled into the adjacent stand and left on the ground, contributing to CWD. Clearing of mature forest would also result in increased edge habitat and may lead to indirect impacts of increased wind-throw.

Impacts to forest habitat would result in impacts to the species associated with the different forest types listed in Table 4.6.3-2.

Table 4.6.3-2:
Habitat by Alternative for Species Having a Primary Association with Forested Habitat in the Study Area

Forested Habitat Type	Species	Alt 1 Existing (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Mod Alt 5 (acres)
Mature western hemlock and Pacific silver fir	Northern spotted owl[a] Marbled murrelet[b] Fisher[c]	828.50	788.98	801.73	815.14	799.21
Mature western hemlock, Pacific silver fir, and mountain hemlock	Great gray owl[b] Pileated woodpecker[a] Primary cavity excavators[a,c] Olive-sided flycatcher[a] Northern goshawk[a] Silver haired bat[c] Hoary bat[c] Long-eared myotis[c] Long-legged myotis[c] Yuma myotis[c] Pacific western big-eared bat[c] Marten[a] Terrestrial mollusks[b] Neotropical migratory birds (30 species – see Table 3.6.1-5)	1,053.11	1,007.83	1,025.46	1,037.45	1,020.38
Immature mixed conifer- Pacific silver fir; Pacific silver fir-sapling; western hemlock	Neotropical migratory birds (11 species – see Table 3.6.1-5)	616.07	611.54	624.10	621.84	615.79

[a] Documented
[b] Surveyed and not found
[c] Not documented
Note: This table includes the Mill Creek portion of the Study Area.

Under Alternative 2, habitat for northern spotted owl, marbled murrelet, and fisher would be reduced from 828.50 acres to 788.98 acres for a net loss of approximately 39 acres, the most of all the Action Alternatives.

Of the 39 acres of impact, 3 acres would occur on public land and less than 1 acre on private land in the S.F. Snoqualmie Watershed, and 28 acres would occur on public land and 8 acres would occur on private land in the U. Yakima Watershed. In addition, approximately 8 acres of mature Pacific silver fir would be gladed on Public land in the U. Yakima Watershed.

Loss of habitat for these species would occur primarily as a result of the permanent loss of mature forest in Section 16 (Summit East) from construction of the *Creek Run* and *Rampart* chairlifts and associated ski trails. Mature forest habitat would also be removed in the *Silver Fir* pod of Summit Central, and for the new *Internationale* chairlift and the realignment of the existing *Sessel* chairlift at Alpental. Construction treatments for these ski trails would include glading, clearing without grading, and clearing with grading as shown on Figures 2.3.3-1, Alternative 2 Proposed Conditions – The Summit and 2.3.3-2, Alternative 2 Proposed Conditions - Alpental and described in Section 2.3.1.3 - Construction. In addition, see Figures 4.5.1-1, Impacts by Soil Erosion Potential – Alternative 2 – The Summit and 4.5.1-2, Impacts by Soil Erosion Potential – Alternative 2 – Alpental, which depict impacts by vegetation cover for Alternative 2.

Potential impacts to northern spotted owls would include a reduction in the amount of foraging and dispersal habitat available as a result of full clearing, and potential disturbance to foraging or dispersing individuals from construction, operations, and maintenance activities. Mature forest in Section 16 between Summit East and Summit Central, particularly the area north of the proposed Creek Run chairlift and south of the cleared *Silver Fir* ski trails, is a large patch of relatively contiguous forest and has been identified as important to habitat connectivity for spotted owls (USFS and USFWS 1997). Potential impacts to habitat connectivity are described in Section 4.6.3.2 – Habitat Connectivity. As described in Section 3.6.1 – Summary of Existing Conditions, this area represents foraging and dispersal habitat, and historically had been considered nesting habitat (MBSNF 1995). No spotted owls were found in Section 16 (Summit East) or the rest of the Study Area during surveys conducted during 1994, 1995, 2001, 2002 and 2007. The nearest known nesting pair was found south of Mt Catherine, approximately 1 mile from the Study Area boundary (WDFW 2002, Sovern 2004 pers. comm.). Full clearing of ski trails would reduce the amount of foraging and dispersal habitat available in the area and would fragment existing habitat, creating increased edge habitat. This would occur in the U. Yakima Watershed in Section 16 (Summit East).

Clearing of mature forest at Summit Central and Alpental would remove portions of small islands of forest in areas that are currently highly fragmented. This clearing would reduce the overall amount of mature forest available, but not interior forest. While these islands of mature trees are not within the area of primary focus for habitat connectivity in the Study Area they do provide potential stepping stones for

forest-dependent species to move through the Study Area. Reducing the size and increasing the distance between these islands may increase the risk of predation for species moving between the islands.

Construction of ski trails in this area would also reduce the amount of foraging habitat available and may reduce the effectiveness of foraging habitat by introducing increased amounts of human activity in the area. Night lighting on trails in the *Silver Fir* and *Rampart* pods, and the associated increase in human activity in these areas during times when owls are actively hunting, may reduce the amount of area suitable for spotted owl foraging in this area. Directional lighting would be employed to reduce impacts to nocturnal species in forested areas adjacent to ski trails with night lighting, as described in Other Management Provision OMP42 (see Table 2.4-2). Grooming of these and Creek Run trails may also disturb spotted owl foraging behavior in this area.

In order to avoid impacts to spotted owls potentially nesting in areas adjacent to the Study Area, all helicopter access and egress routes would be planned such that they avoid passing over known and historic nest sites outside of the Study Area at an altitude of less than 250 feet above the canopy, as described in Other Management Provision OMP41 (see Table 2.4-2).

Gladed areas are not expected to alter the suitability of foraging habitat since ski trail glading has been designed to retain either 70 percent canopy cover in areas where canopy cover currently exceeds this level or maintain existing levels of canopy cover.

The Study Area is not located within designated critical habitat for the northern spotted owl; therefore there would be no impacts to designated critical habitat for this species under Alternative 2.

Mature forest in the western hemlock and Pacific silver fir zone may technically provide nesting habitat for marbled murrelets but is highly unlikely to do so, as described in Section 3.6.1. Surveys conducted in potential nesting habitat for this species in 1994, 1995, 2001, 2002 and 2007 found no murrelets in the Study Area. As a result, potential habitat in the Study Area has a status of probable absence, with impacts to marbled murrelets unlikely.

The Study Area is not located within designated critical habitat for the marbled murrelet; therefore there would be no impacts to designated critical habitat for this species under Alternative 2. Clearing of mature western hemlock and Pacific silver fir forest would also reduce the amount of habitat available in the Study Area for fisher. As mentioned in Section 3.6.1 fishers are considered to be rare in Washington, and may be extirpated. Because of the relatively high elevation, the Snoqualmie Pass area would most likely be used as travel habitat for fishers, the impacts to which are described in Section 4.6.3.2.

Under Alternative 2, the amount of mature western hemlock, Pacific silver fir, and mountain hemlock forest combined in the Study Area would go from 1,053.11 acres to 1,007.83 acres for a net loss of approximately 45 acres, the most of all Action Alternatives. Of the approximately 45 acres, 5 acres would occur on public land and less than 1 acre would occur on private land in the S.F. Snoqualmie Watershed,

and 32 acres would occur on public land and 8 acres would occur on private land in the U. Yakima Watershed. In addition, approximately 8 acres of mature Pacific silver fir and 1 acre of mature mountain hemlock forest would be gladed under this Alternative. These forest types combined provide potential habitat for 46 special status species known or potentially occurring within the Study Area, as shown in Table 4.6.3-2.

Surveys for great gray owls were conducted within suitable habitat in the Study Area in 1999 and 2000 with none found. For this reason, great gray owls are not expected to occur in the Study Area and there would be no impacts to this species.

Under Alternative 2, long-term impacts to pileated woodpecker and other primary cavity excavators would include the permanent removal of mature forest, which would reduce the amount of current habitat available for these species. This would result in a long-term reduction in the availability of snags both through the reduction in the amount of recruitment habitat for snags and from increasing the amount of area subject to hazard tree management. Habitat would be permanently lost within areas of full clearing with or without grading. Gladed areas would retain some habitat characteristics, particularly connective habitat between ungladed areas, however since these areas would be managed as gladed ski trails, hazard tree management would be required with snags removed on a regular basis. Snags that are felled and left in place would lose value as nesting habitat for primary cavity excavators and for secondary cavity nesters, but they would retain value as foraging habitat for pileated woodpeckers and contribute to CWD in the area. Implementation of Other Management Provision OMP40 (see Table 2.4-2) would reduce impacts to snags and CWD.

Direct impacts to nesting woodpeckers may occur if clearing were to occur during the nesting season. To avoid these impacts, clearing of potential nesting habitat for primary cavity excavators would occur in the late summer or fall, after the nesting season for these species, as described in Other Management Provision OMP43 (see Table 2.4-2).

Under Alternative 2, removal of mature forest habitat would also reduce the amount of nesting habitat available for olive-sided flycatchers in the Study Area. Potential direct impacts to olive-sided flycatchers include loss of nesting habitat and a localized reduction in the population. Loss of individual birds could occur during construction if vegetation was removed in suitable nesting habitat during the nesting season. Potential indirect impacts to olive-sided flycatchers may occur as a result of forest fragmentation, particularly in Section 16 (Summit East). Increased fragmentation may contribute to increased nest predation by jays attracted to the edge habitat. Olive-sided flycatchers generally produce eggs by mid-June; incubate eggs for 16 to 17 days, with the young fledging within 15 to19 days of hatching (Baicich and Harrison 1997). Other Management Provision OMP43 (see Table 2.4-2) requires clearing of forested habitat after August 1, to minimize potential impacts to nesting olive-sided flycatchers.

Although no northern goshawks were detected during surveys in 1995, it is possible that goshawks may have moved into the area since that time or may occupy habitat in the Study Area in the future. As a result, there is potential for nesting and foraging habitat to be removed, particularly in Section 16 (Summit East), from chairlift, ski trail and parking lot construction. Ski trail glading may result in a further reduction in nesting habitat since goshawks typically nest in the densest areas of a forest (Johnsgard 1990). Ski trail glading may provide an advantage for foraging goshawks, however, by removing under-story trees and shrubs used as cover by potential prey species. Goshawks have a relatively long nesting season, incubating eggs for up to 41 days and requiring 45 days for young to fledge. To avoid direct impacts to nesting goshawks, clearing or glading in mature forest habitat would occur after August 1, after the end of the nesting season, as described in Other Management Provision OMP43 (see Table 2.4-2).

Clearing of mature forest would impact habitat for six species of bats: silver-haired bat, hoary bat, long-eared myotis, long-legged myotis, Yuma myotis, and Pacific western (Townsend's) big-eared bat. Of these species, the silver-haired, long-eared myotis, and long-legged myotis are known to roost under loose tree bark, a characteristic of mature forest. These three species and the hoary bat also utilize snags as roosting sites. Areas of full clearing within mature forest habitat would result in a reduction in the amount of roosting habitat available for these species. Snags would also be removed from gladed areas and from mature forest stands along the edges of ski trails as a part of hazard tree management. Roosting habitat would therefore be reduced in these management areas. Construction of chairlifts and ski trails would increase the amount of edge habitat in the Study Area, thereby increasing the amount of potential foraging habitat for the Pacific western (Townsend's) big-eared bat. Clearing of mature forest may also reduce roosting but increase foraging habitat for Yuma myotis. Loss of snags within the Study Area would be minimized through implementation of Other Management Provision OMP39 (see Table 2.4-2).

American marten are known to use mature forest in the Study Area as described in Section 3.6.1. Clearing of mature forest would result in a decrease in the amount of denning, foraging, and travel habitat available for this species. Removal of snags in cleared areas, gladed areas, and in forested areas adjacent to new ski trails, roads, and parking lots would also reduce the amount of denning habitat. Impacts to travel habitat are discussed under “Habitat Connectivity”. Loss of snags within the Study Area would be minimized through implementation of Other Management Provision OMP39 (see Table 2.4-2).

As no listed terrestrial mollusks (see Section 3.6.1.5) have been documented within the Study Area, suitable habitat exists. Under Alternative 2, approximately 45 acres of mature forest habitat would be impacted. The removal of mature forest would decrease canopy closure and reduce potential recruitment of downed woody material. The retention of downed woody material as described in Other Management Provision OMP40 would minimize habitat impacts to mollusks.

Thirty species of neotropical migratory birds may occur in the mature forest habitat in the Study Area (see Table 3.6.1-5). Removal of forested habitat in the Study Area would result in a decrease in the amount of

nesting habitat available for these species. Forest fragmentation may also result in an increase in nest predation since nest predators such as jays are attracted to edge habitat. Five of these species (golden-crowned kinglet, Cassin's vireo, chipping sparrow, rufous hummingbird, and Wilson's warbler) have been identified as having declining populations (Andelman and Stock 1994) (see Table 3.6.1-5). Decreases in nesting habitat availability and increases in nest predation in the Study Area may incrementally contribute to these trends. Potential direct impacts to these species may occur as a result of clearing and construction activities during the nesting season, potentially resulting in nestling mortality. To minimize the potential for this to occur, clearing or glading in mature forest habitat would occur after August 1, after the end of the nesting season, as described in Other Management Provision OMP43 (see Table 2.4-2).

Eleven species of neotropical migratory birds potentially occur in the Study Area that are associated with immature forest. Clearing of this forest type would occur in the U. Yakima Watershed at Summit West, Summit Central, Summit East, and in the Mill Creek pod, as shown on Figures 2.3.3-1, Alternative 2 Proposed Conditions – The Summit. Reforestation, a component of the restoration plan, is also proposed throughout the Study Area, as shown in Figures 2.3.3-1, Alternative 2 Proposed Conditions – The Summit and 2.3.3-2, Alternative 2 Proposed Conditions – Alpental and described in Section 2.3.3.11 - Restoration. Clearing of immature forest for construction of MDP components and the eventual maturation over time of immature forest in revegetated areas would result in a reduction in the total amount of immature forest in the Study Area under Alternative 2 of 4.53 acres compared to current conditions.

The orange-crowned warbler has been identified as having a declining population trend (Andelman and Stock 1994) (see Table 3.6.1-5). Short-term decreases in nesting habitat availability for this species in the Study Area may incrementally contribute to this trend. Potential direct impacts to individuals of these species may occur as a result of clearing and construction activities during the nesting season, potentially resulting in nestling mortality. To minimize the potential for this to occur, clearing of immature forest habitat would occur after August 1 after the end of the nesting season, as described in Other Management Provision OMP43 (see Table 2.4-2). Conversion of 4.53 acres of immature forest habitat to modified herbaceous or developed would also result in a long-term reduction in the amount of habitat available for this species in the Study Area.

Riparian Habitat and Associated Species

For the purposes of this analysis, riparian habitat was mapped as occurring within Riparian Buffers on public land, as required under the Forest Plan (USDA and USDI 1994) and within stream buffers required by local ordinance on private land (Kittitas County Code 17A.07, King County Code 21A.24). Impacts to Riparian Buffers are depicted in Figures 4.3.1-3, Impacts to Riparian Conditions - Alternative 2 - The Summit and 4.3.1-4, Impacts to Riparian Conditions - Alternative 2 - Alpental.

The condition of Riparian Buffers varies within the Study Area, and they have been classified as being in a natural, modified, or developed condition. These conditions and the occurrence within the Study Area are described in detail in Section 3.3 and are summarized below.

Impacts to Riparian Buffers in a natural vegetation condition include all reserves covered in natural forest (including mature and second and third growth forests) and natural nonforest vegetation types. There are 435 acres of Riparian Buffers which accounts for approximately 54 percent of the total Riparian Buffer acreage within the Study Area.

Riparian Buffers in modified vegetation condition include all Riparian Buffers cleared by historic timber harvest and for ski area operations (*i.e.,* areas maintained in early-successional conditions of grassland or shrub cover). Some areas retain their original soils, but grading has occurred in other areas. Riparian Buffers in modified shrub and herbaceous vegetation equal 263 acres, approximately one-third of the total Riparian Buffers acreage within the Study Area.

Riparian Buffers in developed condition include all areas entirely or largely cleared of vegetation and include ski area access/maintenance roads, sections of SR906, parking lots, buildings, and maintenance areas. Such reserves may contain patches of grass, shrub, or trees, but pavement, gravel road surfaces, roofs, or similar surfaces cover most areas. The developed condition is present on about 30 acres, representing 4 percent of Riparian Buffers within the Study Area.

Under Alternative 2, there would be a reduction in both mature and immature forest habitat within Riparian Buffers and an increase in the amounts of modified shrub and modified herbaceous habitats (see Table 4.6.2-2). Impacts to Riparian buffers can be seen in Figures 4.3.1-3, Impacts to Riparian Conditions - Alternative 2 – The Summit and 4.3.1-4, Impacts to Riparian Conditions - Alternative 2 - Alpental.

Impacts to mature forest habitat in Riparian Buffers would be greatest under Alternative 2 compared to the other Action Alternatives. Mature forest in Riparian Buffers would primarily be cleared at Alpental for construction of the proposed new Internationale chairlift and the realignment of the existing Sessel and St. Bernard chairlifts and at Summit East for construction of the proposed Creek Run and Rampart chairlifts and associated trails. The amounts of modified shrub and herbaceous habitats would also increase as a result of new ski trail construction. Restoration of riparian habitat would also occur under this Alternative, as described in Section 2.3.3.11, in the vicinity of the existing tubing center at Summit Central and along Beaver Lake Creek at Summit West.

Impacts to riparian habitat would result in impacts to the species associated with this habitat type. Riparian habitat within the Study Area and the associated species are listed in Table 4.6.3-3. It is important to note that in Alternatives 3 and 5, which include the Mill Creek land donation, the resulting acreages of some Riparian Buffers would increase due to gains in Riparian Buffers from the donated land.

Table 4.6.3-3:
Habitat by Alternative for Species Having a Primary Association with Riparian Habitat in the Study Area

Species	Riparian Habitat Types[b]	Alt 1 Existing (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Mod Alt 5 (acres)
Bald eagle[a]	Mature conifer forest adjacent to large bodies of water (within Riparian Reserve of Lake Keechelus).	RR falls Outside of Study Area – There would be no impact.	RR falls Outside of Study Area – There would be no impact.	RR falls Outside of Study Area – There would be no impact.	RR falls Outside of Study Area – There would be no impact.	RR falls Outside of Study Area – There would be no impact.
Van dyke's salamander[a]	Riparian Buffers of streams, seeps and wetlands within mature western hemlock, mature Pacific silver fir, and mature mountain hemlock.	319.57	298.06	321.01	311.44	320.84
Harlequin duck[a]	Riparian Buffers of perennial streams within mature western hemlock, mature Pacific silver fir, and mature mountain hemlock.	68.82	62.70	63.25	63.37	62.75
Neotropical migratory birds	19 species (see Table 3.6.1-7)	n/a	n/a	n/a	n/a	n/a

[a] Not documented
[b] Resulting acreage may be greater than existing acreage because of additional gains of Riparian Buffers from the Mill Creek land donation which offset impacts within the MDP.
Note: This table includes the Mill Creek portion of the Study Area.

Because neotropical migratory birds associated with riparian habitat do not all utilize the same riparian habitat types, as shown in Table 3.6.1-8, the amount of habitat available for these species is not reported in Table 4.6.3-3.

As shown in Table 4.6.3-3, the Study Area is lacking habitat for bald eagles and they are not expected to regularly occur in the Study Area. For this reason, impacts to bald eagles are not expected to occur.

Under Alternative 2, the amount of habitat available for Van Dyke's salamander within the Study Area would be reduced from 319.57 acres to 298.06 acres for a net loss of approximately 22 acres, primarily associated with clearing of mature Pacific silver fir forest within Riparian Buffers.

Of the approximately 22 acres, 2 acres of clearing would occur on public land and less than 1 acre on private land in the S.F. Snoqualmie Watershed. In the U. Yakima Watershed, approximately 16 acres of clearing would occur on public land and 4 acres would occur on private land. In addition, there would also be approximately 2 acres of glading in mature Pacific silver fir forest within Riparian Buffers on public land in the U. Yakima Watershed.

Clearing of habitat would reduce the amount of habitat available for this species and would fragment existing habitat, creating additional edge and reducing the amount of interior forest habitat. Forest clearing can affect salamander habitat in adjacent stands by changing moisture and temperature regimes, changing hydrological and geomorphological processes, and reducing the recruitment potential for large down wood (Crisafulli 1999). Glading of mature forest may also alter habitat conditions for Van Dyke's salamander, by reducing canopy cover and reducing the potential for CWD recruitment. Impacts to Van Dyke's salamanders are unlikely since the species has a status of "not detected" within the areas surveyed.

Potential harlequin duck habitat in the Riparian Buffers is located approximately 50 feet either side of perennial streams, since foraging and nesting of this species is closely tied to the aquatic zone. Under Alternative 2 the amount of potential nesting habitat for harlequin duck within the Study Area would be reduced from 68.82 acres to 62.70 acres for a net loss of approximately 6 acres, primarily within mature Pacific silver fir forest on public land in the upper Yakima River subwatershed. Clearing of this forest type would reduce the amount of nesting habitat available for this species and clearing during the nesting season could lead to nest failure or mortality of individuals. Direct impacts to nesting harlequin ducks would be avoided through implementation of Other Management Provision OMP43 (see Table 2.4-2).

Nineteen species of neotropical migratory birds have a primary habitat association with riparian habitat. These species utilize a variety of habitat types within Riparian Buffers, including mature forest, immature forest, herbaceous, and cliff habitats (see Table 3.6.1-7). Under this Alternative, the amount of habitat for species utilizing mature forest, immature forest, and cliff habitat would be reduced (see Tables 4.6.3-1 a, b, and c), while the amount of habitat for species utilizing herbaceous vegetation types within Riparian Buffers would increase.

Potential impacts to forest-dependent birds would be as previously described under *Forested Habitats and Associated Species* and potential impacts to species associated with cliff or herbaceous habitat will be discussed in subsequent sections of this document. Of the species associated with riparian habitat, one species, the yellow warbler, has declining populations (Andelman and Stock 1994) (see Table 3.6.1-7). Because this species is primarily associated with riparian broadleaf forest, a habitat type that does not occur in the Study Area, no impacts to this species are likely to occur.

In general, decreases in nesting habitat availability and increases in nest predation in the Study Area may incrementally contribute to declining population trends of neotropical migratory birds. Potential direct impacts to individuals of these species may occur as a result of clearing and construction activities during

the nesting season, potentially resulting in nestling mortality. To minimize the potential for this to occur, clearing or glading of potential nesting habitat would occur after August 1, after the end of the nesting season, as described in Other Management Provision OMP43 (see Table 2.4-2).

Aquatic Habitat and Associated Species

Aquatic habitat within the Study Area includes lakes, wetlands, and in-stream habitat. There is only one lake within the Study Area, Beaver Lake, and there are several wetlands providing open water. This section focuses on wildlife species associated with wetlands and wetland types, conditions, functions, and values are described in greater detail in Section 3.3 of this document and impacts to wetlands are described in Section 4.3. Similarly, this section focuses on wildlife species associated with in-stream habitat and impacts to fish are discussed in Section 4.4 of this document.

Table 4.6.3-4:
Habitat by Alternative for Species Having a Primary Association With Aquatic Habitat in the Study Area

Aquatic Habitat Type	Species	Alt 1 Existing (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Mod Alt 5 (acres)
Lakes and Wetlands	Cascades frog[a] Red-legged frog[c] Pacific tree frog[c] Western toad[a]	73.63	72.23	72.19	72.30	72.21
Streams	Tailed frog[a]	29.47	29.22	29.23	29.23	29.23
All Aquatic Habitats[4]	Neotropical migratory birds 17 species (see Table 3.6.1-9)	n/a	n/a	n/a	n/a	n/a

[a] Documented
[b] Surveyed and not found
[c] Not documented
[d] Lakes and wetlands are reported by size in acres, streams are reported by length in miles, therefore these numbers cannot be added to provide a total amount of aquatic habitat.
Note: This table includes the Mill Creek portion of the Study Area.

Many of the wetlands in the Study Area are small seeps on maintained ski trails, formed by either natural flows or ground re-contouring and the majority are less than ¼ acre in size. Larger wetlands occur at the base of slopes. The largest wetland at Alpental is an emergent wetland in the St. Bernard ski area, which receives some disturbance from ski development. The largest wetland complex at The Summit is Hyak Lake and the surrounding shallow emergent wetlands. This wetland complex is outside of but adjacent to the Study Area, is relatively free from disturbance and development, and provides important amphibian habitat and possible bedding and calving for elk. Also, a complex of relatively large and undisturbed wetlands occurs between SR 906 and I-90, across from Summit Central. Some of these wetlands are bogs, a rare and sensitive wetland type that often contains plants that do not grow in other types of wetlands.

Most of the wetlands display a single habitat type, usually either herbaceous or shrub vegetation. Wetlands that are dominated by native vegetation provide superior habitat value for wildlife while wetlands in ski trails, lift lines, or roads show little species and habitat diversity because of disturbance from development, maintenance, and summer recreation. A total of 146 wetlands occur in areas modified by land management and 81 are located in areas containing natural vegetation.

Under Alternative 2, habitat for species dependent on lakes and wetlands would decrease from an existing 73.63 acres to 72.23 acres, a net loss of approximately 1.40 acres (see Table 4.6.3-4). This would occur as a result of loss of wetland habitat, as described in Section 4.3. This would reduce the amount of breeding habitat available for Cascades frog, red-legged frog, Pacific tree frog, and western toad.

The greatest potential impact to these species would result from alteration of breeding habitat either through direct loss of habitat or changes in habitat quality from increased sedimentation or reduced vegetative cover. Impacts from sedimentation could occur from road building, utility trenching, and ski trail construction in Riparian Buffers, as described in Sections 4.2- Geology and Soils and 4.3 – Watershed Resources. Impacts from increased sedimentation would be minimized through implementation of an approved stormwater management plan to be developed prior to specific project implementation.

Lakes, ponds, and wetlands could also be affected by changes in hydrologic regimes as a result of alterations to vegetation. Modification of surrounding vegetation could reduce breeding success through lowered survival of eggs, tadpoles, and dispersing frogs. Clearing of riparian vegetation and culverting of streams could also reduce habitat connectivity for these species. Loss of habitat connectivity would be minimized through implementation of Other Management Provision OMP44 (see Table 2.4-2), which states that where new culverts are installed or old culverts replaced, bottomless arch culverts or bridges would be used to maintain habitat connectivity for low-mobility, riparian-dependent species.

Potential short-term impacts to wetland habitats have been identified as occurring in buffer areas adjacent to buildings, parking lots, roads, and lift terminals and in areas proposed for utility trenching. Site-specific project design may reduce these impacts by avoiding impacts to wetlands, as described in Other Management Provision OMP39, (see Table 2.4-2), therefore the impact may be less.

Because these species spend the winter either buried in the substrate, under leaf litter or under the mud in the bottom of ponds (Leonard et al. 1993), impacts from winter skiing and maintenance activities are unlikely. Increased summer recreational and maintenance activity could cause direct impacts to these species, potentially leading to mortality of frogs using meadows near ponds and streams. Ski trail maintenance such as mowing, could cause mortality of adult frogs. Toads use a wide range of habitats and following metamorphosis could be disturbed or injured by summer recreational and maintenance activity.

Streams are considered the primary habitat for tailed frog within the Study Area, however, his species also utilizes riparian habitat, primarily mature riparian forest. While there would be no change in the amount of stream habitat, there would be impacts to riparian forest, as previously described under *Riparian Habitat and Associated Species*. Changes in riparian forest could impact this species by reducing the amount of habitat available and by altering habitat conditions through increased sedimentation or changes in water temperature. Impacts to water quality are described in Section 4.3. Clearing of riparian vegetation and culverting of streams could also reduce habitat connectivity for this species. Loss of habitat connectivity would be minimized through implementation of Other Management Provision OMP44 (see Table 2.4-2).

There are 17 species of neotropical migratory birds that have a primary association with aquatic habitat and that may occur in the Study Area, as shown in Table 3.6.1-9. Of these, the osprey is unlikely to occur on a regular basis due to a lack of large fish-bearing lakes and rivers within the Study Area. The remaining species generally use these areas for foraging, either in the air above the water (e.g., swallows), in substrates along the shore (e.g., killdeer), or in the water itself (e.g., belted kingfisher). Several of these species are also expected to nest in riparian habitat associated with bodies of water in the Study Area and impacts to riparian habitat are previously described under *Riparian Habitat and Associated Species*. Potential short-term impacts to these species include disturbance of breeding or foraging behavior as a result of construction activities, loss of nesting or foraging habitat, and potential mortality of individuals. Impacts to breeding behavior and mortality of individuals would be minimized through implementation of Other Management Provision OMP43 (see Table 2.4-2), which postpones construction activities to after August 1. Long-term impacts would include the permanent loss of habitat and disturbance from maintenance activities. Disturbance during the breeding season would be minimized through implementation of Other Management Provision OMP42 (see Table 2.4-2).

Alternative 2 also includes several restoration projects that would reduce sedimentation impacts to aquatic habitats and would restore wetland habitat within the Study Area. These restoration projects are described in Section 2.3.3.11 – Restoration. Components of the restoration plan that would reduce sedimentation impacts include slope stabilization projects, reforestation and revegetation of disturbed soils, and implementation of a stormwater management plan. Wetland restoration would occur in two wetlands, one located at Summit West and one at Summit Central.

Cliff and Talus Habitat and Associated Species

Cliff, talus and rock habitat has been mapped in areas where it is the predominant habitat type (see Figures 3.5.1-1, Existing Vegetation Cover - The Summit and 3.5.1-2, Existing Vegetation Cover - Alpental). Under Alternative 2, the amount of cliff/talus habitat would decrease slightly from 235.26 to 234.67 for a net loss of approximately 0.59 acre. This would occur primarily from construction of the *Pulse Gondola* and mountain-top restaurant and the top terminal of the proposed new *Internationale* chairlift at Alpental.

Impacts to cliff/talus would result in impacts to the species associated with this habitat type. The amount of cliff/talus habitat available in the Study Area and the species associated with it are listed in Table 4.6.3-5.

Table 4.6.3-5:
Species Having a Primary Association With Cliff and/or Talus Habitat in the Study Area

Species	Habitat Types	Alt 1 Existing (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Mod Alt 5 (acres)
Peregrine falcon[c]	Cliffs	235.26	234.67	235.76	234.68	234.69
Mountain goat[a]	Cliffs/rock outcrops	235.26	234.67	235.76	234.68	234.69
Larch Mountain salamander[c]	Talus	235.26	234.67	235.76	234.68	234.69
Neotropical migratory birds (2 species[d] - see Table 3.6.1-11)	Cliffs, rock outcrops	235.26	234.67	235.76	234.68	234.69

[a] Documented
[b] Surveyed and not found
[c] Not documented
[e] One of these species is the peregrine falcon, which is also discussed separately.
Note: This table includes the Mill Creek portion of the Study Area.

Table 4.6.3-5 shows that Alternative 2 would cause a reduction in habitat for peregrine falcons. Although the GIS database analysis indicates a reduction in habitat, Alternative 2 would not result in the direct loss of any cliff habitat. Potential disturbance to cliff habitat would occur under Alternative 2 from construction of the *Pulse Gondola* at Alpental. Disturbance impacts are not expected because peregrine falcons have not been reported in the area, and habitat in this area has a rating of fair (a relatively low ranking), making it unlikely that it would be occupied (USFS 1995).

As described in Section 3.6.1, mountain goats are known to utilize cliff habitat at the southern end of Denny Mountain. While not documented within the Study Area, the area of known use is contiguous with habitat within the Study Area and it is assumed that mountain goats occur within suitable habitat in the Study Area. Table 4.6.3-5 indicates that the amount of habitat available for mountain goats would decline from 235.26 acres to 234.67 acres, primarily in association construction of the top terminal of the *Pulse Gondola* and the mountain-top restaurant and construction of the top terminal of the proposed new *Internationale* chairlift at Alpental. Noise and activity of construction of these facilities may cause disturbance to mountain goats, potentially causing short-term avoidance of these areas.

The *Pulse Gondola* would provide year-round access to the top of Denny Mountain, increasing the number of people present in the area during all seasons. The *Internationale* chairlift would operate only during wintertime, however maintenance activities would occur during summer. During winter mountain

goats primarily utilize the area to the south of the existing *Armstrong Express* chairlift outside of the area used by skiers. As a result, increased human activity in the winter is not expected to change wintertime use of the area by mountain goats. During spring and summer mountain goats utilize a broader range, including the area of the proposed upper terminal of the *Pulse Gondola*, the mountain-top restaurant, and the top terminal of the proposed new *Internationale* chairlift. Increased human activity during spring and summer may alter use of the area by mountain goats, potentially causing them to avoid the area altogether. This long-term impact, and the increased human activity associated with the gondola and restaurant, could lead to the permanent displacement of mountain goats from that part of the Study Area. Maintenance activities associated with the *Internationale* chairlift would also occur annually over the long-term, resulting in the potential temporary displacement of mountain goats from the vicinity of the *Internationale* chairlift during maintenance activities.

The greatest potential impacts to mountain goat populations would occur during the kidding season (May and June). Increased human disturbance during spring and summer may result in displacement of mountain goats from preferred kidding and summer habitats. To minimize the potential for these types of impacts, construction of the *Pulse Gondola* and mountain-top restaurant and construction and subsequent maintenance of the *Internationale* chairlift would be scheduled to occur after the kidding season as described in Management Requirement MR35 (see Table 2.4-2). In addition, visitors using the gondola would be encouraged through public education methods to avoid disturbing mountain goats occurring in adjacent habitats (see Other Management Provision OMP45, Table 2.4-2).

Table 4.6.3-5 indicates a decline of 0.59 acre in potential habitat for Larch Mountain salamander. The majority of this impact would occur in a rock outcrop habitat type not associated with mature forest and therefore marginally suitable as habitat for this species. All mature forest habitat proposed for clearing or glading and its adjacent forest habitat was surveyed for this species. Since no Larch Mountain salamanders were found during these surveys, this species has a status of "not detected" within the areas surveyed (Crisafulli 1999).

Two species of neotropical migratory birds are primarily associated with cliff habitat in the Study Area. One, the peregrine falcon, was previously discussed. The second species, the golden eagle, may occur but is not known to nest in the Study Area. Potential habitat for this species occurs primarily at Alpental, in the cliffs below the top terminal of the proposed *Pulse Gondola* and mountain-top restaurant. Construction of the gondola and restaurant would result in an increase in human activity in the vicinity of cliff habitat and potential reduction in the suitability of the area as nesting habitat.

Herbaceous and Shrub Habitat and Associated Species

Under Alternative 2, there would be a reduction in both natural shrub and natural herbaceous habitats as a result of a variety of construction activities, including trenching for utilities, ski trail development, and chairlift construction (see Tables 4.6.3-1 a, b, and c). Conversely, increases in modified herbaceous land

cover would also occur as a result of ski trail development converting a forested habitat type into one dominated either by herbaceous or shrub habitat.

Impacts to herbaceous and shrub habitats would result in impacts to species associated with this habitat type (see Table 4.6.3-6).

Table 4.6.3-6:
Species Having a Primary Association
With Herbaceous and/or Shrub Habitat in the Study Area

Species	Habitat Types	Alt 1 Existing (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Mod Alt 5 (acres)
Neotropical migratory birds (7 species, see Table 3.6.1-13)	All herbaceous and shrub types	898.59	936.57	908.53	899.17	920.73

Note: This table includes the Mill Creek portion of the Study Area.

Seven species of neotropical migratory birds that are associated with meadow (herbaceous) habitat may occur in the Study Area (see Table 3.6.1-13). No special status species have been identified as having a primary association with shrub habitat.

Under Alternative 2, habitat for species associated with herbaceous habitat would increase from an existing 448.73 to 474.11 acres for a net gain of 25.38 acres.

Under Alternative 2, there would be impacts to approximately 52 acres of herbaceous habitat; however this loss would be offset by a gain in the amount of modified herbaceous habitat within the Study Area due to the conversion of other vegetation types to modified herbaceous by ski trail development.

Of the approximately 52 acres impacted, 16 acres would occur on public land and less than 1 acre would occur on private land in the S.F. Snoqualmie Watershed and 16 acres would occur on public land and 19 acres would occur on private land in the U. Yakima Watershed.

Potential impacts to species associated with herbaceous habitat include short-term reductions in the amount of habitat available during construction activities, long-term reduction in habitat quality due to the modified nature of the habitat, and direct mortality of individuals.

Short-term reductions in the amount of habitat available for these species could occur as a result of construction activities clearing currently available habitat, which may or may not be allowed to reestablish. Depending on the type of development (i.e., ski trails, parking lots, construction of buildings), and the time required for herbaceous vegetation to become established in newly cleared areas, reductions in the amount of habitat available for these species could occur in the short- and long-term. Long-term reduction in habitat quality could also occur as a result of plant communities that reestablish in newly

disturbed or cleared areas having a higher probability of containing non-native species and noxious weeds than do undisturbed habitats.

In addition, potential direct impacts to these species could include reduction in nesting success due to nest disturbance or destruction during the nesting season. The potential for direct mortality, nest disturbance, or nest destruction impacts to occur would be minimized through implementation of Other Management Provision OMP43 (see Table 2.4-2).

General Habitats and Associated Species

Species included in this category are those that use a variety of habitat types or which use more than one of the identified habitat types for different life requirements. These species and the habitat types with which they are associated are listed in Table 4.6.3-7.

Table 4.6.3-7:
Species Having a Primary Association with General Habitats in the Study Area

Species	Habitat Types	Alt 1 Existing (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Mod Alt 5 (acres)
Grizzly bear[c]	May use all vegetation types within the SUP	n/a	n/a	n/a	n/a	n/a
Gray wolf[c]	May use all vegetation types within the SUP	n/a	n/a	n/a	n/a	n/a
Elk[a]						
Foraging	Pacific silver fir sapling, herbaceous (natural and modified), shrub (natural and modified, immature Pacific silver fir, immature western hemlock.	1,514.41	1,548.12	1,532.63	1,521.01	1,536.52
Cover	Mature mountain hemlock, mature Pacific silver fir, and mature western hemlock.	1,052.67	1,007.83	1,025.46	1,037.45	1,020.38

Table 4.6.3-7:
Species Having a Primary Association with General Habitats in the Study Area

Species	Habitat Types	Alt 1 Existing (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Mod Alt 5 (acres)
Deer[a]						
Foraging[a]	Pacific silver fir sapling, herbaceous (natural and modified), shrub (natural and modified), immature Pacific silver fir, immature western hemlock.	1,514.41	1,548.12	1,532.63	1,521.01	1,536.52
Cover	Mature mountain hemlock, mature Pacific silver fir, and mature western hemlock.	1,052.67	1,007.83	1,025.46	1,037.45	1,020.38
Wolverine[c]	May use all vegetation types within the SUP.	n/a	n/a	n/a	n/a	n/a

[a] Documented
[b] Surveyed and not found
[c] Not documented
Note: This table includes the Mill Creek portion of the Study Area.

No specific habitat types within the Study Area have been identified as providing habitat with which grizzly bears, gray wolves, or wolverine would have a primary association, therefore Table 4.6.3-7 does not contain an acreage value for habitat for these species.

Of the species listed in Table 4.6.3-7, grizzly bear, gray wolf, and wolverine may use any or all of the habitat types within the Study Area, however documented sightings of all of these species are rare. The high level of human use in the Study Area, in part, limits the use of the Study Area by these species and therefore impacts are unlikely.

The portion of the Study Area north of Interstate 90 (Alpental) is within the North Cascades Ecosystem recovery zone for grizzly bear, however as described in Section 3.6.1.10, the Study Area is designated as Administratively Withdrawn and therefore does not contain core grizzly bear habitat and no impacts to core habitat would occur. It is possible, however unlikely, that grizzly bears may occur in the Study Area, however, utilizing herbaceous and shrub habitats for summer or fall foraging or that grizzly bears may pass through the Study Area. Under Alternative 2 an increase in the amount of potential foraging habitat for grizzly bears would occur as other habitat types were converted to herbaceous and shrub habitats as a result of the Proposed Action as described under *Herbaceous and Shrub Habitat and Associated Species*.

The amount of human activity in the Study Area would also increase. Increases in wintertime activity would not impact grizzly bears as they would be in hibernation, mostly likely outside of the Study Area since suitable habitat for hibernation is lacking in the Study Area. Based on elevation and the vegetation within the Study Area, the highest probability of grizzly bears occurring in the Study Area would be during summer and fall. A rise in recreational use during summer and fall may potentially cause increased avoidance of the area by grizzly bears. Construction of the Pulse Gondola would represent the largest contribution to additional summer and fall recreation use since it would operate on a year-round basis and would increase recreational use of the area. Activity-related impacts would be greatest in the vicinity of the mountain-top restaurant, however some gondola riders may choose to explore more remote areas along the top of Denny Mountain or to hike down from the top, thereby increasing human presence in areas that currently receive little human disturbance during summer and fall. Maintenance activities in newly developed areas would also increase disturbance.

Additional potential direct impacts to grizzly bears could include conflicts with humans. Such conflicts could lead to public safety control measures should bears become habituated to humans or garbage generated by humans in the Study Area. Other Management Provisions OMP45-46 (see Table 2.4-2), would be implemented to minimize the potential for such problems to occur such problems.

The presence of gray wolves is expected to be rare and limited to occasional use of the Study Area as part of a larger home range territory, in part because the Study Area is lacking suitable denning habitat for this species. Wolves may hunt in the Study Area but the high level of human activity associated with the ski area activities is expected to limit use to travel habitat to and from more remote areas. An increase in human activity under all Action Alternatives would occur during winter. Under Alternative 2, there would be an increase in human activity year-round due to construction of the Pulse Gondola and mountain-top restaurant at Alpental.

Potential impacts to wolverine under Alternative 2 would be similar to those described for gray wolf and grizzly bear. Wolverines are known to have large home range territories and tend to avoid areas of high human use. Use of the Study Area by this species is limited to occasionally traveling through the area. Increased recreational use and maintenance activities could reduce the effectiveness of the Study Area for travel habitat; the impacts are described in the Habitat Connectivity section below.

As shown in Table 4.6.3-7 elk and mule deer use the same habitat types for both foraging and cover and therefore are discussed together. Potential direct impacts to these species would include loss or conversion of cover habitat, an increase in foraging habitat, and disturbance due to construction and increased human activity. Under Alternative 2, the amount of foraging habitat for these species would increase by 33.71 acres from an existing 1,514.41 acres to 1,548.12 acres. This would occur as a result of converting mature forest habitat (cover) to a modified herbaceous condition (foraging) through ski trail construction, clearing for chairlift construction, and reforestation. Under Alternative 2 there would be a loss of 44.84 acres of cover habitat for both species (see Table 4.6.3-7). Within the Study Area all mature forest types

are considered potential cover habitat for these species and impacts to this habitat type are previously described under *Forested Habitat and Associated Species*. In addition to the clearing of cover habitat shown in Table 4.6.3-7, there would be an additional 9.10 acres of glading under Alternative 2. Glading would remove under-story trees and shrubs and would reduce thermal cover and the effectiveness of this habitat as hiding cover for both elk and mule deer by increasing sight distances.

Direct short-term impacts to both elk and mule deer would include temporary displacement from specific areas during construction of MDP components and the temporary loss of foraging habitat in areas disturbed by trenching for utility line installation. These impacts would occur over a several-year timeframe and would affect small portions and elk and deer habitat of the Study Area at any one time. Direct long-term impacts to elk and deer may also occur as a result of disturbance from ski trail or lift maintenance, increased summer recreation, and the continued operation of the existing mountain biking program.

Disturbance from construction or maintenance could occur within calving or fawning areas during the period when elk calves and mule deer fawns are not yet mobile enough to follow adults to safety or are left alone to hide while adults forage. Disturbance impacts during these times would be avoided through implementation of Management Requirement MR35 (see Table 2.4-2), which would limit clearing of potential hiding cover or lift and trail maintenance from occurring until after June 15, the end of both elk calving and deer fawning seasons.

Increases in winter recreation would not impact elk or deer since the Study Area is not within winter range for either species. Increases in summer recreation could, however, result in increased disturbance to these species. The greatest increase in summer recreation would occur from construction and operation of the Pulse Gondola and mountain-top restaurant. While most of the activity associated with these project components would occur within the immediate area of the top terminal of the gondola, in the vicinity of the restaurant, or in the base area of Alpental, some gondola users may choose to explore more remote areas along the top of Denny Mountain or to hike down from the top and so may increase human presence in areas that currently receive little or none during summer, potentially increasing disturbance to elk and deer in the area. To minimize these impacts, visitors using the gondola would be encouraged through public education methods to avoid disturbing elk or deer, particularly if calves or fawns are observed, as described under Other Management Provision OMP45 (see Table 2.4-2).

Continued operation of the existing mountain biking program could also potentially impact elk calving areas. The most likely area of impact would be around Hyak Lake, which is a known elk calving area that also includes an existing mountain bike trail. Disturbance during calving may include delay of cows returning to calves, delayed feeding, or discovery of calves and increased risk of predation. To minimize potential impacts to elk Management Requirement MR35 (see Table 2.4-2), would be implemented.

Indirect long-term impacts to elk and deer may occur if noxious weeds become established in areas disturbed by construction activities, leading to a long-term reduction of forage quality in the Study Area. This impact would be minimized through implementation of Management Requirement MR24 (see Table 2.4-2).

4.6.3.2 Habitat Connectivity

General Impacts

As mentioned in Section 3.6.2, the mature forest habitat within Section 16 (Summit East) has been identified as an important area of habitat connectivity for wide-ranging species that occur in the S.F. Snoqualmie Watershed and the U. Yakima Watershed. Low mobility wildlife species also use the mature forest in this area. Construction of chairlifts and ski trails within the mature forest in Section 16 (Summit East) has the potential to impact wildlife habitat connectivity by reducing the available connective habitat, increasing edge habitat, decreasing interior habitat, creating potential barrier affects, and increasing human activity, which in turn increases potential disturbance to animals moving through the area.

Alternative 2 would have the greatest potential impact to habitat connectivity within the Study Area of all the Action Alternatives because it would result in removal of the greatest amount of mature forest habitat in Section 16 (Summit East), as previously described under *Forested Habitat and Associated Species*. Alternative 2 does not include the Mill Creek land donation to provide future replacement habitat. As the land allocation within a 5-mile radius of The Summit-at-Snoqualmie has remained relatively stable in terms of the amount of land that protects or promotes LSH, Alternative 2 would be detrimental to LSH (See FEIS Table 4.6.2-1).

The construction of ski trails would reduce the overall amount of mature forest habitat in Section 16 (Summit East) and would reduce the amount of habitat available for animals moving through the area. This would effectively narrow the existing intact habitat corridor in Section 16 (Summit East). Glading of *Trail 55B*, the upper portion of *Trail 55*, and the outer edges of *Trail 55A* would minimize impacts to this habitat when compared to full clearing.

Full clearing would result in increased fragmentation of the mature forest habitat in Section 16 (Summit East) as well as an increase in edge habitat. This would have the greatest potential affect on low mobility species and species dependent on interior forest conditions. For low mobility species, increased habitat fragmentation would increase the probability of population isolation. For organisms such as mollusks, relatively small openings may represent a complete barrier to movement and individuals may become trapped in islands of remaining habitat, leading to a long-term effect of decreased genetic variability.

Habitat fragmentation and increased edge habitat may also increase the risk of predation for animals moving through the area. For example, increased edge habitat may attract edge species, such as great horned owls, to the area that could result in an increased risk of predation for spotted owls potentially moving through the area, particularly when crossing openings in the forest.

Ski trail glading may alter the use of the area by species that utilize CWD and understory vegetation as cover while traveling, such as American marten and fisher. Glading of the forest would result in a more open ground cover and understory condition, potentially causing avoidance of these areas, with animals selecting areas of ungladed forest to travel through.

Increases in human activity associated with chairlift and ski trail development may also reduce the effectiveness of the area as travel habitat, particularly for species sensitive to human activity. Short-term direct impacts include noise and activity associated with ski lift construction and ski trail clearing, grading, and glading. Noise associated with these activities and human presence may cause animals to avoid moving through the area. Potential long-term direct impacts would result from increased winter recreational use of the area associated with the Creek Run and Rampart chairlifts and associated trails. Under Alternative 2, night lighting would be added to the new *Rampart* pod and the existing *Silver Fir* pod, to allow recreation to occur from mid-morning through to the evening during ski area operations. Many wildlife species are crepuscular, meaning they are most active at dawn and dusk, and increased activity, noise, and light during these times may alter use of the area by such species. In addition, ski trail grooming is often accomplished at night, and noise and light from these activities, particularly in the newly created ski trails in the Rampart and Creek Run pods, may alter use of the area of nocturnal species.

During summer, ski lift and trail maintenance activities may have direct impacts on animals potentially moving through the area, as the associated noise and activity may alter use of the area. These activities would be expected to be of short duration with lift maintenance occurring on an annual basis and ski trail maintenance occurring less frequently. Creation of new ski trails in Section 16 (Summit East) may lead to indirect impacts by attracting summer recreationists to the area, such as hikers exploring off-trail.

4.6.3.3 Special Status Species

Table 4.6.3-8 presents the determination of effect to special status species potentially occurring within The Summit-at-Snoqualmie Study Area under all alternatives. These species include:

- Species listed as endangered or threatened, and species proposed for listing, under the ESA;
- USFS sensitive species, which are species for which there are viability concerns as determined by the Regional Forester;
- Other rare and uncommon species;
- Management Indicator Species, and,
- Species of concern identified by the USFWS, some of which are former Category 1 and Category 2 candidates (those species whose conservation standing is of concern to the USFWS, but for which status information is still needed).

A detailed analysis of effects to these species can be found in Appendix D – Wildlife Resources Report.

Table 4.6.3-8:
Impacts to Special Status Species Potentially Occurring within The Summit-at-Snoqualmie Study Area

Species	Status	Alt 1 (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Mod Alt 5 (acres)	Determination of Effect – All Alternatives
Northern spotted owl *(Strix occidentalis caurina)*	Threatened	828.5	788.98	801.73	815.14	799.21	May Affect, Not Likely to Adversely Affect
Northern spotted owl Critical Habitat		N/A	N/A	N/A	N/A	N/A	No Effect
Marbled murrelet *(Brachyrampus marmoratus)*	Threatened	828.5	788.98	801.73	815.14	799.21	No Effect
Marbled murrelet Critical Habitat		N/A	N/A	N/A	N/A	N/A	No Effect
Grizzly bear (*Ursus arctos horribilis*)	Threatened	2899.36	2702.22	2745.16	2751.08	2711.31	May Affect, Not Likely to Adversely Affect
Gray wolf (*Canis lupus*)	Endangered	2899.36	2702.22	2745.16	2751.08	2711.31	May Affect, Not Likely to Adversely Affect
Canada lynx (*Lynx canadensis*) (see Appendix D – Wildlife Resources Report, Section 9.1 – Vertebrate Threatened and Candidate Species)	Threatened	N/A	N/A	N/A	N/A	N/A	No Effect
Terrestrial mollusks	Rare and Uncommon and other ROD species	1,053.11	1,007.83	1,025.46	1,037.45	1,020.38	May impact individuals but would not likely contribute to a trend toward federal listing
Silver-haired bat	Rare and Uncommon and other ROD species	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals but would not likely contribute to a trend toward federal listing
Hoary bat	Rare and Uncommon and other ROD species	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals but would not likely contribute to a trend toward federal listing
Townsend's bat	Forest Service Sensitive	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals but would not likely contribute to a trend toward federal listing

Table 4.6.3-8:
Impacts to Special Status Species Potentially Occurring within The Summit-at-Snoqualmie Study Area

Species	Status	Alt 1 (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Mod Alt 5 (acres)	Determination of Effect – All Alternatives
Fisher	Forest Service Sensitive	828.5	788.98	801.73	815.14	799.21	May impact individuals but would not likely contribute to a trend toward federal listing
Wolverine	Forest Service Sensitive	2899.36	2702.22	2745.16	2751.08	2711.31	May impact individuals but would not likely contribute to a trend toward federal listing
Northern goshawk	Forest Service Sensitive	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals but would not likely contribute to a trend toward federal listing
Great gray owl	Forest Service Sensitive	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals but would not likely contribute to a trend toward federal listing
Van Dyke's salamander	Forest Service Sensitive	319.57	298.06	321.01	311.44	320.84	May impact individuals but would not likely contribute to a trend toward federal listing
Larch mountain salamander	Forest Service Sensitive	235.26	234.67	235.26	234.68	234.69	May impact individuals but would not likely contribute to a trend toward federal listing
Pileated woodpecker	Management Indicator Species	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals, but would not affect species viability in the project area
Elk Foraging Habitat	Management Indicator Species	1514.41	1548.12	1532.63	1521.01	1536.52	May impact individuals, but would not affect species viability in the project area
Elk Cover Habitat		1052.67	1007.83	1025.46	1037.45	1020.38	
Mule deer Foraging Habitat	Management Indicator Species	1514.41	1548.12	1532.63	1521.01	1536.52	May impact individuals, but would not affect species viability in the project area
Mule deer Cover Habitat		1052.67	1007.83	1025.46	1037.45	1020.38	

Table 4.6.3-8:
Impacts to Special Status Species Potentially Occurring within The Summit-at-Snoqualmie Study Area

Species	Status	Alt 1 (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Mod Alt 5 (acres)	Determination of Effect – All Alternatives
Mountain goat	Management Indicator Species	235.26	234.67	235.76	234.68	234.69	May impact individuals, but would not affect species viability in the project area
American marten	Management Indicator Species	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals, but would not affect species viability in the project area
American peregrine falcon	USFWS Species of Concern	235.26	234.67	235.26	234.68	234.69	May impact individuals but would not likely contribute to a trend toward federal listing
Olive-sided flycatcher	USFWS Species of Concern	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals but would not likely contribute to a trend toward federal listing
Harlequin duck	USFWS Species of Concern	68.82	62.7	63.25	63.37	62.75	May impact individuals but would not likely contribute to a trend toward federal listing
Long-eared myotis	USFWS Species of Concern	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals but would not likely contribute to a trend toward federal listing
Long-legged myotis	USFWS Species of Concern	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals but would not likely contribute to a trend toward federal listing
Yuma myotis	USFWS Species of Concern	1053.11	1007.83	1025.46	1037.45	1020.38	May impact individuals but would not likely contribute to a trend toward federal listing
Cascade frog	USFWS Species of Concern	73.63	72.23	72.19	72.30	72.21	May impact individuals but would not likely contribute to a trend toward federal listing
Neotropical migratory birds (Includes multiple species with different habitat associations)	USFWS Species of Concern	1514.66	1548.11	1532.63	1521.01	1536.52	May impact individuals but would not likely contribute to a trend toward federal listing

4.6.4 Impacts – Alternative 3

Projects associated with implementation of Alternative 3 are discussed in Section 4.0.2 – Summary of Projects Analyzed in This EIS. Alternative 3 doesn't develop some of the projects in Alternative 2, modifies some aspects of Alternative 2, and includes a land donation. These differences are discussed below. All aspects of the projects would be located on public land and are the focus of the range of Alternatives analyzed in this EIS. Impact numbers referenced in this section include impacts common to all Alternatives as well as impacts unique to Alternative 3.

Projects and impact mechanisms under Alternative 3 are as discussed for Alternative 2, with the following exceptions:

- The *Creek Run* chairlift and associated road to the upper terminal at Summit East would not be constructed;
- Existing Trails 55, 66, and 67 would be reforested;
- Land Donation to offset impacts to late Successional habitat in Section 16 (Summit East) is proposed;
- The Pulse Gondola and mountain-top restaurant (including ADA facilities) at Alpental would not be constructed; and
- The existing Edelweiss ski patrol duty station would not be replaced.

Alternative 3 is presented in Figures 2.3.4-1, Alternative 3 Proposed Conditions - The Summit and 2.3.4-2, Alternative 3 Proposed Conditions - Alpental.

4.6.4.1 Wildlife Habitat and Associated Species

Under Alternative 3, there would be impacts to all habitat types, as shown in Tables 4.6.3-1A, B, and C. Under this Alternative, there would be a loss of mature Pacific silver fir and mature mountain hemlock forest habitat and a gain of immature/sapling Pacific silver fir, mature western hemlock within Riparian Reserve, and of modified herbaceous habitat. It is important to note that in Alternative 3, resulting acreage may be greater than existing acreage because of additional habitat gains from the Mill Creek land donation (see Table 4.6.3-1B). Incorporation of the Mill Creek parcel into the National Forest System would result in more acreage designated as riparian under the federal Riparian Reserve allocation than under the current condition, or the condition under Alternatives 2 and 4, which designate smaller riparian areas under the Kittitas County buffers.

Forested Habitat and Associated Species

Under Alternative 3, impacts to mature forest habitat and associated species would be as previously described under Alternative 2 but at a reduced level, as shown in Table 4.6.3-2. Impacts to mature forest

would be 17.63 acres less under Alternative 3 than Alternative 2 primarily because the *Creek Run* chairlift and associated trails would not be constructed.

Impacts to immature forest under Alternative 3 would also be similar to Alternative 2. However, the amount of clearing would be less because the *Creek Run* chairlift would not be constructed and the amount of reforestation would be greater because existing *Trails 55, 66,* and *67* would be reforested, resulting in an increase in the amount of immature forest in the Study Area.

Impacts to forested habitat under Alternative 3 would be offset by the purchase of 440 acres of land in the Mill Creek drainage by Booth Creek Resorts and the donation of 390 acres of this parcel to the Forest Service. This donated land would become part of the SPAMA and would be managed for late-successional habitat and connectivity. Although currently this area is predominantly immature and sapling Pacific silver fir, it would provide long-term replacement value for loss of mature forest habitat under this Alternative.

As shown in Table 4.6.3-2, potential habitat for northern spotted owl, marbled murrelet, and fisher within the Study Area is defined as mature Pacific silver fir and mature western hemlock forest combined. Under Alternative 3, the amount of this habitat type in the Study Area would be reduced from an existing amount of 828.50 acres to 801.73 acres, for a net loss of approximately 27 acres, as shown in Table 4.6.3-2. This reduction would occur entirely within the mature Pacific silver fir type. Of the approximate 27 acres, 3 acres would occur on public land and less than 1 acre would occur on private land in the upper S.F. Snoqualmie Watershed, and 23 acres would occur on private land in the U. Yakima Watershed, with no loss of this habitat type on public land in the U. Yakima Watershed. In addition to these acres of clearing, approximately 9 acres of mature Pacific silver fir forest and 20 acres of mature western hemlock forest would be converted from private ownership to public ownership in the U. Yakima Watershed as a result of the land donation. No glading of mature forest habitat would occur under Alternative 3.

The types of impacts on northern spotted owls under Alternative 3 would be similar to Alternative 2, although the acreage of impact to potential habitat would be less than Alternative 2. Since the *Creek Run* chairlift and associated trails would not be built under Alternative 3 the amount of potential foraging and dispersal habitat for spotted owls that would be removed would be less than under Alternative 2, as previously described. Removal of this habitat type would occur primarily in conjunction with construction of the *Rampart* chairlift and associated trails. Because clearing associated with the Creek Run ski pod and with trail 49 would not occur under this Alternative, the amount of forest fragmentation would be less than under Alternative 2, therefore reducing the increased risk of predation compared to Alternative 2. Reforestation of existing *Trails 55, 66,* and *67* would result in a long-term increase in foraging and dispersal habitat for this species in Section 16 (Summit East). In addition, the purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative.

The potential for disturbance to foraging or dispersing spotted owls would also be reduced compared to Alternative 2 because grooming and maintenance activities would not occur in the Creek Run area. Night lighting of the *Silver Fir* and *Rampart* ski pods would, however, result in an increase over existing conditions of potential disturbance to spotted owls potentially foraging or dispersing through this area. As under Alternative 2, implementation of Other Management Provisions OMP39-42 (see Table 2.4-2), would reduce potential impacts to northern spotted owls.

The Study Area is not located within designated critical habitat for the northern spotted owl; therefore there would be no impacts to designated critical habitat for this species under this Alternative.

As described under Alternative 2, impacts to marbled murrelets are not expected to occur.

The Study Area is not located within designated critical habitat for the marbled murrelet; therefore there would be no impacts to designated critical habitat for this species under this Alternative.

Under Alternative 3, impacts to fisher would be as described under Alternative 2 and would be to travel habitat. These impacts are described under 4.6.3.2 - Habitat Connectivity.

Under Alternative 3, habitat for species associated with mature mountain hemlock, mature Pacific silver fir, and mature western hemlock, would be reduced from 1,053.11 acres to 1,025.46 for a net loss of approximately 27 acres (see Table 4.6.3-2). These forest types combined provide potential habitat for 46 special status species and impacts to these species that would result from implementation of Alternative 3 are described below.

Surveys for great gray owls were conducted within suitable habitat in the Study Area in 1999 and 2000 with none found. For this reason, great gray owls are not expected to occur in the Study Area and there would be no impacts to this species. Under Alternative 3, impacts to pileated woodpeckers and other primary cavity excavators would be as described under Alternative 2 except the amount of habitat for these species that would be removed would be less under this Alternative since the *Creek Run* chairlift and associated trails would not be constructed. Habitat removal would occur primarily for construction of the *Rampart* chairlift and associated trails. Impacts to both current and future snag availability would be reduced under this Alternative compared to Alternative 2 because the total amount of clearing would be less and there would be less area of hazard tree management. Since there would be no glading under Alternative 3, impacts from glading would not occur. In addition, the purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative. Implementation of Other Management Provision OMP40 (see Table 2.4-2), would reduce impacts to snags and CWD and implementation of Other Management Provision OMP43 (see Table 2.4-2), would reduce potential direct impacts to these species.

Under Alternative 3, the type of impacts to olive-sided flycatchers, northern goshawks and neotropical birds associated with mature forest would be similar to Alternative 2 but with less impacted acreage since

the *Creek Run* chairlift and associated trails would not be built. Since the total amount of clearing would be less, the amount of forest fragmentation would be less and the risk of increased nest predation for olive-sided flycatchers would be less. In addition, reforestation of trails 55, 66, and 67 would reduce the amount of edge habitat from current conditions, and would potentially offset some of the impact of clearing for trails 60 and 61 under Alternative 3. The purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative. Since no glading would occur under this Alternative, impacts to goshawk nesting habitat would be reduced. Under this Alternative, clearing of forested habitat would occur after August 1 to reduce potential direct impacts to nesting individuals of these species, as described in Other Management Provision OMP43 (see Table 2.4-2).

Under Alternative 3, impacts to silver-haired bat, hoary bat, long-eared myotis, long-legged myotis, Yuma myotis, and Pacific western (Townsend's) big-eared bat would be similar to Alternative 2 except there would be a smaller reduction of roosting habitat and a smaller increase in foraging habitat since the *Creek Run* chairlift and associated trails would not be constructed. In addition, the purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative.

Under Alternative 3, impacts to American marten would be as described under Alternative 2 but with less impacted acreage. Since the *Creek Run* and associated trails would not be built there would be less habitat removed under this Alternative. Also, since there would be less area cleared for ski trails, lift alignments, and roads there would be less area managed for hazard trees and therefore a reduction in potential loss of denning habitat in areas adjacent to new development. Impacts to travel habitat are described under Habitat Connectivity below. In addition, reforestation of *Trails 55, 66,* and *67* would potentially offset some of the impact of clearing for *Trails 60* and *61* under Alternative 3 and the purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative.

Under Alternative 3, impacts to terrestrial mollusks would be as described under Alternative 2 but with less impacted acreage. Since the *Creek Run* and associated trails would not be built there would be less habitat removed under this Alternative. The donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative.

Under Alternative 3, impacts to the 11 species of neotropical migratory birds that are associated with immature forest and potentially occur in the Study Area would be similar to Alternative 2. The *Creek Run* chairlift would not be constructed however, and instead *Trails 55, 66,* and *67* would be reforested. Small patches of reforestation would also occur throughout the Study Area, similar to Alternative 2, resulting in an overall increase of approximately 8 acres of this habitat type in the Study Area under this Alternative. In addition, approximately 305 acres of immature Pacific silver fir and Pacific silver fir sapling habitat combined would be gained on public land in the U. Yakima Watershed due to a combination of

reforestation and land ownership changes associated with the land donation, while this habitat type would be reduced by approximately 293 acres on private land in the U. Yakima Watershed as a result of project impacts and land ownership changes combined. Potential direct impacts to individuals of these species may occur as a result of clearing and construction activities during the nesting season, potentially resulting in nestling mortality. To minimize the potential for this to occur, clearing would not occur until after August 1, as described in Other Management Provision OMP43 (see Table 2.4-2.).

Riparian Habitat and Associated Species

Under Alternative 3, the types of impacts on riparian habitat and associated species would be as described under Alternative 2, however the amount of clearing of mature Pacific silver fir and mountain hemlock forest would be reduced and the increase in modified herbaceous habitat would be less because the *Creek Run* chairlift and associated trails would not be constructed.

Under Alternative 3, the land purchase and donation would result in an increase in the amount of mature western hemlock considered as riparian habitat as a result of applying Riparian Reserve standards and guidelines to the land donated to the Forest Service under this Alternative. The amount of immature and sapling Pacific silver fir would also increase under this Alternative as a result of applying the Riparian Reserve standards and guidelines and thus increasing the amount of area considered as riparian habitat for this analysis, and as a result of reforestation. Under Alternative 3, reforestation would occur in scattered patches throughout the Study Area as described in Alternative 2 and would also occur on existing trails 55, 66, and 67 in Section 16 (Summit East). Alternative 3 has the greatest amount of reforestation of all the Action Alternatives. Restoration of riparian habitat in the vicinity of the existing tubing center and Beaver Lake Creek would be the same as under Alternative 2. Changes in riparian habitat by Alternative are shown in Tables 4.6.3-1 a, b, and c.

As described under Alternative 2, habitat for bald eagles is lacking within the Study Area and they are not expected to regularly occur, therefore impacts to bald eagles are not expected to occur.

Under Alternative 3, impacts to Van Dyke's salamander habitat would be similar to but fewer than Alternative 2. This reduction in the amount of clearing would occur because under Alternative 3 the Creek Run chairlift and associated trails would not be built. Impacts from glading would not occur because no glading is proposed under Alternative 3. As shown in Table 4.6.3-3, habitat for Van Dyke's salamander would increase from 319.57 acres to 321.01 acres for a net gain of approximately 1.44 acres compared to existing conditions. This would occur as a result of the loss of habitat from clearing of mature forest in Riparian Buffers being offset by the increase in the amount of mature forest contained within Riparian Buffers as Riparian Reserve standards and guidelines are applied to lands donated to the Forest Service under this Alternative. The amount of mature forest in the Study Area would not change but the amount within an area receiving protection or consideration as a Riparian Buffer would.

Under this Alternative, there would be approximately 10 acres of mature forest clearing in Riparian Buffers of which 2 acres would occur on public land and less than 1 acre would occur on private land in the S.F. Snoqualmie Watershed and 4 acres would occur on public land and 4 acres would occur on private land within the U. Yakima Watershed. Under Alternative 3, there would be approximately 23 acres more potential habitat available for this species in the Study Area compared to Alternative 2. This net gain is due to the loss of habitat from clearing of mature forest in Riparian Buffers being offset by the increase in the amount of mature forest.

Under Alternative 3, impacts to harlequin duck would be similar to Alternative 2 although there would be less clearing of mature forest in the Riparian Buffers of perennial streams. Under Alternative 3, the amount of habitat available for harlequin duck would decrease from an existing 68.82 acres to 63.25 acres for a net loss of approximately 5.57 acres. Direct impacts to nesting harlequin ducks would be avoided through implementation of Other Management Provision OMP43 (see Table 2.4-2).

Under Alternative 3, the type of impacts to neotropical migratory birds associated with riparian habitat would be similar for Alternative 2 but less potential habitat would be affected since there would be less clearing of forest habitat and no glading. Alternative 3 would have the greatest amount of reforestation of all the Action Alternatives and, when combined with reduced clearing, would result in an increase in immature riparian forest habitat. The amount of mature riparian forest habitat in the Study Area would also increase under this Alternative, as would the amount of modified herbaceous riparian habitat.

Direct impacts to neotropical migratory birds potentially nesting in the Study Area may include nest failure and nestling mortality caused by construction. To minimize the potential for this to occur, clearing of potential nesting habitat would occur following the nesting season (after August 1), as described in Other Management Provision OMP43 (see Table 2.4-2).

Aquatic Habitat and Associated Species

Under Alternative 3, impacts to aquatic habitats and associated species would be similar to Alternative 2. Under Alternative 3, restoration projects that would reduce sedimentation impacts and wetland restoration would be similar to Alternative 2, with additional wetland restoration in the reforested Trails 55, 56, and 57.

Cliff and Talus Habitat and Associated Species

As shown in Table 4.6.3-5 the amount of cliff and talus habitat within the Study Area would increase 0.50 acre under Alternative 3, increasing slightly from an existing 235.26 acres to 235.76 acres. Compared with Alternative 2, Alternative 3 would result in approximately 1 acre of additional cliff and talus habitat available within the Study Area. Under this Alternative, the Pulse Gondola and mountain-top restaurant would not be constructed and impacts to this habitat type would occur primarily for construction of the top terminal of the proposed new *Internationale* chairlift at Alpental. This loss of habitat would be offset by conversion of an area currently mapped as forest habitat being converted to a rock/talus habitat type.

This would occur from construction of Trail 20 at Alpental, where under the current condition there is an area of rock outcrop under the forest canopy. This area would be cleared for trail construction and the rock outcrop would be blasted to create skiable terrain. This would occur under all Action Alternatives, however it only results in an increase in this habitat type under Alternative 3 because the gondola and mountain-top restaurant would not be constructed.

Under Alternative 3, there would be no impacts to peregrine falcon since the *Pulse Gondola* would not be constructed and disturbance impacts to cliff habitat would not occur.

Under Alternative 3, the type of impacts to mountain goats would be as described under Alternative 2 but of less magnitude since the *Pulse Gondola* and mountain-top restaurant would not be constructed and associated increases in year-round recreation would not occur. Increased disturbance to mountain goats would be associated with construction and maintenance of the proposed new Internationale chairlift. Impacts from construction activities could include the temporary displacement of mountain goats from construction areas. Annual routine maintenance could result in short-term displacement and disturbance during maintenance activities. Potential disturbance to mountain goats would be minimized through implementation of Management Requirement MR35 (see Table 2.4-2).

Under Alternative 3, impacts to Larch mountain salamander would be similar to Alternative 2.

Under Alternative 3, impacts to neotropical migratory birds associated with cliff habitat would not be expected since the *Pulse Gondola* would not be constructed and disturbance impacts to cliff habitat would not occur.

Herbaceous and Shrub Habitat and Associated Species

Under Alternative 3, impacts to neotropical migratory birds associated with herbaceous habitat would be similar to Alternative 2. Potential habitat for these species would increase from an existing 448.73 acres to 468.60 acres for a net gain of 19.87 acres. When compared with Alternative 2, Alternative 3 would result in approximately 5.51 fewer acres of herbaceous habitat (see Table 4.6.3-6).

Under Alternative 3, there would be direct impacts to approximately 31 acres of herbaceous habitat; however this loss would be offset by a gain in the amount of modified herbaceous habitat within the Study Area due to the conversion of other vegetation types to modified herbaceous by ski trail development. The quality of that habitat would be as described for Alternative 2.

Of the approximately 31 acres impacted, 9 acres would occur on public land and none on private land in the S.F. Snoqualmie Watershed and 10 acres would occur on public land and 12 acres would occur on private land in the U. Yakima Watershed.

As under Alternative 2, the potential for direct mortality, nest disturbance, or nest destruction impacts to occur would be minimized through implementation of Other Management Provision OMP (see Table 2.4-2).

No special status species have been identified as having a primary association with shrub habitat.

General Habitats and Associated Species

Under Alternative 3, the types of indirect impacts on grizzly bear, gray wolf, and wolverine would be similar to Alternative 2 except reduced since the *Pulse Gondola* and mountain-top restaurant would not be built. Potential direct impacts to grizzly bears resulting from habituation to humans would be reduced through implementation of Other Management Provisions OMP45-46 (see Table 2.4-2).

Impacts to elk and mule deer under Alternative 3 would be similar to Alternative 2. Differences between Alternative 3 and Alternative 2 include the following: a smaller increase in foraging habitat, and more retention of cover habitat. In addition, there would be a reduced probability of disturbance from increased human activity. Under Alternative 3, the amount of foraging habitat available for these species would increase from an existing 1,514.41 acres to 1,532.63 acres for a net increase of 18.22 acres, as shown in Table 4.6.3-7. This would occur as a result of a combination of clearing of mature forest (cover) and converting these areas to modified herbaceous habitat (foraging), generally for ski trail and lift construction, and reforestation. Alternative 3 would have the greatest amount of reforestation. Under Alternative 3, the amount of cover habitat would decrease from an existing 1,052.67 acres to 1,025.46 acres for a net loss of 27.21 acres. This would be less than under Alternative 2 primarily because the *Creek Run* chairlift and associated trails would not be constructed and there would be no glading under this Alternative.

Potential disturbance impacts from increased summer time recreational use would be less under Alternative 3 than Alternative 2 because the *Pulse Gondola* would not be built. Potential disturbance from construction and maintenance activities and the continued operation of the existing mountain biking program would be similar to Alternative 2 and would be minimized or avoided through implementation of Management Requirement MR35 and Other Management Provision OMP45 (see Table 2.4-2).

4.6.4.2 Habitat Connectivity

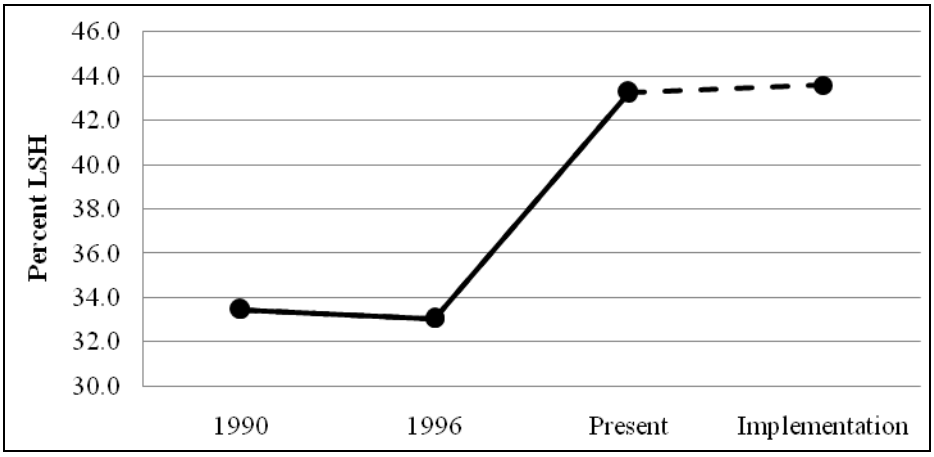
General Impacts

Under Alternative 3, potential impacts to habitat connectivity would be similar to, but less than the Alternative 2 because the *Creek Run* chairlift would not be built and Trail 49 would not be relocated. Construction of the *Rampart* chairlift and associated trails would result in a reduction in the amount of mature forest habitat in Section 16 (Summit East) and an increase in forest fragmentation/edge habitat as well as human activity (winter and summer), although to a lesser extent than under Alternative 2.

Under this Alternative, the purchase and donation of 390 acres of land in Mill Creek (Section 21) would contribute to an improvement in habitat connectivity in the Snoqualmie Pass area in the long-term.

USFS datasets describing forest stands is readily available from the MBSNF and OWNF from 1990, 1996, and 2006 for the area within a 5-mile radius of Snoqualmie Pass, including the 390 acres of land in Mill Creek. Utilizing this data the following illustration indicates that within the vicinity of Snoqualmie Pass (5-mile radius), Alternatives 3 would increase the amount of land managed as LSH from the current 43.3 percent to 43.6 percent (see Illustration 4.6.4 – FEIS 1). As the land allocation within this larger area has remained relatively stable in terms of the amount of land that protects or promotes LSH, the 0.3 percent increase in LSH that would result from implementation of Alternative 3 would be neutral or beneficial to LSH (see FEIS Table 4.6.2-1).

Illustration 4.6.4-FEIS-1:
Percentage of Late Successional Habitat in the Snoqualmie Pass Vicinity



This parcel contains approximately 45 acres of existing mature forest and 345 acres of immature forest. This parcel would become part of the AMA and so would be managed as LSH. As immature forested habitat in this parcel matures, it would increase habitat connectivity between Section 16 (Summit East) and other mature forest habitat to the west and south of the Study Area.

Night lighting of the trails associated with the *Rampart* and *Silver Fir* chairlifts could cause disturbance impacts to crepuscular and nocturnal species occupying habitat adjacent to the lighted area. Potential impacts to these species from night lighting would be reduced through implementation of Other Management Provision OMP42 (see Table 2.4-2). Disturbance impacts from chairlift and ski trail construction, increased winter recreation, ski trail grooming, and chairlift and ski trail maintenance would be similar to Alternative 2.

4.6.4.3 Special Status Species

Table 4.6.3-8 presents the determination of effect to special status species potentially occurring within The Summit-at-Snoqualmie Study Area under all alternatives. A detailed analysis of effects to these species can be found in the Wildlife Resources Report located in Appendix D.

4.6.5 Impacts – Alternative 4

Projects associated with implementation of Alternative 4 would include actions previously discussed in Section 4.0.2 – Summary of Projects Analyzed in this EIS. Alternative 4 doesn't develop some of the projects in Alternative 2 and modifies some aspects of Alternative 2. These differences are discussed below. All aspects of the projects unique to Alternative 4 are listed below. Impacts identified in this section include those common to all Alternatives as well as unique to Alternative 4.

Projects and impact mechanisms under Alternative 4 are as previously discussed for Alternative 2, with the following exceptions:

- Existing Alpental Road would be re-routed between the existing bridge to Parking Lot 6.
- Parking Lots 4, 5, and 6 at Alpental would be reduced in size as a result of the Alpental road reroute.
- Parking Lot 7 at Alpental would be removed.
- The Creek Run and Rampart chairlifts and associated roads at Summit East would not be constructed.

Alternative 4 is presented in Figures 2.3.5-1, Alternative 4 Proposed Conditions - The Summit and 2.3.5-2, Alternative 4 Proposed Conditions – Alpental.

4.6.5.1 Wildlife Habitat and Associated Species

Under Alternative 4, there would be impacts to all vegetation types, as shown in Tables 4.6.3-1 A, B, and C, however the impacts would be the least of all the Action Alternatives. Under this Alternative, there would be a loss of mature forest habitat and a gain of immature/sapling Pacific silver fir, and of modified herbaceous habitat (see Figures 2.3.5-1, Alternative 4 Proposed Conditions - The Summit and 2.3.5-2, Alternative 4 Proposed Conditions - Alpental).

Forested Habitat and Associated Species

Alternative 4 would result in the least amount of impact to mature forest habitat of all the Action Alternatives because the *Creek Run* and *Rampart* chairlifts and associated trails, including gladed trails, would not be constructed. Under Alternative 4, mature forest would be cleared at Alpental for the construction of the proposed new *Internationale* chairlift and the realignment of the existing *Sessel* chairlift, and at Summit Central in the Silver Fir pod, at the base of *Easy Street* chairlift and in the area of

the expanded Silver Fir parking lot 2. Under Alternative 4, the amount of mature forest habitat removed would be 29.62 acres less than under Alternative 2 (see Table 4.6.3-2).

Impacts to immature forest would be similar to Alternative 2, except there would be less clearing required.

Potential habitat for northern spotted owl, marbled murrelet, and fisher within the Study Area is defined as mature Pacific silver fir and mature western hemlock forest combined (see Table 4.6.3-2). Under Alternative 4, the amount of this habitat type in the Study Area would be reduced from 828.50 acres of existing habitat to 815.14 acres, for a net loss of approximately 13 acres (see Table 4.6.3-2). This reduction would occur entirely within the mature Pacific silver fir type.

Of the approximate reduction of 13 acres, 1 acre would occur on public land and less than 1 acre would occur on private land in the upper S.F. Snoqualmie Watershed, and 4 acres would occur on public land and 7 acres would occur on private land in the U. Yakima Watershed.

Under Alternative 4, impacts to foraging and dispersal habitat for the northern spotted owl would be less than would occur under the other Action Alternatives. Under Alternative 4, clearing of mature forest would include the removal of small areas on the edges of existing small patches of highly fragmented mature forest. These patches do not function as interior habitat, with edge effect affecting the entire stand (Crisifulli 1994), and the high level of fragmentation of this forest limits its value as spotted owl habitat (Thomas et al. 1990). In addition, and have limited value as foraging habitat for spotted owls. Spotted owls may use these patches to move between larger patches of habitat in the surrounding area as described later under *Habitat Connectivity*. To minimize potential impacts to nocturnal species associated with mature forest there would be no new night lighting in the silver fir pod under this Alternative. As under Alternative 2, implementation of Other Management Provisions OMP39-42 (see Table 2.4-2), would reduce potential impacts to northern spotted owls.

The Study Area is not located within designated critical habitat for the northern spotted owl; therefore there would be no impacts to designated critical habitat for this species under this Alternative.

Similar to Alternative 2, impacts to marbled murrelets are not expected to occur.

The Study Area is not located within designated critical habitat for the marbled murrelet; therefore there would be no impacts to designated critical habitat for this species under this Alternative.

Removal of small areas of mature forest in areas that are currently highly fragmented is not expected to impact the ability of fishers to move through the area, as described later under *Habitat Connectivity*.

Under Alternative 4, habitat for species associated with a combination of mature mountain hemlock, mature Pacific silver fir, and mature western hemlock, would be reduced from an existing 1,053.11 acres

to 1,037.45 for a net loss of approximately 15 acres (see Table 4.6.3-2). These forest types combined provide potential habitat for 46 special status species.

Of the approximate 15-acre loss of habitat, 2 acres would occur on public land and less than 1 acre would occur on private land in the S.F. Snoqualmie Watershed, and 5 acres would occur on public land and 7 acres would occur on private land in the U. Yakima Watershed.

Surveys for great gray owls were conducted within suitable habitat in the Study Area in 1999 and 2000 with none found. For this reason, great gray owls are not expected to occur in the Study Area and there would be no impacts to this species.

Under Alternative 4, impacts to pileated woodpeckers and other primary cavity excavators would be similar to Alternative 2 except the amount of habitat for these species that would be removed would be less because the *Creek Run* and *Rampart* chairlifts and associated trails would not be constructed. Habitat removal would occur primarily from construction of the proposed new *Internationale* chairlift and the realignment of the existing *Sessel* chairlift at Alpental and at the base of *Easy Street* chairlift and in the area of the expanded Silver Fir parking lot 2 at Summit Central. Impacts to both current and future snag availability would be reduced compared to Alternative 2 because the total amount of clearing would be less and there would be less area in which hazard trees would be managed. Since there would be no glading under Alternative 4, impacts from glading would not occur. As described Under Alternative 2, implementation of Other Management Provision OMP40 (see Table 2.4-2), would reduce impacts to snags and CWD and implementation of Other Management Provision OMP43 (see Table 2.4-2), would reduce potential direct impacts to these species.

Under Alternative 4, potential impacts to olive-sided flycatchers and northern goshawks would also be similar to Alternative 2 except reduced since the *Creek Run* and *Rampart* chairlifts and associated trails would not be built. Since the total amount of clearing would be less, the amount of forest fragmentation would be less and the risk of increased nest predation for olive-sided flycatchers would be reduced compared to Alternative 2. Since no glading would occur under this Alternative, there would be no impacts to goshawk nesting or foraging habitat. Under this Alternative, clearing of forested habitat would be restricted to after August 1 to reduce potential direct impacts to nesting birds, as described in Other Management Provision OMP43 (see Table 2.4-2).

Impacts to silver-haired bat, hoary bat, long-eared myotis, long-legged myotis, Yuma myotis, and Pacific western (Townsend's) big-eared bat would be similar to Alternative 2 except there would be less loss of roosting habitat and a smaller increase in foraging habitat since the *Creek Run* and *Rampart* chairlifts and associated trails would not be constructed.

The types of impacts to American marten would be similar to Alternative 2 except reduced since the *Creek Run* and *Rampart* chairlifts and associated trails would not be built. Also, since there would be less

area cleared for ski trails, lift alignments, and roads than under Alternative 2, there would be less area managed for hazard trees thus less potential loss of denning habitat in areas adjacent to new development. Impacts to travel habitat are described later under *Habitat Connectivity*.

The types of impacts to terrestrial mollusks would be similar to Alternative 2 except reduced since the *Creek Run* and *Rampart* chairlifts and associated trails would not be built.

Under Alternative 4, the types of impacts to neotropical migratory birds associated with mature forest would be similar to Alternative 2 but with less impact since the *Creek Run* and *Rampart* chairlifts and associated trails would not be constructed. Since less clearing would occur, there would be less forest fragmentation, resulting in a decreased risk of nest predation when compared to Alternative 2. Potential direct impacts to individuals would be reduced through implementation of Other Management Provision OMP43 (see Table 2.4-2).

Under Alternative 4, impacts to neotropical migratory birds associated with immature forest would be similar to Alternative 2 for Summit West, Silver Fir parking lot 4 construction, and clearing with and without grading in the Mill Creek pod. The *Creek Run* and *Rampart* chairlifts would not be constructed. Under this Alternative, small patches of reforestation would occur throughout the Study Area similar to Alternative 2, resulting in an overall increase of approximately 6 acres of this habitat type within the Study Area. Potential direct impacts to individuals of these species may occur as a result of clearing and construction activities during the nesting season, potentially resulting in nestling mortality. To minimize the potential for this impact, clearing would not occur until after August 1, as described in Other Management Provision OMP43 (see Table 2.4-2).

On public land in the S.F. Snoqualmie Watershed, there would be approximately 6 acres each of immature forest clearing and reforestation. On public land in the U. Yakima Watershed, there would be less than 1 acre cleared and over 9 acres of reforestation, for an increase of approximately 9 acres of this habitat type; on private land in the U. Yakima Watershed there would be approximately 13 acres of clearing and 10 acres of reforestation for a net loss of approximately 3 acres of this habitat type. Clearing or reforestation of this habitat type would not occur on private lands in the S.F. Snoqualmie Watershed under this Alternative.

Riparian Habitat and Associated Species

Under Alternative 4, there would be impacts to all riparian vegetation types, as shown in Table 4.6.3-3, however the impacts would be the least of all the Action Alternatives. Under this Alternative, there would be a loss of mature riparian forest habitat and an increase in immature/sapling Pacific silver fir and modified herbaceous habitat. Restoration of riparian habitat in the vicinity of the existing tubing center and Beaver Lake Creek would be the same as under Alternative 2. Under Alternative 4, the Alpental Road would be relocated further away from the SF Snoqualmie River and riparian habitat would be restored in this area.

No impacts to bald eagles would occur under this Alternative.

Impacts to Van Dyke's salamander would be similar to Alternative 2 but with fewer acres of potential habitat cleared for construction of lifts and trails. Under Alternative 4, the amount of potential Van Dyke's salamander habitat removed would be 13 acres less than Alternative 2 (see Table 4.6.3-3). Less clearing would occur because the *Creek Run* and *Rampart* chairlifts and associated trails would not be built, and no glading is proposed. As shown in Table 4.6.2-4, potential habitat for Van Dyke's salamander would decrease from 319.57 acres to 311.44 acres for a net loss of approximately 8 acres.

Of the net loss of 8 acres, 2 acres would occur on public land and less than 1 acre would occur on private land in the S.F. Snoqualmie Watershed and 2 acres would occur on public land and 3 acres would occur on private land in the U. Yakima Watershed.

Under Alternative 4, impacts to harlequin duck would be similar to but less than Alternative 2 due to a reduction in the amount of clearing of mature riparian forest. Under this Alternative the amount of habitat available for harlequin ducks would decrease from 68.82 acres to 63.37 acres for a net loss of approximately 5.45 acres. Direct impacts to nesting harlequin ducks would be avoided through implementation of Other Management Provision OMP43 (see Table 2.4-2).

Under Alternative 4, impacts to neotropical migratory birds associated with riparian habitat would be similar to Alternative 2 but with less potential habitat affected since there would be less clearing of forest habitat and no glading under this Alternative. There is a reduction in all riparian habitat types under Alternative 4 except immature and sapling Pacific silver fir and modified herbaceous. The amount of modified herbaceous habitat would increase primarily as a result of new ski trail construction and the amount of immature and sapling Pacific silver fir increases as a result of reforestation. Direct impacts to neotropical migratory birds potentially nesting in the Study Area may occur as a result of construction activities, possibly resulting in nest failure and nestling mortality. To minimize the potential for this to occur, clearing of potential nesting habitat would occur after August 1, after the end of the nesting season, as described in Other Management Provision OMP43 (see Table 2.4-2).

Aquatic Habitat and Associated Species

Under Alternative 4, impacts to aquatic habitats and associated species would be similar to Alternative 2. In addition, restoration projects that would reduce sedimentation impacts and wetland restoration would be similar to Alternative 2.

Cliff and Talus Habitat and Associated Species

Since the *Pulse Gondola*, mountain-top restaurant, and *Internationale* chairlift would all be constructed under Alternative 4, impacts to cliff and talus habitat under Alternative 4 would be similar to Alternative 2 and potential impacts to peregrine falcons, mountain goats, Larch mountain salamanders, and neotropical migratory birds associated with cliff habitat would be similar to Alternative 2.

Herbaceous and Shrub Habitat and Associated Species

Under Alternative 4, the types of impacts to neotropical migratory birds associated with herbaceous habitat would be similar to Alternative 2. Under Alternative 4, herbaceous habitat would increase from an existing 448.73 acres to 454.07 acres for a net gain of 5.34 acres, the least of all Action Alternatives. Under Alternative 4, there would be impacts to approximately 31 acres of herbaceous habitat; however this loss would be offset by a gain in the amount of modified herbaceous habitat within the Study Area due to the conversion of other vegetation types to a modified herbaceous condition resulting from ski trail development. Of the approximately 31 acres impacted, 10 acres would occur on public land and none on private land in the S.F. Snoqualmie Watershed. In the U. Yakima Watershed, 9 acres would occur on public land and 12 acres would occur on private land.

As under Alternative 2, the potential for direct mortality, nest disturbance, or nest destruction impacts to occur would be minimized through implementation of Other Management Provision OMP43 (see Table 2.4-2).

No special status species have been identified as having a primary association with shrub habitat.

General Habitats and Associated Species

Under Alternative 4, impacts to grizzly bear, gray wolf, and wolverine would be similar to Alternative 2.

Impacts to elk and mule deer under Alternative 4 would be similar to Alternative 2 except there would be less of an increase in foraging habitat and less loss of cover habitat. The amount of foraging habitat available for these species would increase from an existing 1,514.41 acres to 1,521.01 acres for a net increase of 6.60 acres, as shown in Table 4.6.3-7. This would occur as a result of a combination of clearing of mature forest (cover) and converting these areas to modified herbaceous habitat (foraging), generally for ski trail and lift construction and reforestation. Under Alternative 4, the amount of cover habitat would decrease from an existing 1,052.67 acres to 1,037.45 acres for a net loss of 15.22 acres. This would be less than under Alternative 2 primarily because neither the *Creek Run* or *Rampart* chairlifts and associated trails would be constructed under this Alternative. Alternative 4 would have the least amount of impact on cover habitat for these species because it would have the least amount of clearing of mature forest and no glading would occur.

Potential disturbance impacts from increased summer time recreational use would be similar to Alternative 2, because the *Pulse Gondola* would be built under this Alternative. Potential disturbance from construction and maintenance activities and the continued operation of the existing mountain biking program would also be similar to Alternative 2. These impacts would be minimized or avoided through implementation of Management Requirements MR35 and MR45 (see Table 2.4-2), as described under Alternative 2.

4.6.5.2 Habitat Connectivity

General Impacts

Alternative 4 would have the least amount of impact to connectivity because no new development would occur in Section 16 (Summit East). The Creek Run and Rampart chairlifts and associated trails would not be constructed, trail 49 would not be realigned, and the Summit East-Summit Central Crossover trail (*Trail 71*) would remain as is. Removal of mature forest habitat would still occur under this Alternative, as previously described under *Forested Habitat and Associated Species*, however the amount would be less than Alternative 2, with mature forest removed from small patches between cleared ski trails at Summit Central/Silver Fir and Alpental. While these areas may provide habitat for some forest species, they do not provide interior forest habitat due to the small patch sizes.

Under this Alternative, the 390-acre Mill Creek land donation described in Alternative 3 and Modified Alterative 5 would not occur. Although Alternative 4 has the least amount of clearing in LSH, it would not provide the short term increase in land managed under that allocation as in Alternative 3 and Modified Alternative 5. As described in Alternative 3 (see FEIS Section 4.6.4.2 – Habitat Connectivity) the land allocation within this larger 5-mile radius of Snoqualmie Pass has remained relatively stable in terms of land that protects or promotes LSH. For this reason Alternative 4 would be neutral to LSH (See FEIS Table 4.6.2-1).

This Alternative would also have the least potential impact to nocturnal species potentially using connective habitat in Section 16 (Summit East) because there would be no night lighting of the Silver Fir pod under this Alternative.

4.6.5.3 Special Status Species

Table 4.6.3-8 presents the determination of effect to special status species potentially occurring within The Summit-at-Snoqualmie Study Area under all alternatives. A detailed analysis of effects to these species can be found in the *Wildlife Resources Report for The Summit-at-Snoqualmie MDP* located in Appendix D.

4.6.6 Impacts – Modified Alternative 5

Projects associated with implementation of Modified Alternative 5 include actions discussed in Section 4.0.2 – Summary of Projects Analyzed in this EIS, as well as additional projects unique to Modified Alternative 5 (discussed below). Modified Alternative 5 does not develop some of the projects in Alternative 2, modifies some aspects of Alternative 2, and includes a land donation. These differences are discussed below. All aspects of the projects are located on public land and are the focus of the range of Alternatives analyzed in this EIS. Impact numbers referenced in this section include impacts common to all Alternatives as well as impacts unique to Modified Alternative 5:

- Reduced trail development within the proposed *Rampart* and *Creek Run* pods.

- Glading-only north of the *Creek Run* chairlift centerline.
- Land donation parcel to offset impacts to Section 16 (Summit East).
- Upgraded *Edelweiss* chairlift.

Modified Alternative 5 is presented in Figures 2.3.6-1, Modified Alternative 5 Proposed Conditions - The Summit and 2.3.6-2, Modified Alternative 5 Proposed Conditions – Alpental.

4.6.6.1 Wildlife Habitat and Associated Species

Under Modified Alternative 5, there would be impacts to all vegetation types, as shown in Tables 4.6.3-1 A, B, and C. Under this Alternative, there would be a loss of mature forest habitat and a gain of modified herbaceous and shrub habitats (see Figures 2.3.6-1, Modified Alternative 5 Proposed Conditions - The Summit and 2.3.6-2, Modified Alternative 5 Proposed Conditions – Alpental). It is important to note that in Modified Alternative 5, resulting acreage may be greater than existing acreage because of additional habitat gained from the Mill Creek land donation (see Table 4.6.3-1B). Incorporation of the Mill Creek parcel into the National Forest System would result in more acreage designated as riparian under the federal Riparian Reserve allocation than under the current condition, or the condition under Alternatives 2 and 4, which designate smaller riparian areas under the Kittitas County buffers.

Forested Habitat and Associated Species

Under Modified Alternative 5, impacts to mature forest habitat and associated species would be similar to but less than Alternative 2 (see Table 4.6.2-2). There would be fewer impacts to mature forest because the amount of clearing associated with the *Creek Run* chairlift and associated trails would be less than Alternative 2, however the amount of glading within mature forest habitat would be greater under Modified Alternative 5.

Impacts to immature forest under Modified Alternative 5 would also be similar to Alternative 2, with similar areas being cleared under both Alternatives, as well as reforestation effort, with approximately 1 more acre of reforestation than Alternative 2. Impacts to forested habitat under this Alternative would be offset by the purchase of 440 acres of land in the Mill Creek drainage by Booth Creek Resorts and the donation of 390 acres to the Forest Service as previously described under Alternative 3. This donated land would become part of the SPAMA and would be managed for late-successional habitat and connectivity.

As shown in Table 4.6.3-2, potential habitat for northern spotted owl, marbled murrelet, and fisher within the Study Area is defined as mature Pacific silver fir and mature western hemlock forest combined. Under Modified Alternative 5, the amount of this habitat type in the Study Area would be reduced from an existing amount of 828.50 acres to 799.21 acres, for a net loss of approximately 29 acres (see Table 4.6.3-2). This reduction would occur entirely within the mature Pacific silver fir type.

Of the approximately 29 acres, 3 acres would occur on public land and less than 1 acre on private land in the upper S.F. Snoqualmie Watershed. In the U. Yakima Watershed, 17 acres would occur on public land and 8 acres on private land. In addition to these acres of clearing, approximately 9 acres of mature Pacific silver fir forest and 20 acres of mature western hemlock forest would be converted from private ownership to public ownership in the U. Yakima Watershed as a result of the land donation.

Impacts to northern spotted owls under Modified Alternative 5 would be similar to Alternative 2, except the amount of clearing would be reduced. In addition, the purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative.

The potential for disturbance to foraging or dispersing spotted owls would also be similar to Alternative 2 although reduced because grooming activities would not occur within gladed trails in the Creek Run ski pod. Night lighting of the *Silver Fir* and *Rampart* ski pods would result in an increase over existing conditions in potential disturbance to spotted owls potentially foraging or dispersing through this area. As under Alternative 2, implementation of Other Management Provisions OMP39-42 (see Table 2.4-2), would reduce potential impacts to northern spotted owls.

The Study Area is not located within designated critical habitat for the northern spotted owl; therefore there would be no impacts to designated critical habitat for this species under this Alternative.

No impacts to marbled murrelets would occur under Modified Alternative 5. The Study Area is not located within designated critical habitat for the marbled murrelet; therefore there would be no impacts to designated critical habitat for this species under this Alternative.

Impacts to fisher would be primarily related to travel through the Study Area, as previously described for Alternative 2.

Under Modified Alternative 5, habitat for species associated with a combination of mature mountain hemlock, mature Pacific silver fir, and mature western hemlock, would be reduced from an existing 1,053.11 acres to 1,020.38 for a net loss of approximately 32 acres (see Table 4.6.3-2). These forest types would provide potential habitat for 46 special status species, the impacts to which are described below.

Of the approximately 32 acres, 5 acres of impact would occur on public land and less than 1 acre on private land in the S.F. Snoqualmie Watershed. In the U. Yakima Watershed, 19 acres of impact would occur on public land and 8 acres would occur on private land. In addition, approximately 20 acres of mature western hemlock forest and 9 acres of mature Pacific silver fir forest would transfer from private to public ownership as a part of the land donation.

Surveys for great gray owls were conducted within suitable habitat in the Study Area in 1999 and 2000 with none found. For this reason, great gray owls are not expected to occur in the Study Area and there would be no impacts to this species. Impacts to pileated woodpeckers and other primary cavity excavators

would be similar to Alternative 2 except that fewer acres of habitat would be cleared (see Table 4.6.3-2). Habitat removal would occur primarily from construction of the *Rampart* and *Creek Run* chairlifts and associated trails. Impacts to both current and future snag availability would be less than Alternative 2 because there would be fewer acres of clearing. The types of impacts from forest glading would be similar to Alternative 2 except that the amount of glading would be greater under Modified Alternative 5. The purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative. As described under Alternative 2, implementation of Other Management Provision OMP40 (see Table 2.4-2), would reduce impacts to snags and CWD, and implementation of Other Management Provision OMP43 (see Table 2.4-2) would reduce potential impacts to these species.

Impacts resulting from Modified Alternative 5 to olive-sided flycatchers and northern goshawks would also be similar to Alternative 2, but with less clearing, less forest fragmentation, and reduced risk of nest predation for olive-sided flycatchers. Impacts from forest glading would be greater than Alternative 2 since more glading would be required under Modified Alternative 5. The purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative. Clearing of forested habitat would occur after August 1 to reduce potential direct impacts to nesting birds, as described in Other Management Provision OMP43 (see Table 2.4-2).

Impacts to silver-haired bat, hoary bat, long-eared myotis, long-legged myotis, Yuma myotis, and Pacific western (Townsend's) big-eared bat would be similar to Alternative 2 except there would be less reduction of roosting habitat and a smaller increase in foraging habitat. The purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative.

Under Modified Alternative 5, the types of impacts to American marten would be similar to Alternative 2 but with less clearing of mature forest. Since there would be less area cleared for ski trails, lift alignments, and roads, there would be less area managed for hazard trees as well as a reduction in the potential loss of denning habitat in areas adjacent to new development. However, the amount of glading would be greater under this Alternative than Alternative 2 however, and both glading and hazard tree management in gladed areas would decrease potential denning habitat in the Study Area. Impacts to travel habitat are described later under Habitat Connectivity. The purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative.

Under Modified Alternative 5, the types of impacts to terrestrial mollusks would be similar to Alternative 2 but with less clearing of mature forest. However, the amount of glading would be greater under this Alternative than the Alternative 2, which would result in less of a decrease in canopy coverage in Section 16. Additionally, the donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative.

Under Modified Alternative 5, impacts to neotropical migratory birds associated with mature forest that may occur in the Study Area would be similar to Alternative 2 except the amount of clearing would be less, therefore resulting in less forest fragmentation, and reduced risk of nest predation compared to Alternative 2. Impacts from forest glading would be similar to but with slightly greater acreage than Alternative 2. The purchase and donation of land in the Mill Creek area would provide long-term replacement habitat for mature forest removed under this Alternative. Clearing of forested habitat would be restricted until after August 1 to reduce potential direct impacts to nesting individuals of these species, as described in Other Management Provision OMP43 (see Table 2.4-2).

Under Modified Alternative 5, impacts to the 11 species of neotropical migratory birds that are associated with immature forest and potentially occur in the Study Area would be similar to Alternative 2 as a result of clearing activities. Similar to Alternative 2, small patches of reforestation would occur throughout the Study Area, thereby reducing the overall impact to this habitat type to less than 1 acre in the Study Area.

Approximately 297 acres of immature Pacific silver fir and Pacific silver fir sapling habitat would be added to public land in the U. Yakima Watershed from the combination of reforestation and land ownership changes associated with the land donation. There would also be a loss of approximately 3 acres of immature forest on public land and no impact on private land in the S.F. Snoqualmie. The impacts on nesting birds would be minimized by avoiding clearing until after August 1, as described in Other Management Provision OMP43 (see Table 2.4-2).

Riparian Habitat and Associated Species

Modified Alternative 5 would have the least impact to riparian habitat of all the Action Alternatives (see Table 4.6.3-3). Under this Alternative, there would be a loss of mature Pacific silver fir and mature mountain hemlock riparian forest habitat and a gain of mature western hemlock riparian forest, immature/sapling Pacific silver fir, and modified herbaceous habitat. The amount of mature western hemlock riparian forest within the Study Area would increase as a result of the land purchase and donation increasing the amount of area included within Riparian Buffers. Restoration of riparian habitat in the vicinity of the existing tubing center and Beaver Lake Creek would be the same as under Alternative 2.

There would be no impact to bald eagles under this Alternative.

Under Modified Alternative 5, habitat for Van Dyke's salamander would increase slightly from 319.57 acres to 320.84 acres for a net increase of approximately 1.27 acres (see Table 4.6.3-3). This increase would occur as a result of the loss of habitat from clearing of mature forest in Riparian Buffers being offset by the increase in the amount of mature forest contained within Riparian Buffers on lands donated to the Forest Service under this Alternative. The amount of mature forest in the Study Area would not change but the amount within an area receiving protection or consideration as Riparian Reserve would increase. Under this Alternative, there would be a approximately 10 acres of mature forest clearing in

Riparian Buffers of which 2 acres would occur on public land and less than 1 acre on private land in the S.F. Snoqualmie Watershed. In the U. Yakima Watershed 4 acres would be impacted on public land and 4 acres on private land.

Impacts to harlequin duck would be similar to but less than Alternative 2 because there would be fewer acres of mature forest cleared in Riparian Buffers of perennial streams. Under this Alternative, the amount of habitat available for harlequin duck would decrease from an existing 68.82 acres to 62.75 acres, for a net loss of approximately 6.07 acres. Direct impacts to nesting harlequin ducks would be avoided through implementation of Other Management Provision OMP43 (see Table 2.4-2).

Under Modified Alternative 5, impacts to neotropical migratory birds associated with riparian habitat would be similar to Alternative 2 but less potential habitat would be affected since there would be less clearing of forest. Modified Alternative 5 would, however, have the greatest amount of glading. The amount of mature riparian forest and modified herbaceous riparian habitat would increase under Modified Alternative 5. Direct impacts to neotropical migratory birds potentially nesting in the Study Area may occur as a result of construction activities. To minimize the potential for this to occur, clearing would not occur until after August 1, as described in Other Management Provision OMP43 (see Table 2.4-2).

Aquatic Habitat and Associated Species

Under Modified Alternative 5, impacts to aquatic habitats and associated species would be similar to Alternative 2. Restoration projects that would reduce sedimentation impacts and wetland restoration would be similar to Alternative 2.

Cliff and Talus Habitat and Associated Species

Since the Pulse Gondola, mountain-top restaurant, and *Internationale* chairlift would all be constructed under Modified Alternative 5, impacts to cliff and talus habitat under Modified Alternative 5 would be similar to Alternative 2, as would the potential impacts to peregrine falcons, mountain goats, Larch mountain salamanders, and neotropical migratory birds associated with cliff habitat.

Herbaceous and Shrub Habitat and Associated Species

Under Modified Alternative 5, impacts to neotropical migratory birds associated with herbaceous habitat would be similar to but less than those under Alternative 2 (see Table 4.6.3-6). Herbaceous habitat would increase from an existing 448.73 acres to 466.85 acres for a net gain of 18.12 acres due to an increase in the amount of modified herbaceous habitat within the Study Area from the conversion of other vegetation types by ski trail development.

Construction activities would impact approximately 32 acres of potential habitat of which 10 acres would occur on public land and none on private land in the S.F. Snoqualmie Watershed. Ten acres of impact would occur on public land and 12 acres would occur on private land in the U. Yakima Watershed.

As under Alternative 2, the potential for direct mortality, nest disturbance, or nest destruction impacts to occur would be minimized through implementation of Other Management Provision OMP43 (see Table 2.4-2).

No special status species have been identified as having a primary association with shrub habitat.

General Habitats and Associated Species

Under Modified Alternative 5, impacts to grizzly bear, gray wolf, and wolverine would be similar to those described for Alternative 2.

Impacts to elk and mule deer would include the following: a smaller increase in foraging habitat, and greater retention of cover habitat as compared to Alternative 2. Under Modified Alternative 5, the amount of foraging habitat available for these species would increase from an existing 1,514.41 acres to 1,536.52 acres for a net increase of 22.11 acres (see Table 4.6.3-7). This would result from a combination of clearing of mature forest (cover) and converting these areas to modified herbaceous habitat (foraging), generally for ski trail and lift construction, and reforestation. Under Modified Alternative 5, the amount of cover habitat would decrease from an existing 1,052.67 acres to 1,020.38 acres for a net loss of 32.29 acres. This would be less than under Alternative 2 primarily because the there would be less clearing in conjunction with the *Creek Run* chairlift and associated trails. There would, however, be an increase in the amount of glading under this Alternative, with 13.87 acres of glading proposed, the most of all action Alternatives which would result in a reduction in the quality and effectiveness of thermal and hiding cover.

Potential disturbance impacts from increased summer time recreational use would be similar to Alternative 2, because the Pulse Gondola would be built under this Alternative. Potential disturbance from construction and maintenance activities and the continued operation of the existing mountain biking program would also be similar to Alternative 2. These impacts would be minimized or avoided through implementation of Management Requirements MR35 and MR45 (see Table 2.4-2), as described under Alternative 2.

4.6.6.2 Habitat Connectivity

General Impacts

Under Modified Alternative 5, impacts to habitat connectivity would be similar to Alternative 2 except with less mature forest removed. Under this Alternative, both the *Creek Run* and *Rampart* chairlifts and associated trails would be constructed, however new ski trails in the *Creek Run* pod that are north of the lift alignment (Trails 55, 55A, and 55B) would be entirely gladed, with no centerline clearing on *Trail 55A*. *Trail 49* would be realigned; however the realignment under this Alternative would not require full clearing within mature forest habitat. Trail 71 would be moved as described in Alternative 2.

Under this Alternative, the purchase and donation of land in Mill Creek (Section 21) would contribute to an improvement in habitat connectivity in the Snoqualmie Pass area in the long-term as described under Alternative 3. This parcel would become part of the AMA and so would be managed as LSH. Similar to Alternative 3, Modified Alternative 5 would increase the amount of land managed as LSH from 43.3 percent to 43.6 percent (see Illustration 4.6.4 – FEIS-1) within a 5-mile radius of Snoqualmie Pass. As immature habitat in this parcel matures, it would increase habitat connectivity between Section 16 (Summit East) and other mature forest habitat to the west and south of the Study Area. As the land allocation within this larger area has remained relatively stable in terms of the amount of land that protects or promotes LSH, the 0.3 percent increase in LSH that would result from implementation of Modified Alternative 5 would be beneficial to LSH (see FEIS Table 4.6.2-1).

Under this Alternative, night lighting would be installed in both the *Rampart* and *Silver Fir* pods. The potential impacts from night lighting would be similar to Alternative 2. Impacts from chairlift and ski trail construction, increased winter recreation, ski trail grooming, and chairlift and ski trail maintenance may also occur, as described under Alternative 2.

4.6.6.3 Special Status Species

Table 4.6.3-8 presents the determination of effect to special status species potentially occurring within The Summit-at-Snoqualmie Study Area under all alternatives. A detailed analysis of effects to these species can be found in the *Wildlife Resources Report for The Summit-at-Snoqualmie MDP* located in Appendix D.

4.6.7 Cumulative Effects

Projects analyzed under cumulative effects include both those associated with The Summit-at-Snoqualmie and past, present and reasonably foreseeable projects not associated with The Summit-at-Snoqualmie. These projects may occur within the S.F. Snoqualmie or U. Yakima Watershed and on either NFSL or on privately owned land.

4.6.7.1 Upper Yakima Watershed

Table 4.6.7-1 describes the past, present and reasonably foreseeable projects at The Summit-at-Snoqualmie, on NFSL and on privately owned land within the U. Yakima Watershed, and identifies the potential impact of each project.

Table 4.6.7-1:
Cumulative Effects on Wildlife of Past, Present, and Reasonably Foreseeable Projects in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last 5 years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately 2 per year.	The replacement and repair of culverts at The Summit-at-Snoqualmie overlaps spatially and temporally with the MDP at the site scale. Approximately 0.01 acre of vegetation around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would be beneficial (i.e., reduced sediment delivery and erosion would allow for maintenance/re-establishment of vegetation and riparian-dependent species habitat along streams). The replacement of culverts, combined with the Action Alternatives, would directly contribute to improved sediment conditions, and therefore, vegetation and habitat conditions downstream.
Projects Not Associated with The Summit-at-Snoqualmie		
Kachess Vegetation Management	Hazard trees were identified in the Kachess Lake Campground through an exhaustive survey. All identified trees are scheduled to be removed by the winter of 2004. The campground contains old growth trees suffering from various stages of root rot. A small amount of timber would be sold as merchantable, the rest would be disposed of through firewood sales, lop and scatter, or burned.	The removal of hazard trees has reduced the canopy cover within the treated areas of the campground. Spatially, the vegetation removal was limited to the campground site, and did not overlap with the MDP or other identified cumulative effects at the site scale. Temporally, the work has been completed and would not overlap with the MDP. This project, combined with the Action Alternatives, contributed to a cumulative loss of wildlife habitat at the 5th field scale. However, the loss of wildlife habitat is not expected to be measurable at the 5th field scale, as the vegetation management project and Action Alternatives occur within an area of existing human use.
Plum Creek Road Restoration	The Cle Elum Ranger District is performing a road analysis covering approximately 50-70 miles of harvest roads on 65,000 acres of land acquired in the last 5 years from Plum Creek Timber lands. Currently, approximately 18 miles of roads that were acquired and deemed to be unsafe or were already closed have been decommissioned by the Forest Service. Under the Proposed Action, approximately 30.57 miles of road would be decommissioned.	Currently, approximately 26.2 acres of roads have been decommissioned within the watershed. Both spatially and temporally, this road decommissioning would overlap with the road obliteration, and other restoration projects identified in the MDP alternatives at the 5th field scale. As a result, the road obliteration under the MDP and the Cle Elum Roads Analysis would cumulatively reduce the available road mileage in the U. Yakima 5th field watershed. The reduction in road mileage would improve downstream riparian vegetation and allow for the re-establishment of vegetation on the obliterated roads. Additionally, the decreased road density would improve wildlife connectivity at the 5th field scale.

Table 4.6.7-1:
Cumulative Effects on Wildlife of Past, Present, and Reasonably Foreseeable Projects in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	The project could improve wildlife habitat connectivity between the north and south Cascades through installation of culverts for wildlife crossings if those alternatives are selected. Approximately 50.9 acres would be impacted by road expansions. This project would overlap in space and time with the MPD, thus Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) would cumulatively enhance wildlife connectivity in the Snoqualmie Pass area.
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	In the Yakima watershed, the acquired lands would be managed under the SPAMA allocation with a late-seral habitat emphasis. The management of these acquired lands would spatially and temporally overlap with the MDP at the 5th field scale, resulting in cumulative benefits to wildlife habitat and connectivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions would contribute to overall improvement in wildlife habitat and connectivity conditions at the 5th field scale.
Keechelus Dam Repairs	The Keechelus Lake dam was repaired in 2003. The existing dam was rebuilt in place to correct structural problems. The project has been completed. Approximately 70 acres of vegetation was cleared to provide a work corridor. The project impacted 3.8 acres of wetlands.	While the dam replacement did not overlap in time with the MDP, stabilization (i.e., grow-in) of the site is projected to overlap with the MDP in both space (at the 5th field) and time. Cumulatively, the 70 acres of vegetation removal and subsequent re-vegetation would cumulatively alter riparian habitat communities and reduce wildlife habitat conditions at the 5th field scale.
Gold Creek Pond Trail Development	A native surface foot trail, approximately 100 feet long was constructed. This project was completed in 2001.	Temporary impacts to 0.005 acre occurred during trail construction. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space (at the 5th field scale) or time with any projected wildlife impacts under the Action Alternatives.
U.S. West Telephone line	Installation of an underground telephone line in old road prism. This project was completed in 2001.	Temporary impact of 1.82 acres to install an underground line created disturbance to an already modified road prism. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space (at the 5th field scale) or time with any projected wildlife impacts under the Action Alternatives.

Table 4.6.7-1:
Cumulative Effects on Wildlife of Past, Present, and Reasonably Foreseeable Projects in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
WSDOT I-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical deicers to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile is applied to I-90 within the Snoqualmie Pass area (WSDOT 1999, 2001).	Approximately 380 tons of sand reach Coal Creek each year from I-90 sanding operations. I-90 Maintenance would overlap with the MDP in both space and time at the site and 5th field scales. Increases in detrimental soil conditions and sediment yield under the Action Alternatives (Alternative 2 being the largest impact and Alternative 4 being the lowest of the Action Alternatives) would cumulatively affect soil productivity and establishment/maintenance of vegetation and wildlife habitat. Chemical de-icing may affect roadside vegetation, and therefore wildlife habitat, if localized concentrations exceed plant tolerance, although such de-icing has been successfully implemented in the MBSNF and OWNF.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	The recent purchase of Sections 5, 17, and 25 of Township 21N Range 11E occur within portions of the Yakima River Watershed. These acquired lands would be allocated to the SPAMA and managed with an emphasis for late-seral habitat preservation. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP, resulting in cumulative benefits to wildlife habitat and connectivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions would also contribute to overall improvement in wildlife habitat and connectivity at the 5th field scale.
Plum Creek Cascade Habitat Conservation Plan	A HCP was developed for the Plum Creek Timber Company to manage timber harvest and protect wildlife habitat over several 5th field watersheds in the vicinity of Snoqualmie Pass.	Approximately 52,100 acres of land is managed under the HCP. Protection of wildlife habitat would temporally and spatially overlap at the 5th field scale with the MDP resulting in cumulative benefits to wildlife habitat and connectivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), lands managed under the HCP, combined with private land acquisitions would contribute to overall improvement in wildlife habitat and connectivity at the 5th field scale.

Table 4.6.7-1:
Cumulative Effects on Wildlife of Past, Present, and Reasonably Foreseeable Projects in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of The Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in both space at the site scale and time with the MDP development. Alternative 2 and Modified Alternative 5 would increase detrimental soil conditions in the Study Area, and in conjunction with the private land developments and other ground disturbing activities, would cumulatively affect wildlife habitat and connectivity.
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the Upper Yakima River watershed. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	A total of 210 acres of forest would be commercially thinned to accelerate the development of late successional forest structure. Short-term impacts resulting in wildlife avoidance of the area would occur. Protection of wildlife habitat would temporally and spatially (at the 5th field scale) overlap with the MDP, resulting in cumulative benefits to wildlife habitat and connectivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek HCP and private land acquisitions would contribute to overall improvement in wildlife habitat and connectivity at the 5th field scale.
Snoqualmie Pass AMA Plan	Land management plan for the AMA emphasizing late successional habitat maintenance and enhancement	The management of lands to emphasize late-successional habitat would overlap spatially and temporally with the MDP at the 5th field scale. The management of lands under the SPAMA would result in cumulative benefits to wildlife habitat and connectivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek HCP and private land acquisitions would contribute to overall improvement to wildlife habitat and connectivity at the 5th field scale.

Table 4.6.7-1:
Cumulative Effects on Wildlife of Past, Present, and Reasonably Foreseeable Projects in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
Cle Elum RD roads analysis	Analysis of road system to determine long-term need. Implementation is expected in 2010.	The analysis of road systems and implementation of the plan would overlap spatially (at the 5th field) and temporally with the MDP. In conjunction with the Implementation, Operations, Restoration and Management Plan for The Summit-at-Snoqualmie MDP (see Appendix F), the roads analysis would improve road and trail management in the U. Yakima Watershed. The result will be a cumulative benefit to wildlife habitat in the 5th field with improved road and trail management under both plans.
WSDOT road de-icing	Application of sand and chemical deicers to roadway surfaces	Deicing of roadways would overlap spatially, at the site and 5th field scales, and temporally with the MDP. No impacts to wildlife are expected due to this project.
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the Wenatchee National Forest Land and Resource Management Plan.	The study of lands to determine suitability for preservation as wilderness would overlap spatially (at the 5th field scale) and temporally with the MDP. If lands are re-allocated to Wilderness under this project, cumulative benefits to wildlife habitat and connectivity would result. Coupled with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisitions, this project would contribute to overall improvement in wildlife habitat and connectivity at the 5th field scale.
Pro Guiding Service Area Expansion	Pro Guiding has requested expansion of their area of operation to include the Cascade crest area from Kendall Lakes to Mt. Daniel, plus the Alta Mountain area. They are not requesting an increase in number of service days.	The expansion of Pro Guiding's area of operation would overlap spatially (at the 5th field scale) and temporally with the MDP. No impacts to wildlife are expected from this project.
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (W. Keechelus subwatershed). The proposed project includes thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	The thinning of forests to accelerate late-successional habitat structure and restore ecological conditions would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in wildlife avoidance of the area and changes to the wildlife habitat could occur during thinning operations. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Combined with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisition projects, this project would result in cumulative benefits to wildlife habitat and connectivity. Under Alternatives 2 and 4 (with no land donation), this project and the other private land acquisitions would contribute to overall improvement in wildlife habitat and connectivity at the 5th field scale.

Table 4.6.7-1:
Cumulative Effects on Wildlife of Past, Present, and Reasonably Foreseeable Projects in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (E. Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and fish passage improvements, and other restoration projects.	The thinning of forests to accelerate late-successional habitat structure and restore ecological conditions would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in changes to wildlife habitat and temporary avoidance of the area by wildlife would occur during thinning operations. Long-term beneficial impacts are anticipated due to the long-term objective of improving late-successional habitat. Combined with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation) and the private land acquisition projects, this project would result in cumulative benefits to wildlife habitat and connectivity. Under Alternatives 2 and 4 (with no land donation), this project and the other private land acquisitions would contribute to overall improvement in wildlife habitat and connectivity at the 5th field scale.

Only one project type identified within the U. Yakima Watershed is located within the Study Area but is not associated with the proposed MDP; the replacement of culverts. Within the Study Area, culverts are inspected on an annual basis and replaced as needed. As described in Table 4.6.7-1, based on the rate of culvert replacement over the past five years, approximately two culverts are replaced per year. Culvert replacement can have short-term impacts on water quality and aquatic habitat, including temporary increases in sedimentation and changes in channel morphology. Impacts to wildlife could include the short-term loss of riparian vegetation during culvert removal and installation.

Most culverts in the Study Area are located in areas of modified herbaceous habitat of low wildlife value. Affected habitat is expected to quickly reestablish and, due to the small areas involved and the low number of culverts replaced, impacts to special status wildlife species at the U. Yakima Watershed scale from these projects are not expected to be measurable. Over the long-term these projects would improve conditions at the site-specific scale. Impacts to riparian habitat from culvert replacement would incrementally increase impacts at the site scale when considered cumulatively with impacts from proposed MDP alternatives.

Impacts from proposed projects not associated with the proposed MDP can be roughly divided into the following: loss of wildlife habitat; wildlife habitat improvement; loss of habitat connectivity; improvements to habitat connectivity; and increased human disturbance.

Projects listed in Table 4.6.7-1 that would cause a potential loss of wildlife habitat in the U. Yakima Watershed include: Kachess vegetation management; I-90 modifications; Keechelus dam repair; U.S. West telephone line; WSDOT I-90 maintenance; and private land developments. The Kachess vegetation

management project would remove mature forest habitat and cause further reductions of this forest type in the U. Yakima Watershed. This would further reduce the amount of this habitat type available for associated species.

The I-90 modification and Keechelus dam repair projects would result in a loss of a variety of habitat types, including wetlands, thereby reducing the amount of habitat available for aquatic amphibians and other species associated with this habitat type. The WSDOT I-90 maintenance project is an ongoing annual operation that results in an incremental impact to riparian and stream habitat in areas adjacent to the Interstate, thereby reducing habitat quality and quantity for riparian and stream dwelling species.

Development of private lands would result in clearing of forested habitat types and conversion of forest habitat to a developed condition. This would reduce the amount of habitat available for forest dependent species in the U. Yakima Watershed, increasing habitat fragmentation and risk of predation for species such as neotropical migratory birds. Habitat removal associated with these projects combined with habitat removal that would occur under any of the Action Alternatives of the proposed MDP would contribute to the loss or conversion of wildlife habitats in the watershed, however at the watershed scale this loss or conversion would be minimal.

Projects listed in Table 4.6.7-1 that would result in potential wildlife habitat improvement include the I-90 Land Exchange, other land acquisitions, the Plum Creek HCP, commercial thinning projects, SPAMA, the I-90 Wildlife Study, and the Roaring Thin and East Keechelus Restoration projects. The I-90 land exchange and other land acquisitions have increased the amount of land under federal ownership in the Snoqualmie Pass area, increasing the amount of area managed for late successional forest habitat and thus providing a long-term benefit to species dependent on this habitat type. This would improve habitat conditions to some extent, although intense development within the immediate Snoqualmie Pass area would continue to limit use of some portions of the area by wildlife. The Plum Creek HCP provides for management of wildlife habitat as part of the overall land management strategy and will provide long-term benefits to wildlife in the U. Yakima Watershed. The commercial thinning projects, and the Roaring Thin and East Keechelus Restorations would be designed to promote the development of LSH and would have a long-term beneficial impact on mature forest habitat. The increase in land area managed for forested habitat within the U. Yakima Watershed from these projects would be much greater than the amount of habitat altered by implementation of the proposed MDP alternatives and at the U. Yakima Watershed scale there would be a long-term increase in forest habitat available.

Development of private lands listed in Table 4.6.7-1 would cause a potential loss of wildlife habitat connectivity. Private land development would result in the fragmentation of forest habitat and an increase in human activity in the area, thereby reducing opportunities for travel and movement by wildlife species and reducing connectivity. Development of private lands in the Gold Creek valley (Township 22 North, Range 11 East, Sections 5 and 11) would have the greatest potential impact on wildlife habitat connectivity in the Snoqualmie Pass area. These projects have the potential to cause a long-term decrease

in habitat connectivity within the U. Yakima Watershed and between the U. Yakima Watershed and the S.F. Snoqualmie Watershed. Development of private lands would also contribute to habitat loss; however the increase in the amount of habitat managed for forest conditions would offset this loss at the watershed scale. Implementation of MDP Alternative 2 would contribute to the loss of habitat connectivity within the U. Yakima Watershed, while Alternatives 3 and 5 would increase the amount of land managed for habitat connectivity (due to a 390-acre land donation) and Alternative 4 would neither reduce nor increase habitat connectivity.

Loss of wildlife habitat connectivity would be offset to some degree by projects that would improve connectivity. Projects listed in Table 4.6.7-1 that would potentially improve wildlife habitat connectivity include road restoration projects on lands acquired in the Plum Creek land exchange, I-90 modifications, the I-90 land exchange, and land acquisitions. The Plum Creek and I-90 land exchanges and other land acquisitions would result in a reduction in the amount of checkerboard land ownership, consolidating land management as per the WNF *Land Resource Management Plan*. This would result in an increase in the area managed for late successional habitat and habitat connectivity in the U. Yakima Watershed. Modifications to I-90 are being designed to improve connectivity across the interstate through the construction of bridges and enlarged culverts. The road restoration project on land acquired in the Plum Creek land exchange and the Plum Creek Road Restoration would both likely result in road decommissioning, thus reducing road density in the U. Yakima Watershed and benefiting habitat connectivity.

Impacts to connectivity would be greatest under Alternative 2, which has the greatest amount of clearing and does not include the Mill Creek land donation. The Mill Creek land donation would occur under Alternatives 3 and 5 and would offset proposed habitat losses, resulting in a neutral or beneficial impact to habitat connectivity.

Projects listed in Table 4.6.7-1 that would cause a potential increase in human use in the area include the Gold Creek Pond trail and private land development. Development of the Gold Creek Pond trail and picnic area has resulted in increased recreational use in the area, potentially increasing disturbance to wildlife. Private land development also increases the number of people utilizing the area, leading to an increased potential for wildlife disturbance both at the site scale and in the U. Yakima Watershed.

Table 4.6.7-2 summarizes the cumulative effects of past, present and reasonably foreseeable projects within the 5th field U. Yakima Watershed. Projects associated with The Summit-at-Snoqualmie would cumulatively affect 1.05 to 1.11 percent of the 5th field watershed scale under the Action Alternatives. When combined with the past, present, and reasonably foreseeable projects described in the table above, implementation of the MDP would result in cumulative effects to 3.97 to 4.03 percent of the 5th field U. Yakima Watershed.

Table 4.6.7-2:
Cumulative Acreage of Effects on Wildlife from Past, Present, and Reasonably Foreseeable Projects within the 5th Field Upper Yakima River Watershed

Impact Type	Alt. 1[a]		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th
Summit-at-Snoqualmie Projects										
Long-Term Impacts	666.72	0.90	787.72	1.06	758.72	1.02	742.88	1.00	778.90	1.05
Short-Term Impacts	0	0	37.30	0.05	36.45	0.05	34.51	0.05	37.03	0.05
Impacts Not Associated with The Summit-at-Snoqualmie										
Long-Term Impacts	50.90	0.07	50.90	0.07	50.90	0.07	50.90	0.07	50.90	0.07
Short-Term Impacts	2126.34	2.86	2126.34	2.86	2126.34	2.86	2126.34	2.86	2126.34	2.86
Total Long-Term and Short-Term Impacts	2177.24	2.92	2177.24	2.92	2177.24	2.92	2177.24	2.92	2177.24	2.92
Beneficial Impacts	2023.12	2.72	2023.12	2.72	2023.12	2.72	2023.12	2.72	2023.12	2.72
Total Cumulative Effects	**2843.96**	**3.82**	**3002.25**	**4.03**	**2972.40**	**3.99**	**2954.63**	**3.97**	**2993.17**	**4.02**

[a] The impacts associated with ongoing, maintenance related activities at The Summit-at-Snoqualmie are displayed in Alternative 1 (the No Action Alternative), since these activities would occur under all alternatives, they have been added to the impacts for the Action Alternatives.

4.6.7.2 South Fork Snoqualmie Watershed

Table 4.6.7-3 describes the past, present and reasonably foreseeable projects occurring at The Summit-at-Snoqualmie, on NFSL and on privately owned land within the S.F. Snoqualmie Watershed, and identifies the potential impact of each project.

Table 4.6.7-3:
Cumulative Effects to Wildlife from Past, Present and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last 5 years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately 2 per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	Approximately 0.01 acre of vegetation around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would likely be beneficial, as reduced sediment delivery and erosion would allow for maintenance and re-establishment of habitat along streams. These culvert replacements would overlap spatially (at the site scale) and temporally with the MDP, and would, as a whole, improve the culvert conditions throughout the Study Area. As the culverts occupy several hundred square feet within the watershed, this project would directly contribute to improved sediment conditions downstream.

Table 4.6.7-3:
Cumulative Effects to Wildlife from Past, Present and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
Alpental Covered Bridge Replacement	The existing covered footbridge at Alpental washed out during a storm in 2003. The Summit-at-Snoqualmie replaced the bridge in 2005.	No new permanent impacts occurred as the new bridge was placed within the footprint of the old bridge. Temporary soil disturbance occurred during construction and riparian vegetation was re-established in 2006. While the bridge replacement overlaps spatially with the MDP at the site scale, the re-establishment of riparian vegetation, and stabilization will not overlap in time with the MDP and therefore would not cumulatively affect wildlife habitat or connectivity.
Cave Ridge Land Donation	The Summit at Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	The land donation would overlap spatially and temporally with the MDP. Up to 100 acres would be added to Wilderness, and the remainder would continue to be managed in its current unroaded character. This project would not cumulatively affect wildlife at the site or 5th field watershed scale.
Projects Not Associated with The Summit-at-Snoqualmie		
FS Road 58 Bridge Replacement	An existing steel bridge over the South Fork Snoqualmie River was replaced on Forest Service Road 58 due to structural problems. The new bridge was expanded from one to two lanes with upgraded load capacity. Construction of the bridge was completed in spring 2005.	Approximately 0.05 acre was graded to provide an expanded roadway approach. Bridge footings were installed below the ordinary high water mark and required temporary flow diversion structures to create a dry work zone. With completion of the project in 2005, the bridge replacement does not overlap with the MDP in either space or time. Thus the bridge replacement would not cumulatively affect wildlife or wildlife habitat at the 5th field scale.
Huckleberry Land Exchange	Exchange of NFSL for Weyerhaeuser Lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	Approximately 6,798 acres of Weyerhaeuser land was received by the Forest Service. Approximately 702 acres are managed as LSR. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP, resulting in cumulative benefits to wildlife habitat and connectivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and the other private land acquisitions contribute to a cumulative improvement in wildlife habitat and connectivity at the 5th field scale.

Table 4.6.7-3:
Cumulative Effects to Wildlife from Past, Present and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
WSDOT 1-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical deicers to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile is applied to I-90 within the Snoqualmie Pass area.	Approximately 294 tons of sand reach the South Fork Snoqualmie River each year from I-90 sanding operations. I-90 Maintenance would overlap with the MDP in both space and time at both the site and 5th field scale. Increases in detrimental soil conditions and sediment yield under the Action Alternatives (Alternative 2 being the largest impact and Alternative 4 being the lowest of the Action Alternatives) would cumulatively affect soil productivity and establishment/maintenance of vegetation and wildlife habitat. Chemical de-icing may affect roadside vegetation, and therefore wildlife habitat, if localized concentrations exceed plant tolerance, although such de-icing has been successfully implemented in the MBSNF and OWNF.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The recent purchase of Section 19 of Township 22N Range 11E occurs within portions of the South Fork Snoqualmie River Watershed, and its management overlaps spatially (in the 5th field) and temporally with the MDP. These lands will be allocated to Late Successional Reserve. Coupled with other land acquisitions in the Snoqualmie Pass area, cumulative wildlife habitat and habitat connectivity conditions would improve at the 5th field scale, with a greater improvement under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation).
U.S. West Telephone line	Installation of an underground telephone line in the I-90 corridor	Temporary impacts to sediment regime occurred during installation of an underground line, which created disturbance to an already modified soil profile in the road prism. This project is assumed to have been stabilized as of 2005, and therefore does not overlap spatially or temporally with any projected wildlife impacts under the MDP.
WSDOT road de-icing	Application of sand and chemical deicers to roadway surfaces	Deicing of roadways would overlap spatially and temporally with the MDP at the site and 5th field scales. No impacts to wildlife are expected from the roadway deicing project.
BPA Proposed Additional Power Lines	Supplemental DEIS to examine development of an additional powerline. Options include adding lines to existing towers or adding new towers.	The construction of additional power lines would overlap spatially (in the 5th field) and temporally with the MDP. This project, if tree clearing is required to construct new towers, coupled with the Action Alternatives, would result in cumulative effects to vegetation communities, and potential impacts to wildlife habitat.

Table 4.6.7-3:
Cumulative Effects to Wildlife from Past, Present and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
McClellan Butte Trail Reconstruction Project	The project will relocate approximately 1.5 miles of trail to newly constructed trail or old road bed, abandon 1.5 miles of trail, and rehabilitate tread, drainage and switchbacks as required along the remainder of the 4.4-mile trail.	Temporary impacts along 5.9 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected wildlife impacts under the MDP.
Bandera Mountain/Mason Lake Trail Relocation Project	Project reorganized trail access to Mason Lake and Bandera Mountain in order to minimize social and resource impacts associated with the existing trails. The project involved construction of 1.5 miles of new trail, reconstructing 2.0 miles of existing trail and decommissioning 2.3 miles of existing trail.	Temporary impacts along 3.5 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected wildlife impacts under the MDP.
High Lakes Trail #1012 and Snow Lake Trail #1013 Reconstruction	This project repaired seven switchbacks on the Snow Lake Trail and reconstructed 2 miles on the High Lakes Trail from Snow to Gem Lake.	Temporary impacts along 3.5 miles of trail occurred during trail reconstruction. The project is assumed to have been stabilized, and therefore does not overlap spatially (at the 5th field scale) or temporally with any projected wildlife impacts under the MDP.
South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project	Reduce the maintenance level (ML) on 11 roads (26.3 miles). 19.4 miles would be reduced to ML 1 (closed to motorized access) and utilized as loop and destination trail routes; 2.7 miles would be closed - placed in storage for future forest management; 1.1 mile would be removed from the transportation system and converted to trail; approximately 22.2 miles of spur roads mostly associated with roads proposed for reduction to ML 1 would be closed and removed from the Forest Road Transportation System.	The road decommissioning and maintenance level reductions would overlap spatially (in the 5th field) and temporally with the MDP. Road closures would decrease the road density at the 5th field and contribute to improved wildlife habitat and connectivity. Closure of roads to motorized vehicles would also contribute to improved connectivity. Coupled with the Implementation, Restoration, Operation, and Monitoring Plan (see Appendix F), the South Fork Access and Travel Management Plan and other road management projects, this project would result in cumulative benefits to wildlife habitat and connectivity at the 5th field scale.

Table 4.6.7-3:
Cumulative Effects to Wildlife from Past, Present and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
Denny Salvage	This project would salvage approximately 50 mbf of windblown trees utilizing a ground based logging system. All undamaged trees with secure root systems would be left.	The salvage of approximately 50 mbf would overlap spatially (in the 5th field) and temporally with the MDP. Short-term impacts to vegetation communities and wildlife habitat during the salvage would occur due to tree removal and logging equipment. The stabilization of the salvage area would overlap in time with the implementation of the MDP at the 5th field scale. When combined with the Implementation, Operations, Restoration, and Monitoring Plan under the Action Alternatives, revegetation of the salvage area would cumulatively add to beneficial impacts to vegetation communities and wildlife habitat.
Annual Road Maintenance	Brushing/blading of roads on a rotating schedule as funds allow. Includes roads 55, 5510, 58, and road 9030 and 9031 systems.	Brushing and blading of roads would overlap spatially (at the 5th field) and temporally with the MDP. Short-term impacts to wildlife resulting in avoidance of the area associated with construction noise would result from this project. Coupled with the Action Alternatives and other roadway projects, this project would cumulatively affect wildlife resulting in short-term avoidance.
Road 9020 ERFO Repair	The project proposes to either replace the culvert at Alice Creek or reduce the ML of Road 9020 pas Alice Creek to 1 (no motorized access).	The replacement of a culvert or closure of the road to motorized access would overlap spatially (at the 5th field) and temporally with the MDP. If the road is decommissioned, this project would result in an improvement to wildlife habitat and connectivity. If the culvert is replaced, this project would result in temporary impacts to riparian vegetation, and could affect riparian-dependent species. Long-term impacts of the culvert replacement would likely be beneficial, as reduced sediment delivery and erosion would allow for maintenance and re-establishment of habitat along streams.
I-90 Corridor Thin	The project involves commercially thinning approximately 338 acres in the I-90 Corridor. About 4.3 mmbf would be thinned from 14 units.	The thinning of approximately 338 acres would overlap spatially (in the 5th field) and temporally with the MDP. The thinning project would result in short-term impacts to wildlife usage of the area.
Snoqualmie Pass Utility District Permit Amendment	The project would extend water and sewer lines along Forest Service Road 4832 from the I-90 Hyak interchange for approximately 3,000 feet. The new lines would stop before reaching Gold Creek. Lines would be laid within the existing road right of way.	Temporary impacts from extension of water and sewer lines within the previously disturbed soils of the road prism would overlap spatially (in the 5th field) and temporally with the MDP. No impacts to wildlife are expected due to this project, because construction activities will take place within the existing road prism at the 5th field scale.

Table 4.6.7-3:
Cumulative Effects to Wildlife from Past, Present and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Wildlife
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	The construction of a new trail and trailhead parking would overlap spatially (in the 5th field) and temporally with the MDP. Impacts to wildlife habitat and connectivity would result from trail and parking area construction. Avoidance of the area by wildlife would occur during construction and from increased human presence on new recreation trails. This project, coupled with the Action Alternatives, would result in impacts to wildlife habitat and connectivity due to clearing and modification of vegetation communities. However, there would be no measurable cumulative effect due to this project.

Of the project types identified for cumulative impact analysis within the S.F. Snoqualmie Watershed, culvert replacement, WSDOT I-90 and other road Maintenance, US West Telephone Line, and Land Acquisitions are common to both the U. Yakima Watershed and the upper S.F. Snoqualmie Watershed and affects at the site specific and watershed scales within the S.F. Snoqualmie Watershed would be the same as described for the U. Yakima Watershed.

The Alpental covered bridge replacement, which would occur within the Study Area, would cause short-term impacts at the site-specific scale only, and no measurable impacts at the upper S.F. Snoqualmie Watershed scale would occur.

Of the projects not associated with Summit at Snoqualmie and occurring outside of the Study Area, the FS Road 58 Bridge Replacement, and trail construction projects would result in a loss of wildlife habitat. The Huckleberry Land Exchange, road decommissioning projects, and land acquisitions would improve wildlife habitat connectivity within the S.F. Snoqualmie Watershed.

Trail construction associated with the South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project would result in the permanent removal of vegetation. The type of vegetation impacted would depend on the trail location. Impacts to wildlife habitat would, however, be expected to be measurable at the site scale only, and trail construction would not measurably alter wildlife habitat availability at the S.F. Snoqualmie Watershed level. Road management could improve habitat conditions if roads are decommissioned. The FS Road 58 Bridge Replacement project, completed in spring of 2005, is estimated to have impacted 0.05 acre of riparian habitat and will be a long-term impact at the site-specific scale. When considered cumulatively with the impacts of the proposed MDP these projects would cause an incremental increase in the amount of riparian habitat impacted. However at the 5th field S.F. Snoqualmie Watershed scale this difference would be minimal.

The Huckleberry Land Exchange reduced the amount of checkerboard land ownership in the S.F. Snoqualmie Watershed and will benefit wildlife by improving habitat connectivity at the 5th field over the long-term and increasing the amount of land managed for forest habitat. The increase in land area managed for forested habitat within the S.F. Snoqualmie Watershed from these projects would be much greater than the amount of habitat altered by implementation of the proposed MDP alternatives and at the S.F. Snoqualmie Watershed scale there would be a long-term increase in forest habitat available.

In general, the trend appears to be increased development in the areas directly adjacent to I-90, reducing habitat quality, quantity, and connectivity while management of lands not directly adjacent to I-90 is increasingly focused on providing wildlife habitat and connectivity in both the U. Yakima Watershed and the upper S.F. Snoqualmie Watershed. For species to benefit from improved connectivity on either side of I-90, they must be able to approach and cross the Interstate. The I-90 modification project is the first in the area to specifically address this issue with a discussion about wildlife bridges or other means of wildlife access across I-90. No such connectivity project has been identified as reasonably foreseeable.

Table 4.6.7-4 summarizes the cumulative effects of past, present and reasonably foreseeable projects in the 5th field S.F. Snoqualmie Watershed. Under the Action Alternatives, 0.78 to 0.82 percent of the 5th field S.F. Snoqualmie Watershed would be impacted. When combined with the past, present and reasonably foreseeable projects listed above, implementation of the MDP would result in wildlife impacts to approximately 1.95 to 1.99 percent of the 5th field S.F. Snoqualmie Watershed.

Table 4.6.7-4:
Cumulative Acreage of Effects to Wildlife from Past, Present, and Reasonably Foreseeable Projects within the 5th Field South Fork Snoqualmie River Watershed

Impact Type	Alt. 1[a]		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th	Area (acres)	% 5th
Summit-at-Snoqualmie Projects										
Long-Term Impacts	203.73	0.69	228.41	0.77	223.54	0.76	227.33	0.77	228.47	0.77
Short-Term Impacts	0.00	0.00	14.17	0.05	5.95	0.02	14.00	0.05	14.09	0.05
Projects Not Associated with The Summit-at-Snoqualmie										
Long-Term Impacts[b]	0.26	0.00	0.26	0.00	0.26	0.00	0.26	0.00	0.26	0.00
Short-Term Impacts	346.21	1.17	346.21	1.17	346.21	1.17	346.21	1.17	346.21	1.17
Total Long-Term and Short-Term Impacts	346.47	1.17	346.47	1.17	346.47	1.17	346.47	1.17	346.47	1.17
Beneficial Impacts	7167.88	24.26	7167.88	24.26	7167.88	24.26	7167.88	24.26	7167.88	24.26
Total Cumulative Effects	**550.20**	**1.86**	**589.05**	**1.99**	**575.97**	**1.95**	**587.80**	**1.99**	**589.04**	**1.99**

[a] The impacts associated with ongoing, maintenance related activities at The Summit-at-Snoqualmie are displayed in Alternative 1 (the no action alternative), since these activities would occur under all Alternatives, they have been added to the impacts for Alternatives 2 through 5.
[b] Long Term, but non-quantifiable, impacts occur to the watershed as a result of winter sanding and deicing operations on I-90.

4.6.7.3 Cumulative Effects to Connectivity

Several of the activities listed in Tables 4.6.7-1 and 4.6.7-3, above, would affect habitat connectivity in the U. Yakima and S.F. Snoqualmie watersheds, specifically:

- Land Acquisitions;
- I-90 Modifications;
- I-90 Land Exchange;
- Plum Creek Road restoration;
- South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project; and the
- Huckleberry Land Exchange.

The land exchanges and acquisitions benefit wildlife habitat connectivity by reducing the amount of land that is in checkerboard ownership in the watersheds and thus providing for more consistent management of this land. Exchange lands that are acquired within the SPAMA boundary would be managed per the SPAMA plan for LSH, which would provide a long-term increase in the amount of LSH within the SPAMA and provide this habitat in larger blocks than would occur without the land exchange. Land acquired through the Mill Creek land donation that would occur under Alternatives 3 and 5 would be located within the SPAMA and would be managed for LSH and so would contribute to the long-term increase in habitat connectivity within the SPAMA.

The Plum Creek Restoration and South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning projects would benefit habitat connectivity within the SPAMA, the S.F. Snoqualmie Watershed and the U. Yakima Watershed by identifying roads that are no longer needed and decommissioning them. This is beneficial to habitat connectivity because it reduces disturbance from roads on sensitive wildlife, and removes possible barriers for species that avoid roads or for which a road may present a barrier. Lands within the parcel that would be donated to the USFS under Alternatives 3 and 5 contain several roads that could be evaluated for potential decommissioning.

WSDOT's proposed modifications to I-90 would benefit habitat connectivity by providing increased permeability for animals across the Interstate. The Mill Creek land donation, in Alternatives 3 and Modified Alternative 5, would provide habitat on the south side of I-90 for wildlife to use as travel habitat to access the Interstate from the south side or to disperse into available habitat on the south side of the Interstate after crossing it from the north.

When considered cumulatively, the proposed projects and the Mill Creek land donation would provide for increased connectivity throughout the Snoqualmie Pass area, particularly within the Connectivity Emphasis Area of the SPAMA.

4.6.8 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of wildlife resources are those that cannot be reversed. Irretrievable commitments of wildlife resources are those that are lost for a period of time and, in time, can be replaced. Implementation of the Proposed Action or of any of the Action Alternatives would result in the irretrievable commitment of approximately 127 to 175 acres of forested and nonforested wildlife habitat to develop ski trails and other facilities. Although the loss of forested habitats would occur as ski trails are developed, forested habitats could reestablish if certain trails are closed and no longer used for skiing, or after the site is no longer used as a ski area. Replacement of immature forest could take up to 100 years after a site is no longer used as a ski trail. Replacement of mature forest could take several hundred years after ski trails are no longer used.

Buildings, parking lots, and other structures could be removed and the site restored to forest and nonforest wildlife habitats if an area is no longer specified to be used as a ski area. It cannot be determined when the SUP area or portions of the SUP area may be designated for non-ski use, but the potential remains for the area to be restored to native vegetation and associated wildlife values. Loss of soil productivity of some sites (e.g., asphalt-covered parking lots and buildings) may limit their potential to fully realize timber productivity and species diversity until many years have passed.

No threatened or endangered wildlife species are present that would become extinct if Action Alternatives are implemented. Although some USFS sensitive wildlife species are present, the Action Alternatives would not cause the species to become extinct because of other known occurrences of the species within the SUP area and elsewhere on public and private lands.

4.6.9 Adaptive Management Area Standards and Guidelines

The portion of the Study Area located on the Okanogan-Wenatchee National Forest is located within the SPAMA and within a Connectivity Emphasis Area (CEA) as described in the SPAMA Plan EIS. The SPAMA Plan EIS specifies that National Forest System Lands within CEAs be managed "to protect and enhance late-successional forest conditions and connectivity"(USFS and USFWS 1997). The SPAMA Plan EIS adopts the Standards and Guidelines for Late Successional Reserves (LSR) from the Forest Plan (USDA and USDI 1994) with some alterations. The Forest Plan specifies that non-silvicultural activities are generally allowed within LSRs if they are neutral or beneficial to late-successional habitat (LSH) (USDA and USDI 1994). The SPAMA Plan EIS applies this condition only to CEAs within the SPAMA (USFS and USFWS 1997). Therefore, for the proposed MDP to be consistent with the SPAMA Plan EIS, MDP components must be shown to be neutral or beneficial to LSH and to connectivity.

Table 4.6.2-1 presents a summary of the Action Alternatives in relation to the AMA/LSR Standards and Guidelines that are relevant to wildlife and vegetation.

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Access, Road Construction and Maintenance					
1 Relocate trails when necessary to prevent degradation to late-successional habitat and water quality (SPAMA, p. 2-35)	No trails would be proposed for relocation. Maintains existing condition. (Neutral)	New ski trails would be proposed in LSH. There would be a long-term loss of LSH since no future replacement habitat would be purchased and donated to the Forest Service. This would reduce the amount of habitat available for forest dependent wildlife species and degrade the quality of remaining habitat by increasing fragmentation and edge effect (Detrimental).	New ski trails would be proposed in LSH but the land donation would provide long-term replacement habitat for impact area. Less clearing proposed in LSH than Alternative 2. Reforestation in decommissioned trails adjacent to LSH would also provide LSH recovery (Neutral).	No new ski trails would be proposed in LSH in Section 16 (Summit East). No loss of LSH in Section 16 (Summit East) compared to Alternatives 2, 3, and 5 (Neutral).	New ski trails would be proposed in LSH with the land donation providing replacement habitat for impact area. Trail reforestation would not occur as in Alternative 3. Less clearing of LSH than Alternative 2, but slightly more clearing/glading than Alternative 3. Some tree removal would occur for gladed trails, but maintaining 70 percent overstory canopy (Neutral).

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
2 Road construction in LSR's/AMA for silvicultural, salvage, and other activities generally is not recommended unless potential benefits exceed the costs of habitat impairment. If new roads are necessary to implement a practice that is otherwise in accordance with these guidelines, they will be kept to a minimum, be routed through non-late-successional habitat where possible, and be designed to minimize adverse impacts. Alternative access methods, such as aerial logging, should be considered to provide access for activities in LSR/AMA (Forest Plan p. C-16; SPAMA p. 2-52).	No roads would be proposed for relocation. Maintains existing condition. Existing roads in LSH would remain (Neutral).	Portion of new road would be proposed in LSH. Some loss of habitat would occur. Reforestation of decommissioned roads would occur in LSH for a net reduction in road miles in LSH in the SPAMA (Beneficial).	A new road would be proposed in LSH, but in the longer term the land donation would compensate for the impact. Road decommissioning would result in a net decrease in road miles in LSH in the SPAMA. Reforestation in decommissioned trails adjacent to LSH would also eventually provide LSH recovery (Beneficial).	No roads would be proposed for relocation. Maintains existing condition. Existing roads in LSH would remain (Neutral).	A new road would be proposed in LSH, but in the longer term, the land donation would compensate for associated habitat loss. Trail reforestation would not occur as in Alternative 3. Less clearing of LSH than Alternative 2, but slightly more clearing than Alternative 3. Some tree removal would occur for gladed trails, but maintaining 70 percent overstory canopy (Neutral).

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
3 Road maintenance may include felling hazard trees along rights-of-way. Leaving material on site should be considered if available CWD is inadequate. Topping trees should be considered as an Alternative to felling (SPAMA p. 52)	Hazard trees would continue to be felled as necessary to maintain ski area. Trees would be felled into nearby forest when possible. Trees supporting sensitive species of moss or lichen would be topped instead of felled when feasible (Neutral).	Per the Implementation, Operations, Restoration and Management Plan (Appendix F): Hazard trees would continue to be felled into nearby forest when possible; Trees would not be felled into a wetland or known sensitive plant location; Trees supporting sensitive mosses or lichens would be topped when feasible; Existing roads would be used when possible; and Guidelines for woody vegetation management in wetlands located in ski trails would be developed (Neutral).	Per the Implementation, Operations, Restoration and Management Plan (Appendix F), hazard tree management would be as described for Alternative 2, however the amount of managed area would be less since there would be less new ski trail development (Neutral).	Per the Implementation, Operations, Restoration and Management Plan (Appendix F), hazard tree management would be as described for Alternative 2, however the amount of managed area would be less since there would be less new ski trail development (Neutral).	Per the Implementation, Operations, Restoration and Management Plan (Appendix F), hazard tree management would be as described for Alternative 2, however the amount of managed area would be less since there would be less new ski trail development (Neutral).

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Developments					
4 Proposals for new facilities and the expansion of existing facilities will be encouraged in non-CEAs rather than CEAs. New facilities and the expansion of existing facilities need to be neutral or beneficial to existing late-successional forest conditions (SPAMA p. 2-48).	No new development would occur (Neutral).	Mature trees would be removed in LSH and in CEA for new ski trails and lift lines (Detrimental).	Mature trees would be removed in LSH for new ski trails and lift line. Less acreage of impact on mature forest than Alternative 2. Land donation would provide LSH in the long-term; would provide LSH recovery. Reforestation in decommissioned trails adjacent to mature forest would also provide LSH recovery (Neutral).	No mature trees would be removed in LSH in Section 16 (Summit East) (Neutral).	Mature trees would be removed in LSH for ski trails and lift lines similar to Alternative 3, except one more chairlift would be built in LSH than in Alternative 3. Land donation would provide LSH in the long-term and would result in impacts to LSH being neutral or beneficial. Trail reforestation would not occur in Section 16 (Summit East) as in Alternative 3. More tree removal would occur than Alternative 3 for gladed trail development, but would maintain a 70 percent overstory canopy (Neutral).

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
5 Development of new facilities that may adversely affect LSRs should not be permitted. New development proposals that address public need or provide significant public benefits, such as powerlines, pipelines, reservoirs, recreation sites, or other public works projects will be reviewed on a case-by-case basis and may be approved when adverse effects can be minimized and mitigated (Forest Plan p. C-17).	No new development would occur (Neutral).	Mature trees would be removed in LSH and in CEA for new ski trails and lift lines (Detrimental).	Mature trees would be removed in LSH and CEA for new ski trails and lift line. Land donation would provide LSH in the long-term; would provide LSH recovery. Reforestation in decommissioned trails adjacent to mature forest would also provide LSH recovery (Neutral).	No mature trees would be removed in LSH and no project action proposed in LSH in CEA (Neutral).	Mature trees would be removed in LSH and CEA for ski trails and lift lines similar to Alternative 3, except one more chairlift would be built in LSH than in Alternative 3. Land donation would provide LSH in the long-term; would provide LSH recovery; and would result in impacts to LSH being neutral or beneficial. Trail reforestation would not occur in Section 16 (Summit East) as in Alternative 3. More tree removal would occur than Alternative 3 for gladed trails, but would maintain a 70 percent overstory canopy (Neutral).

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
6 Existing developments in LSRs, such as campgrounds, recreational residences, ski areas, utility corridors, and electronic sites are considered exiting uses with respect to LSR objectives, and may remain, consistent with other standards and guidelines. Routine maintenance of existing facilities is expected to have less effect on old-growth conditions than development of new facilities. Maintenance activities may include felling hazard trees along utility rights-of-way, trails, and other developed areas (Forest Plan p. C-17).	Ongoing maintenance and operations would maintain existing mature forest conditions; hazard trees would be felled into existing forest where feasible (Neutral).	The proposed Implementation, Operations, Restoration and Management Plan (Appendix F) would maintain existing development (Neutral).	The proposed Implementation, Operations, Restoration and Management Plan (Appendix F) would maintain existing development (Neutral).	The proposed Implementation, Operations, Restoration and Management Plan (Appendix F) would maintain existing development (Neutral).	The proposed Implementation, Operations, Restoration and Management Plan (Appendix F) would maintain existing development (Neutral).

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Habitat Improvement Projects					
7 Projects designed to improve conditions for fish, wildlife, or watershed should be considered if they provide late-successional habitat benefits or if their effect on late-successional associated species is negligible. Design and implement watershed restoration projects in a manner that is consistent with LSR objectives (Forest Plan p. C-17).	No restoration projects currently proposed. Existing condition would be maintained (Neutral).	Proposed restoration projects include reforestation, stream improvements, and road decommissioning which would improve conditions for fish, wildlife, and watersheds. They would not affect LSH (Neutral).	Besides the restoration projects identified in Alternative 2, additional restoration projects would be implemented. In addition there is additional acreage of reforestation identified for restoration in Section 16 (Summit East) adjacent to LSH. This Alternative also includes the land donation which would improve long-term habitat conditions (Beneficial).	Besides the restoration projects identified in Alternative 2, additional restoration projects would be implemented. Proposed restoration projects include reforestation, stream improvements, road decommissioning (Neutral).	Similar to Alternative 3, except there would be less reforestation in Section 16 (Summit East) (Beneficial).

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Recreational Uses					
8 Dispersed recreational uses, including hunting and fishing, generally are consistent with the objectives of LSR. Use adjustment measures such as education, use limitations, traffic control devices, or increased maintenance when dispersed and developed recreation practices retard or prevent attainment of LSR objectives (Forest Plan p. C-18)	Ongoing maintenance and operations would maintain existing mature forest conditions; hazard trees would be felled into existing forest where feasible (Neutral).	The Implementation, Operations, Restoration and Management Plan (Appendix F) would provide measures to reduce dispersion of summer use visitors into sensitive forest and habitat areas (Neutral).	The Implementation, Operations, Restoration and Management Plan (Appendix F) would provide measures to reduce dispersion of summer use visitors into sensitive forest and habitat areas (Neutral).	The Implementation, Operations, Restoration and Management Plan (Appendix F) would provide measures to reduce dispersion of summer use visitors into sensitive forest and habitat areas (Neutral).	The Implementation, Operations, Restoration and Management Plan (Appendix F) would provide measures to reduce dispersion of summer use visitors into sensitive forest and habitat areas (Neutral).

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Ecosystem Function					
9 Maintain natural forest cover along riparian areas and ridge lines, thereby providing for wildlife movement and CWD recruitment and retention (SPAMA p. 2-37)	No projects proposed. Existing forest conditions in riparian areas and ridge lines would remain (Neutral).	Clearing would occur in forested riparian areas. Some reforestation would also occur in riparian areas, however there would be an overall net loss of forested riparian habitat (Detrimental).	Forest and associated habitat would be removed in riparian areas but to a lesser degree than Alternative 2. Reforestation and land donation would increase area to be managed by USFS as riparian reserves compared to Alternative 2. This Alternative has the greatest amount of reforestation (Beneficial).	Riparian and associated habitat would be removed but with less acreage than other action Alternatives. Area of reforestation and restoration projects would be similar to Alternative 2 (Neutral).	Forest and associated habitat would be removed in riparian areas but to lesser degree than Alternative 2. Reforestation and land donation would increase area to be managed by USFS as riparian reserves compared to Alternative 2. Less clearing of riparian areas than Alternative 2, but slightly more clearing than Alternative 3. Amount of reforestation in Section 16 (Summit East) would be less than Alternative 3 (Beneficial).

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Land Exchanges					
10 Criteria have been established to guide the selection of land to be exchanged/acquired in the future. These criteria include: (1) land exchanges will be a "willing seller/willing buyer basis, and (2) will provide benefits equal to or better than current conditions. Given these criteria, the priority for acquisitions will be to reduce fragmentation of late-successional habitat and provide connectivity now or in the future (SPAMA p. 2-51).	No land exchanges are proposed (Neutral).	No land exchanges are proposed (Neutral).	Land donation of 390 acres is proposed and would reduce fragmentation and improve habitat connectivity within the Study Area in the long-term. (Beneficial).	No land exchange is proposed (Neutral).	Land donation of 390 acres is proposed and would reduce fragmentation and improve habitat connectivity within the Study Area in the long-term. (Beneficial).

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Old-Growth					
11 Provide for retention of old-growth fragments in watersheds where little remains (Forest Plan p. C-44).	Maintains existing patches of old-growth forest (Neutral).	Removal of trees in mature forest would occur in Section 16 (Summit East). Amount of forest to be removed is small compared to entire 5th field watershed as the Yakima Watershed Analysis reports 43 percent of watershed contains mature forest ; but Section 16 (Summit East) is noted as important mature forest unit in SPAMA (Detrimental).	Trees would be removed in mature forest in Section 16 (Summit East) but with less acreage impacted than under Alternative 2. Land donation and reforestation in Section 16 (Summit East) would result in a long-term increase in LSH in the Study Area (Beneficial).	Mature trees would not be removed in Section 16 (Summit East) where mature forest exists in large patches (Neutral).	Trees would be removed in mature forest in Section 16 (Summit East) with less clearing of mature forest than Alternative 2, but slightly more clearing than Alternative 3. Land donation) would result in a long-term increase in LSH in the Study Area (Beneficial).
12 Landscape areas where little late-successional forest persists should be managed to retain late-successional patches. This standard and guideline will be applied in 5th Field Watersheds in which federal forest land is currently comprised of 15 percent or less late-successional forest (Forest Plan p. C-44).	Not applicable since Yakima Watershed Analysis reports 43 percent of watershed contains mature forest. (Neutral)	Not applicable since Yakima Watershed Analysis reports 43 percent of watershed contains mature forest. (Neutral)	Not applicable since Yakima Watershed Analysis reports 43 percent of watershed contains mature forest. (Neutral)	Not applicable since Yakima Watershed Analysis reports 43 percent of watershed contains mature forest. (Neutral)	Not applicable since Yakima Watershed Analysis reports 43 percent of watershed contains mature forest. (Neutral)

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
13 In AMAs, less than 15 percent of 5th field watershed in late-successional forest should be considered as a threshold for analysis rather than a strict standard and guideline, and the role of remaining stands of late-successional forest must be fully considered in watershed analysis before they can be modified (Forest Plan p. D-11).	Existing mature forest would remain in Study Area. Would not affect the 43 percent of mature forest in Yakima watershed as reported in Yakima Watershed Analysis (USFS 1997). (Neutral)	Although mature forest would be removed, the amount of mature forest removed would be small compared to 5th field watershed. Clearing proposed under this Alternative would not cause percent of mature forest to drop below 15 percent threshold. (Neutral)	Although mature forest would be removed, the amount of mature forest removed would be small compared to 5th field watershed. Clearing proposed under this Alternative would not cause percent of mature forest to drop below 15 percent threshold. Land donation would increase amount of mature forest in NFSL in the long-term. (Beneficial)	Mature forest in Section 16 (Summit East) would not be removed and would not affect amount of mature forest in Section 16 (Summit East). (Neutral)	Although mature forest would be removed, the amount of mature forest removed would be small compared to 5th field watershed. Clearing proposed under this Alternative would not cause percent of mature forest to drop below 15 percent threshold. Land donation would increase amount of mature forest in NFSL in the long-term. (Beneficial)

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
CWD					
14 Dead and down woody materials are recognized as important components of the forest environment. Goals of the guidelines are to leave a distribution of various size classes on site after management activities for short (20-50 years) and long-term (next 100 years or more) ecosystem functions. This includes moisture retention, hydrologic function, nutrient mobilization, mineral cycling and natural forest regeneration (SPAMA p. 2-58).	Maintains existing conditions. Hazard trees would be felled into adjacent forest where feasible to contribute to the amount of CWD. Trees supporting sensitive species of moss or lichen would be topped instead of felled when feasible. (Neutral)	Mature forest would be removed in Section 16 (Summit East), reducing the potential for CWD recruitment. Where feasible, some downed trees would remain in forest for CWD recruitment. Development of ski trails using mitigation to minimize impacts to *Schistostega pennata* would leave existing CWD material. Areas of LSH would continue to provide CWD in a variety of size classes distributed across forested portions of the landscape. (Detrimental)	Mature forest would be removed in Section 16 (Summit East), reducing the potential for CWD recruitment. Less impact on mature forest than Alternative 2, however. Where feasible, some downed trees would remain in forest for CWD recruitment. Development of ski trails using mitigation to minimize impacts to *Schistostega pennata* would leave existing CWD material. Land donation would increase long-term potential for recruitment of CWD. Areas of LSH would continue to provide CWD in a variety of size classes distributed across forested portions of the landscape. (Beneficial)	No mature forest would be removed in Section 16 (Summit East) and CWD recruitment potential would be maintained in large patches of mature forest Areas of LSH would continue to provide CWD in a variety of size classes distributed across forested portions of the landscape. (Neutral)	Mature forest would be removed in Section 16 (Summit East), reducing the potential for CWD recruitment. Less impact on mature forest than Alternative 2, but slightly more than Alternative 3. Where feasible, some downed trees would remain in forest for CWD recruitment. Development of ski trails using mitigation to minimize impacts to *Schistostega pennata* would leave existing CWD material. Land donation would increase long-term potential for CWD recruitment. Areas of LSH would continue to provide CWD in a variety of size classes distributed across forested portions of the landscape. (Beneficial)

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Snag Management					
15 Dead and partially dead trees have been recognized as important to many species of wildlife, lichen, and fungi. Goals of the standards and guidelines are to leave a distribution of various diameter size classes to be suitable for a variety of cavity-nesting species (SPAMA p. 2-60).	Maintains existing conditions. Hazard trees would be felled as needed for ski operations that could reduce to small degree number of snags. Trees supporting sensitive species of moss or lichen would be topped instead of felled when feasible. (Neutral)	Mature forest would be removed in Section 16 (Summit East), reducing the potential for snag recruitment. Some snags would likely be removed but many snags of various sizes in Section 16 (Summit East) and outside of new developments would remain. Hazard trees may be removed under the Implementation, Operations, Restoration and Management Plan (Appendix F). Overall goal of maintaining a distribution of snags in mature forest is achieved. (Neutral)	Mature forest would be removed in Section 16 (Summit East), reducing the potential for snag recruitment. Less impact on mature forest than Alternative 2. Some snags would likely be removed but many snags of various size in Section 16 (Summit East) and outside of new developments would remain. Hazard trees may be removed under the Implementation, Operations, Restoration and Management Plan (Appendix F). Overall goal of maintaining distribution of snags in mature forest is achieved. The land donation increases long-term potential for snag recruitment. (Beneficial)	No mature forest would be removed in Section 16 (Summit East) and snag recruitment potential would be maintained in largest patches of mature forest. Some hazard snags may be removed per the Implementation, Operations, Restoration and Management Plan (Appendix F). (Neutral)	Mature forest would be removed in Section 16 (Summit East), reducing the potential for snag recruitment. Less impact on mature forest than Alternative 2. Some snags would likely be removed but many snags of various sizes in Section 16 (Summit East) and outside of new developments would remain. Hazard trees may be removed under the Implementation, Operations, Restoration and Management Plan (Appendix F). Overall goal of maintaining distribution of snags in mature forest is achieved. The land donation increases long-term potential for snag recruitment. (Beneficial)

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Nonnative species					
16 Nonnative species should not be introduced into LSR. If an introduction of nonnative species is proposed, complete an assessment of impacts and avoid any introduction that would retard or prevent achievement of LSR objectives. Evaluate impacts of nonnative species (plant and animal) currently existing within reserves, and develop plans and recommendations for eliminating or controlling nonnative species that are inconsistent with LSR objectives. These will include and analysis of the effects of implementing such programs to other species or habitats with LSRs (Forest Plan p. C-19).	No projects are proposed. Nonnative species management would follow existing USFS policies. (Neutral)	Vegetation management includes use of USFS approved desirable nonnative plant species as recommended and authorized by USFS botanist. Nonnative grass or forb species would likely be used as an erosion control measure on some construction sites where nonnative plants currently occur. Other Mitigation Measures, Management Requirements and Other Management Provisions consistent with USFS policy on noxious weed control and prevention would apply. (Neutral)	Ground disturbance would be less than under Alternative 2 and the amount of desirable nonnative species for erosion control would be less. USFS botanist would be required to approve of use of nonnative species. (Neutral)	Ground disturbance would be less than under Alternatives 2, 3, and 5 and the amount of desirable nonnative species for erosion control would be less. USFS botanist would be required to approve of use of desirable nonnative species. (Neutral)	Ground disturbance would be less than Alternative 2 but slightly more than Alternative 3. Therefore, the amount of nonnative plant species used for erosion control would be slightly more compared to Alternative 3. USFS botanist would be required to approve of use of desirable nonnative species. (Neutral)

Table 4.6.2-1:
Selection of AMA/LSR Standards and Guidelines for The Summit-at-Snoqualmie EIS Analysis

Standard/Guideline	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Fire Suppression and Prevention					
17 Each LSR will be included in fire management planning as part of watershed analysis. Fuels management in LSR will utilize minimum impact suppression methods in accordance with guidelines for reducing risks of large-scale disturbances. Plans for wildfire suppression will emphasize maintaining LSH. In LSRs a specific fire management plan will be prepared prior to any habitat manipulation activities. In all LSRs, watershed analysis will provide information to determine the amount of CWD to be retained when applying prescribed fire. Goal of wildfire suppression in LSRs is to limit the size of all fires (Forest Plan p. C-17)	Maintains existing condition. The ski area would continue to manage the site consistent with guidelines specified in the fire plans in the SPAMA Plan and the Yakima Watershed Analysis. (Neutral)	Fire prevention and slash burning from trail clearing would be consistent with Fire Plan per Yakima Watershed Analysis and SPAMA. (Neutral)	Fire prevention and slash burning from trail clearing would be consistent with Fire Plan per Yakima Watershed Analysis and SPAMA. Less clearing of forest would occur under this Alternative than Alternative 2. (Neutral)	Fire prevention and slash burning from trail clearing would be consistent with Fire Plan per Yakima Watershed Analysis and SPAMA. Less clearing of forest under this Alternative than other action Alternatives. (Neutral)	Fire prevention and slash burning from trail clearing would be consistent with Fire Plan per Yakima Watershed Analysis and SPAMA. Less clearing of forest would occur under this Alternative than Alternative 2. (Neutral)

4.7 AQUATIC CONSERVATION STRATEGY

3.7.1 Introduction

The 1994 ROD describes that standards and guidelines are designed to focus the review of proposed and certain existing projects to determine the compatibility with the ACSOs. The standards and guidelines focus on "meeting" and "not preventing attainment" of the ACSOs. In order to evaluate the compatibility of the alternatives with the ACSOs, Tables 3.7-FEIS-1 and 3.7-FEIS-2 present an evaluation of each ASCO within the context of five related resource areas: Geology and Soils, Water and Watershed Resources, Vegetation, Wildlife, and Fisheries. In order to determine whether each alternative will "meet" or "not prevent attainment" of the ASCOs, the evaluation includes a summary of the existing conditions for each resource area, based on watershed analysis and site-specific evaluations, and then refers the reader to the appropriate section of the EIS for more detailed discussion. The analysis then summarizes the effects of the alternatives at two scales: Site (location varies by resource) and 5th field (Upper Yakima River Watershed and South Fork Snoqualmie River Watershed) to support a determination of the effect of the proposed development and cumulative effects. Finally, the evaluation presents a comparison of the severity of impacts by alternative in descending degree of impact in order to display the similarities or differences between the alternatives.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Previous developments (timber harvest, ski area, road construction) have altered physical landscape features through the loss of soil productivity (USFS 1995a). • Overall, the physical resources in the S.F. Snoqualmie watershed are in an unacceptable condition. This is due primarily to the logging and roadbuilding activities south of I-90 and the impact of I-90 (USFS 1995a).	• Overall, the physical resources in the S.F. Snoqualmie watershed are in an unacceptable condition. This is due primarily to the logging and roadbuilding activities south of I-90 and the impact of I-90 (USFS 1995a). • The road density of the S.F. Snoqualmie portion of the Study Area is 1.96 mi/mi^2 (see Table 3.3.1-4). • There are 16 stream-road crossings (culvert, bridge, or ford) in the S.F. Snoqualmie watershed portion of the Study Area (see Table 3.3.1-4). • 2% of the S.F. Snoqualmie watershed is in a permanently disturbed state due to developments, utility corridors and I-90 (Jones & Stokes 1998).

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• Land-use activities within the S.F. Snoqualmie watershed (checkerboard land ownership pattern, timber harvest, development) have contributed to the existing land cover, as represented by the mosaic of vegetation communities and developed areas that comprise the existing vegetation conditions (USFS 1995a). • Fragmentation of forest stands, particularly old-growth western hemlock, and the loss of mature conditions in riparian stands has degraded connectivity between habitat types (USFS 1995a). • Roads, housing and resort development along the mainstem S.F. Snoqualmie River have resulted in increased early seral conditions in valley bottom riparian areas (Jones & Stokes 2001). • Stand complexity is expected to increase through the maturing of early seral stands that had been initiated by timber harvest (Jones & Stokes 2001). • Fires of historical size and intensity may be inevitable in the future, as the S.F. Snoqualmie has the highest fire frequency of any watershed in the Snoqualmie River basin (USFS 1995a).	• While the distribution, diversity and complexity of watershed and landscape scale features are important components of wildlife habitat, the physical properties on which impacts to wildlife would be measured are primarily associated with the properties described for Vegetation.	• Previous developments (timber harvest, ski area and road construction) have altered physical landscape scale feature through road construction and removal of vegetation. These alterations are generally localized to small areas within the larger watershed (USDA 1995a; see also Section 3.4.1 – Summary of Existing Conditions). • No anadromous fish species are present in the S.F. Snoqualmie watershed due to the presence of Snoqualmie Falls (Jones & Stokes 2001). • Existing condition of Fisheries is as described under Watershed Resources.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.***
Geology and Soils	**Watershed Resources**
Site Scale	
Analysis area: 1,014 acres	
• Implementation of the Action Alternatives would increase the loss of soil productivity within the site scale. The effect at the landscape scale would not result in measurable changes to the distribution, diversity, and complexity of geology and soils features. • Under the Action Alternatives, the total acreage of detrimental soil conditions within the site scale would range from 114.31 acres (4% of Study Area) under Alternative 5 to 115.28 acres (4% of Study Area) under Alternative 2 (see Table 4.2.3-3C), which is below the 20 percent threshold for an activity area. Under Alternatives 3 and 4, the total detrimental soil condition would decrease to below existing conditions (see Table 4.2.3-3C).	• Clearing and grading in Riparian Buffers, road density and hydrologic maturity associated with the Action Alternatives would not measurably affect landscape-scale watershed features at the site scale. • Under all the Action Alternatives, the total area of Riparian Buffers within the S.F. Snoqualmie watershed portion of the Study Area would be 274.18 acres, which is slightly less than the existing condition of 277.35 acres (see Table 4.3.3-12). • Alternatives 2, 4 and Modified Alternative 5 would result in the greatest effects to the distribution, diversity and function of Riparian Buffers among the Action Alternatives due to the removal of mature forest along streams. Riparian function would be reduced at ski trail and bridge crossings, but would be maintained along these streams at the site scale. Alternative 3 would have the least impact on mature forests along streams (see Table 4.3.3-12). • Under the Action Alternatives, the road density would range from 1.97 mi/mi^2 under Alternative 4 to 1.99 mi/mi^2 under Alternatives 2, 3 and Modified Alternative 5, representing a slight increase over the existing condition of 1.96 mi/mi^2 (see Table 4.3.3-7) • Under the Action Alternatives, road length within Riparian Buffers would range from 1.73 miles under Alternative 4 to 1.85 miles under Alternatives 2, 3 and Modified Alternative 5. All the Action Alternatives would represent a decrease in road length within Riparian Buffers over the existing condition of 1.87 miles (see Table 4.3.3-12).

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted***	
Vegetation	**Wildlife**	**Fisheries**
Site Scale		
Analysis area: 1,014 acres		
• The effects to vegetation communities associated with the Action Alternatives would not have a measurable effect on landscape-scale features at the site scale because all plant communities would continue to persist (see Section 4.5 - Vegetation). • Removal of mature, forested land cover dominated by Pacific silver fir and mountain hemlock would range from 3.56 acres under Alternative 3 to 5.33 acres under Alternatives 2, 4 and Modified Alternative 5 (see (see Tables 4.5.2-1A through 4.5.2-1C). • Under the Action Alternatives, total long-term vegetation impacts within the S.F. Snoqualmie watershed portion of the Study Area would range from 19.81 acres under Alternative 3 to 24.74 acres under Modified Alternative 5 (see Table 4.5.3-FEIS-3). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 473.28 acres under Alternatives 2 and 5 to 475.84 acres under Alternative 4 (see Table 4.3.3-10). • Under all the Action Alternatives, the total area of Riparian Buffers within the S.F. Snoqualmie watershed portion of the Study Area would be 274.18 acres, which	• Wildlife impacts at the site scale would be as described under Vegetation.	• Fisheries impacts would be as described under Geology and Soils, Vegetation and Watershed Resources.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.***
Geology and Soils	**Watershed Resources**
Finding: **Does not prevent attainment of ACSO 1**	**Finding:** **Does not prevent attainment of ACSO 1**
5th Field Scale	
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)	
• The geology and soils effects of the Action Alternatives, coupled with the cumulative actions, ranges from approximately 373.52 acres (under Alternative 3) to 375.80 acres (under Alternative 2), which equates to approximately 1.26 percent to 1.26 percent of the 5th field scale, respectively (see Section 4.2.7 – Cumulative Effects). Section 4.2 – Geology and Soils describes that the effects to geology and soils would not measurably affect the distribution and complexity of landscape-scale geology and soil features at the 5th field scale.	• The Action Alternatives, coupled with the cumulative actions, would affect approximately 461.69 acres (under Alternative 4) to 463.24 acres (under Alternative 2 and Modified Alternative 5) of Riparian Buffers, which equates to approximately 2.69 percent to 2.70 percent of the 5th field scale Riparian Buffers, respectively (see Section 4.3.8 – Cumulative Effects). As discussed in Section 4.3 – Water and Watershed Resources, the effects to Riparian Buffers would not measurably affect the landscape-scale distribution and complexity of watershed and landscape-scale features at the 5th field scale.
Finding: Meets ACSO 1	**Finding: Meets ACSO 1**
Degree of impacts by alternative: **Alternative 2>5>4>3>1**	**Degree of impacts by alternative:** **Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted***	
Vegetation	**Wildlife**	**Fisheries**
is slightly less than the existing condition of 277.35 acres (see Table 4.3.3-12).		
Finding: Does not prevent attainment of ACSO 1	**Finding: Does not prevent attainment of ACSO 1**	**Finding: Does not prevent attainment of ACSO 1**
5th Field Scale		
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from 575.97 acres (1.95 percent of the 5th field scale) under Alternative 3 and 589.05 acres (1.99 percent of the 5th field scale) under Alternative 2 (see Section 4.5.7 – Cumulative Effects). A majority of these effects occur outside of Riparian Buffers, and would therefore have no effect on riparian plant communities. Cumulative actions occurring within Riparian Buffers are localized to small areas that are scattered throughout the 5th field. Therefore, no measurable impacts to the distribution and complexity of landscape-scale vegetation features at the 5th field scale are expected.	• Wildlife impacts at the 5th field scale would be as described under Vegetation.	• Fisheries impacts would be as described under Watershed Resources.
Finding: Meets ACSO 1	**Finding: Meets ACSO 1**	**Finding: Meets ACSO 1**
Degree of impacts by alternative: Alternative 2>5>4>3>1	**Degree of impacts by alternative: Alternative 2>5>4>3>1**	**Degree of impacts by alternative: Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.***
Geology and Soils	**Watershed Resources**
Existing Condition	
• Existing Geology and Soils conditions are as described under Vegetation.	• No culverts or other human-made structures which may create barriers to fish passage exist in the S.F. Snoqualmie watershed. No other physical or chemical barriers are known which would prevent fish access to critical habitat (Jones & Stokes 2001). • Approximately 2 percent of mapped channel segments in the S.F. Snoqualmie are culverted channels (Jones & Stokes 1998). • The road density of the S.F. Snoqualmie portion of the Study Area is 1.96 mi/mi^2 (see Table 3.3.1-4). • There are 16 stream-road crossings (culvert, bridge, or ford) in the S.F. Snoqualmie watershed portion of the Study Area (see Table 3.3.1-4).
Site Scale	
Analysis area: 1,014 acres	
• Effects on geology and soils are as described under Vegetation.	• Clearing in Riparian Buffers for construction and ski trail clearing would reduce forest continuity, fragmenting riparian habitat. Such clearing may create localized barriers to fish and wildlife movement along riparian corridors (see Wildlife). The Action Alternatives would not measurably affect spatial and temporal connectivity within the site scale. • Under all the Action Alternatives, the total area of Riparian Buffers within the S.F. Snoqualmie

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• Development within the watershed has removed native vegetation and fragmented contiguous forested areas (USFS 1995a). • Risks to spatial connectivity include timber harvest, the construction of roads, dispersed and developed recreation, and catastrophic fire (USFS 1995a). • Fragmentation is high in this watershed as evidenced by the high amount of harvest units and burn areas (Jones & Stokes 2001). • Several natural and management-related landscape disturbances have influenced the vegetation patterns within the upper reaches of the S.F. Snoqualmie watershed, including checkerboard land ownership, railway and road construction, commercial and residential development, wildfire, mass wasting, windthrow, avalanches, floods, insects and disease (Jones & Stokes 2001).	• Existing wildlife conditions are as described under Vegetation.	• No culverts or other human-made structures which may create barriers to fish passage exist in the S.F. Snoqualmie watershed. No other physical or chemical barriers are known which would prevent fish access to critical habitat (Jones & Stokes 2001). • Other existing fisheries and aquatic habitat conditions are as described under Watershed Resources.
Site Scale		
Analysis area: 1,014 acres		
• Under the Action Alternatives, vegetation removed for the development of additional ski area facilities would affect the connectivity between watersheds at the site scale. • Under the Action Alternatives, the total area of Riparian Buffers within the S.F. Snoqualmie watershed portion	• As described in Section 4.6 – Wildlife, the Action Alternatives would have the greatest affect on connectivity for low mobility species (see Section 4.6.3.2 – Habitat Connectivity). The removal of vegetation would reduce available connective habitat at the site scale. These effects are	• Under the Action Alternatives, no in-stream work in fish-bearing streams would occur (see Section 4.4.3.2 – South Fork Snoqualmie River Watershed). There would be no change in fish passage or road crossings on fish-bearing stream segments in the S.F. Snoqualmie Watershed (see

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.***
Geology and Soils	**Watershed Resources**
	watershed portion of the Study Area would be 274.18 acres, which is slightly less than the existing condition of 277.35 acres (see Table 4.3.3-12). • Alternative 2, 4 and Modified Alternative 5 would result in the greatest effects to the distribution, diversity and function of Riparian Buffers among the Action Alternatives due to the removal of mature forest along streams. Riparian function would be reduced at ski trail and bridge crossings, but would be maintained along these streams at the site scale. Alternative 3 would have the least impact on mature forests along streams (see Table 4.3.3-12). • Under the Action Alternatives, the road density would range from 1.97 mi/mi^2 under Alternative 4 to 1.99 mi/mi^2 under Alternatives 2, 3 and Modified Alternative 5, representing a slight increase over the existing condition of 1.96 mi/mi^2 (see Table 4.3.3-7) • Under the Action Alternatives, road length within Riparian Buffers would range from 1.73 miles under Alternative 4 to 1.85 miles under Alternatives 2, 3 and Modified Alternative 5. All the Action Alternatives would represent a decrease in road length within Riparian Buffers over the existing condition of 1.87 miles (see Table 4.3.3-12). • All Action Alternatives would result in one additional stream crossing over the existing condition of 16 crossings in the S.F. Snoqualmie watershed portion of the Study Area. All Action Alternatives would have .29 mile of culverted channels over the existing .22 miles (see Table 4.3.3-7). • All Action Alternatives minimize clearing and grading in Riparian Buffers by locating the proposed design outside Riparian Buffers to the extent possible. Ski trail design is intended to parallel Riparian Buffers while minimizing disturbance in riparian areas (see Table 2.4-2). • All Action Alternatives would avoid and minimize impacts to streams and wetlands where possible through the implementation of Mitigation

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
of the Study Area would be 274.18 acres, which is slightly less than the existing condition of 277.35 acres (see Table 4.3.3-12). • Alternative 2, 4 and Modified Alternative 5 would result in the greatest effects to the distribution, diversity and function of Riparian Buffers among the Action Alternatives due to the removal of mature forest along streams. Riparian function would be reduced at ski trail and bridge crossings, but would be maintained along these streams at the site scale. Alternative 3 would have the least impact on mature forests along streams (see Table 4.3.3-12). • Removal of mature, forested land cover dominated by Pacific silver fir and mountain hemlock would range from 3.56 acres under Alternative 3 to 5.33 acres under Alternatives 2, 4 and Modified Alternative 5 (see (see Tables 4.5.2-1A through 4.5.2-1C). • Under the Action Alternatives, total long-term vegetation impacts within the S.F. Snoqualmie watershed portion of the Study Area would range from 19.81 acres under Alternative 3 to 24.74 acres under Modified Alternative 5 (see Table 4.5.3-FEIS-3). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 473.28 acres under	described under Vegetation.	Table 4.4.3-3). The only potential indirect impacts to fish would be associated with terrestrial construction activities and changes in land use (see Section 4.4.3.2 – South Fork Snoqualmie River Watershed).

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.***
Geology and Soils	**Watershed Resources**
	Measures, Management Requirements and Other Management Provisions listed in Table 2.4-2, the use of BMPs, and field fitting the individual construction projects (see Section 2.4 – Mitigation).
Finding: **Does Not Prevent Attainment of ACSO 2**	**Finding:** **Does Not Prevent Attainment ACSO 2**
5th Field Scale	
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)	
• Geology and soils impacts at the 5th field are as described under Vegetation.	• The effects of the Action Alternatives, coupled with the cumulative actions, on Riparian Buffers range from approximately 461.69 acres (Alternative 4) to 463.24 acres (Alternative 2 and Modified Alternative 5), which equates to approximately 2.69 percent to 2.70 percent of the 5th field Riparian Buffers, respectively (see Section 4.3.8 – Cumulative Effects). Watershed resource impacts would not result in any measurable changes to the connective riparian habitat at the 5th field. These actions are localized to small areas scattered throughout the entire 5th field.
Finding: Meets ACSO 2	**Finding: Meets ACSO 2**
Degree of impacts by alternative: **Alternative 2>5>4>3>1**	**Degree of impacts by alternative:** **Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
Alternatives 2 and 5 to 475.84 acres under Alternative 4 (see Table 4.3.3-10).		
Finding: Does Not Prevent Attainment ACSO 2	**Finding: Does Not Prevent Attainment ACSO 2**	**Finding: Does Not Prevent Attainment ACSO 2**
5th Field Scale		
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from 575.97 acres (Alternative 3) to 589.05 acres (Alternative 2), which equates to approximately 1.95 to 1.99 percent of the 5th field scale (see Section 4.5.7 – Cumulative Effects). A majority of these effects occur outside of Riparian Buffers, and would therefore have no effect on the connectivity of riparian habitat. Cumulative actions occurring within Riparian Buffers are localized to small areas that are scattered throughout the 5th field. Therefore, impacts to vegetation would result in no measurable impacts to connective riparian habitat at the 5th field scale.	• Impacts to connective riparian habitat are not expected to be measurable at the 5th field scale (see Vegetation). Therefore, wildlife impacts would not result in any measurable impacts to riparian-dependent species at the 5th field scale.	• The effects of the Action Alternatives, coupled with the cumulative actions, on fisheries range from approximately 461.69 acres (Alternative 4) to 463.24 acres (Alternative 2 and Modified Alternative 5), which equates to approximately 2.69 percent to 2.70 percent of the 5th field Riparian Buffers, respectively (see Section 4.3.8 – Cumulative Effects). Cumulative actions would result in isolated tree removal within the 5th field Riparian Buffers. Therefore, fisheries impacts would not result in any measurable effects to connective aquatic habitat at the 5th field scale.
Finding: Meets ACSO 2	**Finding: Meets ACSO 2**	**Finding: Meets ACSO 2**
Degree of impacts by alternative: Alternative 2>5>4>3>1	**Degree of impacts by alternative: Alternative 2>5>4>3>1**	**Degree of impacts by alternative: Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 3	***Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.***
Geology and Soils	**Watershed Resources**
Existing Condition	
• Increasing development along the S.F. Snoqualmie River could generate unstable side slopes (Jones & Stokes 1998). • Many reaches of the mainstem of the S.F. Snoqualmie and its tributaries are scoured or are unstable with wide active channels, likely caused by increased magnitudes and frequencies of peak flows as a result of logging and road construction (USFS 1995a). • Bed and bank erosion along stream channels is probably the largest erosion source related to the developed ski area (see Section 3.2.1.3 – Soils). • Traction sand is a source of road-related sediment that may be discharged to adjacent streams, effecting channel conditions and fish habitat (see Section 3.2.1.3 – Soils). Road sand is present in streams and on the banks of streams adjacent to I-90, SR 906, and other roads (see Section 3.4.1.3 – Fish Habitat). Yearly application of traction sand in the Snoqualmie Pass area by WSDOT has been reduced from 45,000 to 2,500 yards (Kukes 2007 pers. comm.).	• There are 10.26 miles of jurisdictional streams in the S.F. Snoqualmie watershed portion of the Study Area (see Table 3.3.1-2). • Approximately 1.70 miles of stream channels have been directly modified through excavation and re-alignment (see Table 3.3.1-2). The result has been the scour of bed and bank material, downstream sediment deposition, and the simplification of the channel cross-section and aquatic habitat (see Section 3.3.1.2 – Hydrography). • Direct channel impacts associated with ski area management are channelization and road and ski trail crossings of streams (see Section 3.3.1.2 – Hydrography). • There are 16 stream-road crossings (culvert, bridge, or ford) in the S.F. Snoqualmie watershed portion of the Study Area (see Table 3.3.1-4). • All culverted streams have been isolated from riparian processes that provide aquatic habitat, downstream channel stability, LWD recruitment, bank cover and stability (see Section 3.3.1.2 – Hydrography). • Approximately 2 percent of mapped channel segments in the S.F. Snoqualmie are culverted channels (Jones & Stokes 1998).
Site Scale	
Analysis area: 1,014 acres	
• Clearing and grading activities may increase the risk of mass wasting, but these risks would be managed through the use of watershed protection management requirements (see Section 4.2.3.2 – South Fork Snoqualmie River Watershed). • Under the Action Alternatives, it is anticipated that temporary increases in soil erosion and sediment delivery to streams would probably occur with trail grading and other ground disturbances, although the use of sediment control BMPs would minimize this risk by preventing sediment mobilization and by capturing any mobilized sediment prior to delivery to streams (see Section 4.2.3.2 – South Fork Snoqualmie River Watershed and Table 2.4-2).	• The Action Alternatives would impact the physical integrity of the aquatic system through clearing and grading within Riparian Buffers, but are not expected to be measurable at the site scale. • The condition along the S.F. Snoqualmie River would be essentially unchanged from the existing condition under the Action Alternatives, therefore no direct reduction in LWD recruitment potential would occur along the S.F. Snoqualmie River (see Table 4.4.3-3 and Section 4.4.3.2 – South Fork Snoqualmie River Watershed). • All Action Alternatives minimize clearing and grading in Riparian Buffers by locating the proposed design outside Riparian Buffers to the extent possible. Ski trail design is intended to

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 3	***Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• As immature and sapling forest areas in Riparian Buffers continue to mature, LWD recruitment potential would increase (see Section 4.4.2 – Impacts – Alternative 1 [No Action]). • Impaired LWD recruitment potential occurs in immature, naturally forested areas on 6.2 acres of Riparian Buffers in the S.F. Snoqualmie watershed portion of the Study Area (see Table 3.3.1-12). All areas with impaired recruitment potential are dominated by immature forest stands that are regenerated after disturbance by logging and/or historic development (see Section 3.3.1.6 – Riparian Resources).	• While shorelines, banks, and bottom configurations are important components of wildlife habitat, the physical properties on which the effects to wildlife would be measured are primarily detailed under Watershed Resources.	• Traction sand is a source of road-related sediment that may be discharged to adjacent streams, effecting channel conditions and fish habitat (see Section 3.4.13 – Fish Habitat). • Prior development, timber harvest, and road construction have reduced the physical integrity of aquatic systems through the placement of streams in culverts (Jones & Stokes 2001). • While shorelines, banks, and bottom configurations are important components of fish habitat, the physical properties on which the effects to fish would be measured are primarily detailed under Watershed Resources.
Site Scale		
Analysis area: 1,014 acres		
• In order to maintain bank stability, native shrubs and herbaceous vegetation would be planted to achieve 80% cover in five years in all areas within 10 meters of streams under all Action Alternatives (see Table 2.4-2). • The effects on the physical integrity of the aquatic system for vegetation are as described under Watershed Resources.	• While shorelines, banks, and bottom configurations are important components of wildlife habitat, the physical properties on which the effects to wildlife would be measured are primarily described under Watershed Resources.	• Under the Action Alternatives, no in-stream work in fish-bearing streams would occur (see Section 4.4.3.2 – South Fork Snoqualmie River Watershed). There would be no change in fish passage or road crossings on fish-bearing stream segments in the S.F. Snoqualmie Watershed (see Table 4.4.3-3). The only potential indirect impacts to fish would be associated with terrestrial construction activities and changes in land

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 3	***Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.***
Geology and Soils	**Watershed Resources**
• Under all Action Alternatives, parking lot paving and implementation of a Stormwater Management Plan would reduce surface erosion and sediment production from these surfaces (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed).	parallel Riparian Buffers while minimizing disturbance in riparian areas (see Table 2.4-2). • Ground disturbance would be minimized during project construction so that sediment delivery to streams and wetlands would be nominal (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed). • All Action Alternatives would result in one additional stream crossing over the existing 16 crossings in the S.F. Snoqualmie watershed portion of the Study Area. All Action Alternatives would have 0.29 mile of culverted channels over the existing 0.22 mile (see Table 4.3.3-7).
Finding: **Does Not Prevent Attainment of ACSO 3**	**Finding:** **Does Not Prevent Attainment of ACSO 3**
5th Field Scale	
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)	
• Geology and soils impacts at the 5th field are as described under Vegetation.	• The effects of the Action Alternatives, coupled with the cumulative actions, on Riparian Buffers range from approximately 461.69 acres (Alternative 4) to 463.24 acres (Alternative 2 and Modified Alternative 5), which equates to approximately 2.69 percent to 2.70 percent of the 5th field Riparian Buffers, respectively (see Section 4.3.8 – Cumulative Effects). Cumulative effects to watershed resources would not result in any measurable changes to the physical integrity of aquatic systems at the 5th field scale. As described in Section 4.3 – Water and Watershed Resources, these actions are localized to small areas scattered throughout the entire 5th field.
Finding: Meets ACSO 3	**Finding: Meets ACSO 3**
Degree of impacts by alternative: **Alternative 2>5>4>3>1**	**Degree of impacts by alternative:** **Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 3	***Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.***	
Vegetation	**Wildlife**	**Fisheries**
		use (see Section 4.4.3.2 – South Fork Snoqualmie River Watershed).
Finding: Does Not Prevent Attainment of ACSO 3	**Finding: Does Not Prevent Attainment of ACSO 3**	**Finding: Does Not Prevent Attainment of ACSO 3**
5th Field Scale		
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from 575.97 acres (Alternative 3) to 589.05 acres (Alternative 2), approximately 1.95 to 1.99 percent of the 5th field scale (see Section 4.5.7 – Cumulative Effects). A majority of these effects occur outside of Riparian Buffers, and would therefore have no effect on the physical integrity of aquatic systems. Cumulative actions occurring within Riparian Buffers are localized to small areas that are scattered throughout the 5th field. Therefore, impacts to vegetation are not expected to result in any measurable impacts to the physical integrity of aquatic systems at the 5th field scale.	• The effects to the physical integrity of aquatic systems utilized by riparian-dependent species are described in Vegetation.	• As described in Watershed Resources, no measurable impacts to the physical integrity of aquatic systems at the 5th field scale are expected.
Finding: Meets ACSO 3	**Finding: Meets ACSO 3**	**Finding: Meet ACSO 3**
Degree of impacts by alternative: Alternative 2>5>4>3>1	**Degree of impacts by alternative: Alternative 2>5>4>3>1**	**Degree of impacts by alternative: Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Sediment from mass wasting and surface sources near Snoqualmie Pass will dominate the sediment regime in the S.F. Snoqualmie, with surface sediment gradually declining through road management and stabilization of previously harvested slopes as second-growth forests mature (Jones & Stokes 1998). • Surface erosion of roads contributes approximately 92% of all sediment produced in the watershed, including over 99% of all fine sediment. Mass-wasting processes, however, were the dominant sediment source in the S.F. Snoqualmie watershed prior to development and timber harvest. Mass-wasting frequency and catalysts remain at natural levels (Jones & Stokes 1998).	• The S.F. Snoqualmie watershed is listed as a Class AA watershed (USFS 1995a). • The S.F. Snoqualmie River and its tributaries are not listed on the Department of Ecology's 303(d) list (Jones & Stokes 1998). • Water quality in the S.F. Snoqualmie watershed near Alpental is excellent, but is impaired for temperature at river mile 17.3 and for pH at river miles 10.0 and 13.6 (see Section 3.3.1.4 – Surface Water Quality). • Water quality parameters are expected to improve throughout the S.F. Snoqualmie watershed as second-growth vegetation matures (Jones & Stokes 1998). • According to Jones & Stokes (1998), all parameters measured met State water quality standards, and for those parameters without standards, were within generally accepted limits. • Water quality in the S.F. Snoqualmie River is excellent, well below Washington state standards for temperature, turbidity, and fecal coliform bacteria (Jones & Stokes 1998).
Site Scale	
Analysis area: 1,014 acres	
• The Action Alternatives would result in increased sediment detachment at the site scale. Increased sediment detachment has the potential to impact water quality within streams at the site scale (see Section 4.3 – Water and Watershed Resources). The use of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions described in Tables 2.4-2, would reduce the potential sediment yield to streams at the site scale. • Using the Water Erosion Prediction Project (WEPP) model, sediment yields for the S.F. Snoqualmie River Watershed were compared by Alternative. Under the Action Alternatives, the	• The Action Alternatives would result in increased sediment detachment at the site scale, which has the potential to impact stream water quality at the site scale (see Section 4.3.3.4 – South Fork Snoqualmie River Watershed). The use of BMPs, Mitigation Measures, Management Requirements, and Other Management Provisions described in Tables 2.4-2, would reduce the potential sediment yield to streams at the site scale. • Implementation of the Action Alternatives is not expected to contribute to the listing of any stream on the Department of Ecology's 303(d) list since there would be no new point sources of pollution and water quality impacts are projected to be

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• Water quality parameters are expected to improve throughout the S.F. Snoqualmie watershed as second-growth vegetation matures (Jones & Stokes 1998).	• While water quality is an important component of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Geology and Soils, Watershed Resources and Vegetation.	• While water quality is an important component of fish habitat, the physical properties on which effects to fish would be measured are primarily described under Geology and Soils, Watershed Resources and Vegetation.
Site Scale		
Analysis area: 1,014 acres		
• The removal of overstory riparian canopy along streams associated with the Action Alternatives could result in an increase in indirect thermal impacts to streams (Section 4.3.3.2 – South Fork Snoqualmie River Watershed). • Under all the Action Alternatives, the total area of Riparian Buffers within the S.F. Snoqualmie watershed portion of the Study Area would be 274.18 acres, which is slightly less than the existing	• While water quality is an important component of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Geology and Soils, Watershed Resources, and Vegetation.	• While water quality is an important component of fish habitat, the physical properties on which effects to fish would be measured are primarily described under Geology and Soils, Watershed Resources, and Vegetation.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***
Geology and Soils	**Watershed Resources**
change in sediment yields to the S.F. Snoqualmie River when compared to the existing condition would range from -18.16 tons/year under Alternative 2, 3, and 5 to -18.29 tons/year under Alternative 4 (see Table 4.2.3-2). • Ground disturbance would be minimized during project construction so that sediment delivery to streams and wetlands would be nominal (see Section 4.2.3 – Impacts – Alternative 2). • No access corridors, staging areas, spoils piles, or other construction related materials would be placed in Riparian Buffers. The number of vehicle trips across project sites would be limited to the minimum necessary (see Table 2.4-2). • An Erosion Control Plan would be included in the SWPPP for construction documents for proposed projects (see Table 2.4-2).	nominal (see Section 4.3.3.4 – South Fork Snoqualmie River Watershed). • Ground disturbance would be minimized during project construction so that sediment delivery to streams and wetlands would be nominal (see Section 4.3.3.4 – South Fork Snoqualmie River Watershed and Section 4.2.3.2 – South Fork Snoqualmie River Watershed). • All Action Alternatives would minimize clearing and grading in Riparian Buffers by locating the proposed design outside Riparian Buffers to the extent possible. Ski trail design is intended to parallel Riparian Buffers while minimizing disturbance in riparian areas (see Table 2.4-2). • Under the Action Alternatives, water pollution, such as oil and grease, is expected to decrease due to the implementation of the Stormwater Management Plan (see Section 4.3.3.2). • Under all the Action Alternatives construction of lift terminals, lift towers and tower concrete bases would occur within Riparian Buffers. Runoff from concrete structures could increase the pH impacts of affected waters in the S.F. Snoqualmie Watershed, however implementation of BMP's and Management Requirements (see Table 2.4-2) would decrease the chance of high pH runoff entering streams. Current pH levels are expected to be maintained (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed). • Implementation of any of the Action Alternatives is not expected to measurably affect stream temperature or dissolved oxygen concentrations at the site scale (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed). • Under all Action Alternatives, if flooding or weather results in water quality not meeting current State standards for surface water quality, operations would stop until the conditions improve and the site stabilization has been approved by USFS personnel (see Table 2.4-2).
Finding: **Does Not Prevent Attainment of ACSO 4**	**Finding:** **Does Not Prevent Attainment of ACSO 4**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***	
Vegetation	**Wildlife**	**Fisheries**
condition of 277.35 acres (see Table 4.3.3-12). • In order to maintain bank stability and prevent erosion, native shrubs and herbaceous vegetation would be planted to achieve 80% cover over five years in all areas within 10 meters of a stream (see Table 2.4-2). • The Erosion Control Plan would include revegetation techniques and would be approved by the USFS prior to ground disturbance (see Table 2.4-2). • Under the Action Alternatives, total long-term vegetation impacts within the S.F. Snoqualmie watershed portion of the Study Area would range from 19.81 acres under Alternative 3 to 24.74 acres under Modified Alternative 5 (see Table 4.5.3-FEIS-3). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 473.28 acres under Alternatives 2 and 5 to 475.84 acres under Alternative 4 (see Table 4.3.3-10).		
Finding: Does Not Prevent Attainment of ACSO 4	**Finding: Does Not Prevent Attainment of ACSO 4**	**Finding: Does Not Prevent Attainment of ACSO 4**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***
Geology and Soils	**Watershed Resources**
5th Field Scale	
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)	
• The effects of the Action Alternatives, coupled with the cumulative actions would not result in a measurable increase in sediment detachment at the 5th field scale. These actions would occur within small, localized areas that are scattered throughout the entire watershed. Actions occurring within the Study Area would result in a decrease in annual sediment loading to the S.F. Snoqualmie watershed from the existing 682.81 tons/year to a low of 664.52 tons/year under Alternative 4, approximately 1.34 and 1.31 percent of the 5th field, respectively (see Section 4.3.8 – Cumulative Effects). Furthermore, a majority of the actions occur outside of Riparian Buffers and therefore are less likely to result in sediment yield to streams within the 5th field scale. Therefore, no effects to geology and soils at the 5th field are expected to measurably impact water quality.	• The effects of the Action Alternatives, coupled with the cumulative actions, on Riparian Buffers range from approximately 461.69 acres (Alternative 4) to 463.24 acres (Alternative 2 and Modified Alternative 5), which equates to approximately 2.69 percent to 2.70 percent of the 5th field Riparian Buffers, respectively (see Section 4.3.8 – Cumulative Effects). Cumulative effects to watershed resources would not result in any measurable changes to water quality at the 5th field scale. These actions are localized to small areas scattered throughout the entire 5th field. Sediment impacts to water quality would be as described under Geology and Soils.
Finding: Meets ACSO 4	**Finding: Meets ACSO 4**
Degree of impacts by alternative: **Alternative 1>2=3=5>4**	**Degree of impacts by alternative:** **Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***	
Vegetation	**Wildlife**	**Fisheries**
5th Field Scale		
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from 575.97 acres (Alternative 3) to 589.05 acres (Alternative 2), which equates to approximately 1.95 to 1.99 percent of the 5th field scale (see Section 4.5.7 – Cumulative Effects). A majority of these effects occur outside of Riparian Buffers, and would therefore have less of an effect on water quality as they do not occur within close proximity to waterbodies. Cumulative actions occurring within Riparian Buffers are localized to small areas that are scattered throughout the 5th field. Therefore, impacts to vegetation would result in no expected measurable impacts to water quality at the 5th field scale.	• While water quality is an important component of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Geology and Soils, Watershed Resources, and Vegetation.	• While water quality is an important component of fish habitat, the physical properties on which effects to fish would be measured are primarily described under Geology and Soils, Watershed Resources, and Vegetation.
Finding: Meets ACSO 4	**Finding: Meets ACSO 4**	**Finding: Meets ACSO 4**
Degree of impacts by alternative: Alternative 2>5>4>3>1	**Degree of impacts by alternative: Alternative 2>5>4>3>1**	**Degree of impacts by alternative: 1>2=3=5>4**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Sediment from mass wasting and surface sources near Snoqualmie Pass will dominate the sediment regime in the S.F. Snoqualmie, with surface sediment gradually declining through road management and stabilization of previously harvested slopes as second-growth forests mature (Jones & Stokes 1998). • Surface erosion of roads contributes approximately 92% of all sediment produced in the watershed, including over 99% of all fine sediment. Mass-wasting processes, however, were the dominant sediment source in the S.F. Snoqualmie watershed prior to development and timber harvest. Mass-wasting frequency and catalysts remain at natural levels (Jones & Stokes 1998). • Mass wasting processes are consistent with natural conditions (USFS 1995a).	• Only one channel showed signs of increased sediment transport and transient storage due to winter sanding and snow removal from an adjacent road and parking lot. Other channels in the S.F. Snoqualmie watershed were in excellent or good condition (Jones & Stokes 2001). • Mass wasting is negligible as a sediment source (Jones & Stokes 2001).
Site Scale	
Analysis area: 1,014 acres	
• The Action Alternatives would result in decreased sediment detachment at the site scale. As roads are the main contributor of fine sediment in the S.F. Snoqualmie watershed, the paving projects, re-vegetation and stopping the application of traction sand associated with the Action Alternatives would reduce the sediment delivery to streams (Section 4.3.3.2 – South Fork Snoqualmie River Watershed). The use of BMPs and Mitigation Measures described in Table 2.4-2 would reduce the likely sediment yield to streams. Therefore, impacts to sediment regime and are not expected to be measurable at the site scale. • Using the Water Erosion Prediction Project (WEPP) model, sediment yields for the S.F. Snoqualmie River Watershed were compared by Alternative. Under the Action Alternatives, the change in sediment yields to the S.F. Snoqualmie River when compared to the existing condition would range from -18.16 tons/year under Alternative 2, 3, and 5 to -18.29 tons/year under Alternative 4 (see Table 4.2.3-2).	• As described in Geology and Soils, the WEPP model indicates that long-term sediment detachment would decrease under the Action Alternatives. The use of BMPs and Mitigation Measures would further reduce actual sediment yield. • Under the Action Alternatives, all new roads would be sloped to drain away from potentially unstable channels, fills, and hillslopes so that sediment from roads would not be transported to riparian areas (see Appendix F – Implementation, Operations, Restoration and Monitoring Plan). • Ground disturbance would be minimized during project construction so that sediment delivery to streams and wetlands would be nominal (see Section 4.2.3 – Impacts – Alternative 2). • All Action Alternatives would minimize clearing and grading in Riparian Buffers by locating the proposed design outside Riparian Buffers to the extent possible. Ski trail design is intended to parallel Riparian Buffers while minimizing disturbance in riparian areas (see Table 2.4-2).

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• Shrub and herbaceous cover is increasing on ski slopes, but sheet erosion of bare soils also contributes some sediment to streams (Jones & Stokes 2001). • There are 108.28 acres of forested, mature land cover within Riparian Buffers in the S.F. Snoqualmie watershed portion of the Study Area (Table 3.3.1-12). • 60% of the Riparian Buffers in the S.F. Snoqualmie watershed are in a natural, non-modified land cover (see Table 3.3.1-12 and Section 3.3.1.6 – Riparian Resources).	• While changes in sediment regimes can influence the quality of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Geology and Soils, Watershed Resources and Vegetation.	• Changes in the sediment regime can influence the quality of fish habitat through covering suitable spawning gravel and increasing turbidity.
Site Scale		
Analysis area: 1,014 acres		
• The Action Alternatives would reduce the sediment filtering function of vegetation through clearing and grading in Riparian Buffers. • Under all the Action Alternatives, the total area of Riparian Buffers within the S.F. Snoqualmie watershed portion of the Study Area would be 274.18 acres, which is slightly less than the existing condition of 277.35 acres (see Table 4.3.3-12). • In order to maintain bank stability and prevent erosion, native shrubs and herbaceous vegetation would be planted to achieve 80% cover over five years in all areas within 10 meters of a stream (see Table 2.4-2).	• While changes in sediment regimes can influence the quality of wildlife habitat at the site scale, the physical properties on which effects to wildlife would be measured are primarily described under Geology and Soils, Watershed Resources, and Vegetation.	• As described in Geology and Soils and Watershed Resources, changes to the sediment regime are not expected to be measurable at the site scale. Therefore, no measurable effects to the quality of fish habitat are expected at the site scale.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***
Geology and Soils	**Watershed Resources**
• Ground disturbance would be minimized during project construction so that sediment delivery to streams and wetlands would be nominal (see Section 4.2.3 – Impacts – Alternative 2). • No access corridors, staging areas, spoils piles, or other construction related materials would be placed in Riparian Buffers. The number of vehicle trips across project sites would be limited to the minimum necessary (see Table 2.4-2). • An Erosion Control Plan would be included in the SWPPP for construction documents for proposed projects (see Table 2.4-2).	• Under all Action Alternatives, if flooding or weather results in water quality not meeting current State standards for surface water quality, operations would stop until the conditions improve and the site stabilization has been approved by USFS personnel (see Table 2.4-2).
Finding: **Does Not Prevent Attainment of ACSO 5**	**Finding:** **Does Not Prevent Attainment of ACSO 5**
5th Field Scale	
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)	
• The effects of the Action Alternatives, coupled with the cumulative actions would not result in a measurable increase in sediment detachment at the 5th field scale. These actions would occur within small, localized areas that are scattered throughout the entire watershed. Actions occurring within the Study Area would result in a decrease in annual sediment loading to the S.F. Snoqualmie watershed from the existing 682.81 tons/year to a low of 664.52 tons/year under Alternative 4, approximately 1.34 and 1.31 percent of the 5th field, respectively (see Section 4.3.8 – Cumulative Effects). • A majority of the actions occur outside of Riparian Buffers and therefore are less likely to result in sediment yield to streams within the 5th field	• The effects of the Action Alternatives, coupled with the cumulative actions, on Riparian Buffers range from approximately 461.69 acres (Alternative 4) to 463.24 acres (Alternative 2 and Modified Alternative 5), which equates to approximately 2.69 percent to 2.70 percent of the 5th field Riparian Buffers, respectively (see Section 4.3.8 – Cumulative Effects). • Projects occurring within Riparian Buffers would not result in any measurable changes to sediment regime at the 5th field scale. As described in Section 4.3 – Water and Watershed Resources, these actions are localized to small areas scattered throughout the entire 5th field. Sediment detachment and annual sediment loading impacts would be as described under Geology and Soils.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***	
Vegetation	**Wildlife**	**Fisheries**
• The Erosion Control Plan would include revegetation techniques and would be approved by the USFS prior to ground disturbance (see Table 2.4-2). • Under the Action Alternatives, total long-term vegetation impacts within the S.F. Snoqualmie watershed portion of the Study Area would range from 19.81 acres under Alternative 3 to 24.74 acres under Modified Alternative 5 (see Table 4.5.3-FEIS-3). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 473.28 acres under Alternatives 2 and 5 to 475.84 acres under Alternative 4 (see Table 4.3.3-10).		
Finding: Meets ACSO 5	**Finding: Does Not Prevent Attainment of ACSO 5**	**Finding: Does Not Prevent Attainment of ACSO 5**
5th Field Scale		
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from 575.97 acres (Alternative 3) to 589.05 acres (Alternative 2), which equates to approximately 1.95 to 1.99 percent of the 5th field scale (see Section 4.5.7 - Cumulative Effects). A majority of these effects occur outside of Riparian Buffers, and would therefore have less of an effect on the sediment regime as they do not occur within a close proximity to waterbodies. Cumulative actions occurring	• While changes in sediment regimes can influence the quality of wildlife habitat at the 5th field scale, the physical properties on which effects to wildlife would be measured are primarily Geology and Soils, Watershed Resources, and Vegetation.	• As described in Geology and Soils and Watershed Resources, changes to the sediment regime are not expected to be measurable at the 5th field scale. Therefore, no measurable effects to the quality of fish habitat are expected at the 5th field scale.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***
Geology and Soils	**Watershed Resources**
scale. Therefore, no effects to geology and soils at the 5th field are expected to measurably impact sediment regime at the 5th field scale.	Therefore, no effects to watershed resources are expected to measurably impact sediment regime at the 5th field scale.
Finding: Meets ACSO 5	**Finding: Meets ACSO 5**
Degree of impacts by alternative: **Alternative 1>2=3=5>4**	**Degree of impacts by alternative:** **Alternative 2=5>3>4>1**
ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Decreased soil permeability and increases in impervious areas (e.g., facilities, parking lots, road network, timber harvest) have contributed to increased runoff within the watershed (see Section 3.3.1.3 – Surface Water Quantity).	• Increased runoff has the potential to change the timing, magnitude and duration of peak, high and low flows. • Pavement and developed facilities result in increased surface flow (Wright et al. 1990). • The S.F. Snoqualmie River produces a snow-dominant hydrologic response, with the longest duration, sustained high flows occurring during the spring snowmelt months (Jones & Stokes 2001). • There are 16 stream-road crossings (culvert, bridge, or ford) in the S.F. Snoqualmie watershed portion of the Study Area (Table 3.3.1-4). Surveys of culverts at the Summit-at-Snoqualmie suggest that they are adequately sized to handle peak stormflows (Jones & Stokes 2001). • In the Source Lake subwatershed in the vicinity of Alpental, wetlands are generally small and not significant in controlling watershed response to stormflow or maintaining base streamflows (Jones & Stokes 2001).

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***	
Vegetation	**Wildlife**	**Fisheries**
within Riparian Buffers are localized to small areas that are scattered throughout the 5th field. Therefore, no impacts to vegetation are expected to measurably affect sediment regime at the 5th field scale.		
Finding: Meets ACSO 5	**Finding: Meets ACSO 5**	**Finding: Meets ACSO 5**
Degree of impacts by alternative: Alternative 2>5>4>3>1	**Degree of impacts by alternative: Alternative 2>5>4>3>1**	**Degree of impacts by alternative: Alternative 1>2=3=5>4**
ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• Reduced forest cover results in elevated discharge during spring runoff compared to a naturally occurring condition (Jones & Stokes 2001). • Timber harvest, ski slope clearing, I-90, and residential development comprise areas of modified vegetation which decrease the hydrologic maturity of the subwatershed (Jones & Stokes 2001). • The watershed is increasing in its hydrologic maturity as natural succession of forested stands continues throughout most of the watershed (Jones & Stokes 2001). • There are currently 478.86 acres of hydrologically mature forested land cover in the S.F. Snoqualmie watershed portion of the Study Area (see Table 3.3.1-6).	• While changes in instream flows can influence the quality of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Watershed Resources.	• While changes in instream flows can influence the quality of fish habitat, the physical properties on which effects to fish would be measured are primarily described under Watershed Resources.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***
Geology and Soils	**Watershed Resources**
Site Scale	
Analysis area: 1,014 acres	
• Under the Action Alternatives, additional impervious surfaces and developed areas would increase runoff within the site scale. The effects would be as described for Watershed Resources.	• Under the Action Alternatives, in-stream flows would be affected at the site scale through the removal of vegetation (which may further reduce hydrologic maturity) and increases in impervious surfaces. • Under all the Action Alternatives, culverts would be sized to pass the 100 year flow, with considerations for debris and fish passage (see Table 2.4-2, MR8). • In-stream flows would be maintained at existing conditions under all Alternatives, since no new surface or groundwater withdrawals would occur (see Table 4.3.7-2). • Local increases in streamflow may occur due to implementation of the Action Alternatives, but are expected to be mitigated through the BMPs and measures in Table 2.4-2 (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed). • Under the Action Alternatives, total clearing and grading in wetlands would range from 1.71 acres under Alternative 3 to 1.74 acres under Alternatives 2, 4, and 5 (see Table 4.3.3-9). • Construction techniques, including the embedding of coarse woody debris within the ground surface, along with OMP25, OMP26, and OMP27 would minimize localized increases in sheet flow on construction sites during and after construction (see Table 2.4-2 and Section 4.3.3.2 – South Fork Snoqualmie River Watershed). • Land conversions (ski trails and impervious surfaces) would likely generate a slight new export of water, and may indirectly affect snow accumulation and snowmelt locally (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed). • The restoration projects listed and described in the MDP Implementation Plan (Appendix F) would benefit Riparian Buffers and indirectly beneficially impact streams and wetlands. Implementation of Management Requirements and Other

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***	
Vegetation	**Wildlife**	**Fisheries**
Site Scale		
Analysis area: 1,014 acres		
• Effects of the Action Alternatives on vegetation at the site scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on wildlife at the site scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on fish at the site scale would be as described for Watershed Resources.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***
Geology and Soils	**Watershed Resources**
	Management Provisions (see Table 2.4-2) would improve Riparian Buffer function such as stream shading, nutrient and litter input, streambank stabilization and LWD recruitment (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed).
Finding: **Does Not Prevent Attainment of ACSO 6**	**Finding:** **Does Not Prevent Attainment of ACSO 6**
5th Field Scale	
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)	
• The geology and soils effects of the Action Alternatives, coupled with the cumulative actions would not result in a measurable increase in runoff at the 5th field scale. The geology and soils effects of the Action Alternatives, coupled with the cumulative actions, ranges from approximately 373.52 acres (under Alternative 3) to 375.80 acres (under Alternative 2), which equates to approximately 1.26 percent to 1.26 percent of the 5th field scale, respectively (see Section 4.2.7 – Cumulative Effects). These actions occur within small, localized areas that are scattered throughout the entire watershed. Therefore no impacts to geology and soils would result in measurable effects to in-stream flows at the 5th field scale.	• The effects of the Action Alternatives, coupled with the cumulative actions, on Riparian Buffers range from approximately 461.69 acres (Alternative 4) to 463.24 acres (Alternative 2 and Modified Alternative 5), which is approximately 2.69 percent to 2.70 percent of the 5th field Riparian Buffers, respectively (see Section 4.3.8 - Cumulative Effects). The removal of vegetation and increased impervious surfaces associated with these actions would not result in any measurable changes to runoff at the 5th field scale. As described in Section 4.3 – Watershed Resources, these actions are localized to small areas scattered throughout the entire 5th field. • The flow model analysis details that the average annual discharge associated with the Study Area ranges from 33.80 cfs (Alternative 3) to 33.83 cfs (Alternatives 2, 4, and Modified Alternative 5). This is approximately 6.19 to 6.20 percent of the average annual discharge of the S.F. Snoqualmie River (see Section 4.3.8 - Cumulative Effects). As a result, there would not be a measurable effect on the flow regime at the site scale, and therefore, no measurable effect is expected at the 5th field. • Impacts to watershed resources would not result in measurable affects to in-stream flows at the 5th field scale.
Finding: Meets ACSO 6	**Finding: Meets ACSO 6**
Degree of impacts by alternative: **Alternative 2>5>4>3>1**	**Degree of impacts by alternative:** **Alternative 2=4=5>3>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***	
Vegetation	**Wildlife**	**Fisheries**
Finding: Does Not Prevent Attainment of ACSO 6	**Finding: Does Not Prevent Attainment of ACSO 6**	**Finding: Does Not Prevent Attainment of ACSO 6**
5th Field Scale		
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)		
• Effects of the Action Alternatives on vegetation at the 5th field scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on wildlife at the 5th field scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on fish at the 5th field scale would be as described for Geology and Soils and Watershed Resources.
Finding: Meets ACSO 6	**Finding: Meets ACSO 6**	**Finding: Meets ACSO 6**
Degree of impacts by alternative: Alternative 2=4=5>3>1	**Degree of impacts by alternative: Alternative 2=4=5>3>1**	**Degree of impacts by alternative: Alternative 2=4=5>3>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 7	***Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands***
Geology and Soils	**Watershed Resources**
Existing Condition	
• Decreased soil permeability and increases in impervious areas (e.g., facilities, parking lots, road network, timber harvest) have contributed to increased runoff, potentially resulting in changes to water levels and floodplain inundation within the watershed (USFS 1995a).	• As described in Geology and Soils, increased runoff has the potential to affect water levels and floodplain inundation within the watershed. • Many wetlands are groundwater seeps, some of which were created or enlarged with ski slope recontouring. No evidence of significant changes to the water table exist (Jones & Stokes 2001). • In the Source Lake subwatershed in the vicinity of Alpental and the Summit North drainage, wetlands are generally small and not significant in controlling watershed response to stormflow or maintaining base streamflows (Jones & Stokes 2001). • Floodplains are not a significant source of flood storage, sediment storage, and nutrient cycling for the S.F. Snoqualmie River (Jones & Stokes 2001). • Water surface and water table elevations are currently within desired conditions (Jones & Stokes 1998).
Site Scale	
Analysis area: 1,014 acres	
• Under the Action Alternatives, additional impervious surfaces and developed areas would increase runoff, but are not expected to result in measurable changes to water levels or floodplain inundation within the site scale (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed). The effects would be as described for Watershed Resources.	• Under the Action Alternatives, water levels in streams, wetlands, and floodplains would be affected at the site scale through the removal of vegetation (which may further reduce hydrologic maturity) and increases in impervious surfaces. • Under the Action Alternatives, total clearing and grading in wetlands would range from 1.71 acres under Alternative 3 to 1.74 acres under Alternatives 2, 4, and Modified 5 (see Table 4.3.3-9). Grading displaces wetland area and removes all functionality of the wetland through the placement of fill material and/or soil excavation in wetlands. Grading activities can modify the hydrology of wetlands via the creation of impervious surfaces, or by changing existing drainage patterns (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed). • At the site scale, water levels of streams and wetlands are strongly influenced by groundwater sources (Jones & Stokes 2001). The groundwater influence acts to moderate water levels. As described in Section 4.3.3.2 – South Fork

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 7	***Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• There are currently 478.86 acres of hydrologically mature forested land cover in the S.F. Snoqualmie watershed portion of the Study Area (see Table 3.3.1-6).	• While changes in water levels and floodplain inundation can influence the quality of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Vegetation and Watershed Resources.	• While changes in water levels and floodplain inundation can influence the quality of fish habitat, the physical properties on which effects to fish would be measured are primarily described under Vegetation and Watershed Resources.
Site Scale		
Analysis area: 1,014 acres		
• Under the Action Alternatives, the hydrologically mature forest cover type would range from 473.28 acres under Alternatives 2 and 5 to 475.84 acres under Alternative 4 (see Table 4.3.3-10). • Other effects of the Action Alternatives on vegetation at the site scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on wildlife at the site scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on fish at the site scale would be as described for Watershed Resources.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 7	***Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands***
Geology and Soils	**Watershed Resources**
	Snoqualmie River Watershed, streams within the site scale are narrow, deeply incised channels and therefore have very limited floodplain development. • The restoration projects listed and described in the MDP Implementation Plan (Appendix F) would benefit Riparian Buffers and indirectly beneficially impact streams and wetlands (see Section 4.3.6.2 – South Fork Snoqualmie River Watershed). • The Stormwater Management Plan would reduce the transportation of stormwater and sediments to Riparian Buffers, streams and wetlands, and riparian functions would eventually return to a more natural condition (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed).
Finding: Meets ACSO 7	**Finding: Meets ACSO 7**
5th Field Scale	
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)	
• The geology and soils effects of the Action Alternatives, coupled with the cumulative actions, would not result in measurable changes to water levels or floodplain inundation at the 5th field scale. The geology and soils effects of the Action Alternatives, coupled with the cumulative actions, ranges from approximately 373.52 acres (under Alternative 3) to 375.80 acres (under Alternative 2), which equates to approximately 1.26 percent to 1.26 percent of the 5th field scale, respectively (see Section 4.2.7 – Cumulative Effects). These actions occur within small, localized areas that are scattered throughout the entire watershed. Therefore no effects to geology and soils are expected to result in measurable effects to water levels or floodplains at the 5th field scale.	• The effects of the Action Alternatives, coupled with the cumulative actions, on Riparian Buffers range from approximately 461.69 acres (Alternative 4) to 463.24 acres (Alternative 2 and Modified Alternative 5), which equates to approximately 2.69 percent to 2.70 percent of the 5th field Riparian Buffers, respectively (see Section 4.3.8 – Cumulative Effects). The removal of vegetation and increased impervious surfaces associated with these actions would not result in any measurable changes to water levels or floodplain inundation at the 5th field scale. As described in Section 4.3 – Water and Watershed Resources, these actions are localized to small areas scattered throughout the entire 5th field.
Finding: Meets ACSO 7	**Finding: Meets ACSO 7**
Degree of impacts by alternative: **Alternative 2>5>4>3>1**	**Degree of impacts by alternative:** **Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 7	***Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands***	
Vegetation	**Wildlife**	**Fisheries**
Finding: Meets ACSO 7	**Finding: Meets ACSO 7**	**Finding: Meets ACSO 7**
5th Field Scale		
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)		
• Effects of the Action Alternatives on vegetation at the 5th field scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on wildlife at the 5th field scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on fish at the 5th field scale would be as described for Geology and Soils and Watershed Resources.
Finding: Meets ACSO 7	**Finding: Meet s ACSO 7**	**Finding: Meets ACSO 7**
Degree of impacts by alternative: Alternative 2=5>3>4>1	**Degree of impacts by alternative: Alternative 2=5>3>4>1**	**Degree of impacts by alternative: Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Existing geology and soils conditions are as described under Vegetation.	• Risks to plant community composition, structure and function include timber harvest, the construction of new roads, dispersed/developed recreation, and catastrophic fire (USFS 1995a). • As immature and sapling forest areas in Riparian Buffers continue to mature, LWD recruitment potential would increase (see Section 4.4.2 – Impacts – Alternative 1 [No Action]). • Impaired LWD recruitment potential occurs in immature, naturally forested areas on 6.2 acres of Riparian Buffers in the S.F. Snoqualmie watershed portion of the Study Area. All areas with impaired recruitment potential are dominated by immature forest stands that are regenerated after disturbance by logging and/or historic development (see Section 3.3.1.6 – Riparian Resources).

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• Riparian and wetland communities are currently within or marginally within the acceptable range of natural variation of stand structure and composition for the Source Lake project-level watershed. The International and Summit North sub-watersheds are outside the range of natural conditions because of ski slope clearing (Jones & Stokes 1998). • The amount of old growth western hemlock ecosystem is at a very low level due to the logging and I-90 development that have occurred in this ecosystem (USFS 1995a). • There are 108.28 acres of forested, mature land cover within Riparian Buffers in the S.F. Snoqualmie watershed portion of the Study Area (see Table 3.3.1-12). • 60% of the Riparian Buffers in the S.F. Snoqualmie watershed are in a natural, non-modified land cover (see Table 3.3.1-12 and Section 3.3.1.6 – Riparian Resources). • There are currently 478.86 acres of hydrologically mature forested land cover in the S.F. Snoqualmie watershed portion of the Study Area (see Table 3.3.1-6). • Many of the riparian ecosystems in the S.F. Snoqualmie watershed lack	• Riparian and wetland habitat have been altered by past development activities, including vegetation removal, filling and grading activities and through modification of vegetation type (USDA 1995a). • Other existing wildlife conditions are as described under Vegetation.	• Existing fisheries and aquatic habitat conditions are as described under Watershed Resources.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***

Geology and Soils	Watershed Resources

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***	
Vegetation	**Wildlife**	**Fisheries**
mature stand conditions due to logging and the development of I-90. This results in low levels of habitat for riparian dependent species, a lack of species diversity, lack of canopy cover, stream instability and lack of LWD recruitment potential (USFS 1995a). • The S.F. Snoqualmie watershed has been subjected to the introduction of various nonnative plant species (USDA 1995a). • As immature and sapling forest areas in Riparian Buffers continue to mature, LWD recruitment potential would increase (see Section 4.4.2 – Impacts – Alternative 1 [No Action]). • Impaired LWD recruitment potential occurs in immature, naturally forested areas on 6.2 acres of Riparian Buffers in the S.F. Snoqualmie watershed portion of the Study Area. All areas with impaired recruitment potential are dominated by immature forest stands that are regenerated after disturbance by logging and/or historic development (see Section 3.3.1.6 – Riparian Resources).		

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***	
Geology and Soils		**Watershed Resources**
Site Scale		
Analysis area: 1,014 acres		
• Effects on geology and soils are as described under Vegetation.		• Clearing in Riparian Buffers associated with the Action Alternatives would affect plant community composition, structure and function. • Under all the Action Alternatives, the total area of Riparian Buffers within the S.F. Snoqualmie watershed portion of the Study Area would be 274.18 acres, which is slightly less than the existing condition of 277.35 acres (see Table 4.3.3-12). • All Action Alternatives minimize clearing and grading in Riparian Buffers by locating the proposed design outside Riparian Buffers to the extent possible. Ski trail design is intended to parallel Riparian Buffers while minimizing disturbance in riparian areas (see Table 2.4-2). • The condition along the S.F. Snoqualmie River would be essentially unchanged from the existing condition under the Action Alternatives, therefore no direct reduction in LWD recruitment potential would occur along the S.F. Snoqualmie River (see Table 4.4.3-3 and Section 4.4.3.2 – South Fork Snoqualmie River Watershed). • Construction prescriptions and Mitigation Measures in Table 2.4-2 include lop and scatter requirements, with no removal of woody material from cleared areas. Wood would also be placed in stream channels to enhance channel complexity and reduce channel erosion (see Table 2.4-2). • Under the Action Alternatives, total clearing and grading in wetlands would range from 1.71 acres under Alternative 3 to 1.74 acres under Alternatives 2, 4, and 5 (see Table 4.3.3-9). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 473.28 acres under Alternatives 2 and 5 to 475.84 acres under Alternative 4 (see Table 4.3.3-10).

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***	
Vegetation	**Wildlife**	**Fisheries**
Site Scale		
Analysis area: 1,014 acres		
• Under the Action Alternatives, vegetation removed for the development of additional ski area facilities would affect plant community structure and function in Riparian Buffers at the site scale. • Under all the Action Alternatives, the total area of Riparian Buffers within the S.F. Snoqualmie watershed portion of the Study Area would be 274.18 acres, which is slightly less than the existing condition of 277.35 acres (see Table 4.3.3-12). • The greatest impact to Riparian Buffers would be the complete removal of riparian function through the creation of impervious surfaces (roads, buildings, and parking lots) and the installation of stream culverts (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed). • The function of modified wetlands within the S.F. Snoqualmie watershed portion of the Study Area have been reduced and in some cases eliminated because of the clearing and mowing necessary to maintain the ski trails. These activities can result in lower plant species diversity; however, most of the wetland vegetation includes native plant species that are considered	• The effects to the composition, structure and function of plant communities utilized by riparian-dependent species are as described under Vegetation.	• As described in Watershed Resources, riparian community composition, structure and function would be impacted by clearing and grading associated with the Action Alternatives. BMPs and Mitigation Measures listed in Table 2.4-2 would minimize the impacts to streambank function and riparian communities as described under Watershed Resources.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***

Geology and Soils	Watershed Resources
Finding: **Does Not Prevent Attainment of ACSO 8**	**Finding:** **Does Not Prevent Attainment of ACSO 8**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***	
Vegetation	**Wildlife**	**Fisheries**
dominant species (Jones & Stokes 2001). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 473.28 acres under Alternatives 2 and 5 to 475.84 acres under Alternative 4 (see Table 4.3.3-10). • The removal of vegetation communities at the site scale would occur predominantly in the shrub and herbaceous plant communities under all the Action Alternatives (see Table 4.5.2-1C and Section 4.5.3.2 – Upper South Fork Snoqualmie River Watershed). • The construction of ski trails and roads increases the potential for noxious weed transport and establishment into these areas. Under the Action Alternatives, establishment of noxious weeds would be reduced by the use of BMPs (see MR28 in Table 2.4-2).		
Finding: Does Not Prevent Attainment of ACSO 8	**Finding: Does Not Prevent Attainment of ACSO 8**	**Finding: Does Not Prevent Attainment of ACSO 8**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***
Geology and Soils	**Watershed Resources**
5th Field Scale	
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)	
• Geology and soils impacts at the 5th field are as described under Vegetation.	• The effects of the Action Alternatives, coupled with the cumulative actions, on Riparian Buffers range from approximately 461.69 acres (Alternative 4) to 463.24 acres (Alternative 2 and Modified Alternative 5), which equates to approximately 2.69 percent to 2.70 percent of the 5th field Riparian Buffers, respectively (see Section 4.3.8 – Cumulative Effects). As described in Section 4.3 – Water and Watershed Resources, these actions are localized to small areas scattered throughout the entire 5th field. Effects to watershed resources would not result in any measurable changes to the composition, structure and function of riparian plant communities at the 5th field scale.
Finding: Meets ACSO 8	**Finding: Meets ACSO 8**
Degree of impacts by alternative: **Alternative 2>5>4>3>1**	**Degree of impacts by alternative:** **Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***	
Vegetation	**Wildlife**	**Fisheries**
5th Field Scale		
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from 575.97 acres (Alternative 3) to 589.05 acres (Alternative 2), which equates to approximately 1.95 to 1.99 percent of the 5th field scale (see Section 4.5.7 - Cumulative Effects). A majority of these effects occur outside of Riparian Buffers, and would therefore have no effect on riparian plant communities. Cumulative actions occurring within Riparian Buffers are localized to small areas that are scattered throughout the 5th field. Therefore, no impacts to vegetation would result in measurable impacts to the composition, structure and function of riparian plant communities at the 5th field scale.	• The wildlife effects to the composition, structure and function of plant communities utilized by riparian-dependent species are as described under Vegetation.	• As described in Watershed Resources, no measurable impacts to the composition, structure and function of riparian plant communities at the 5th field scale are expected.
Finding: Meets ACSO 8	**Finding: Meets ACSO 8**	**Finding: Meets ACSO 8**
Degree of impacts by alternative: Alternative 2>5>4>3>1	**Degree of impacts by alternative: Alternative 2>5>4>3>1**	**Degree of impacts by alternative: Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Previous developments (timber harvest, ski area) have altered habitat characteristics through road construction and tree removal (USFS 1995a). • Risks to Riparian Buffers include timber harvest, the construction of new roads, dispersed/developed recreation, low LWD recruitment potential, potential mass wasting, windthrow, and catastrophic fire (USFS 1995a). • Overall, the physical resources in the S.F. Snoqualmie watershed are in an unacceptable condition. This is due primarily to the logging and roadbuilding activities south of I-90 and the impact of I-90 (USFS 1995a).	• Overall, the physical resources in the S.F. Snoqualmie watershed are in an unacceptable condition. This is due primarily to the logging and roadbuilding activities south of I-90 and the impact of I-90 (USFS 1995a). • The road density of the S.F. Snoqualmie portion of the Study Area is 1.96 mi/mi^2 (see Table 3.3.1-4). • There are 16 stream-road crossings (culvert, bridge, or ford) in the S.F. Snoqualmie watershed portion of the Study Area (see Table 3.3.1-4). • 2% of the S.F. Snoqualmie watershed is in a permanently disturbed state due to developments, utility corridors and I-90 (Jones & Stokes 1998). • Risks to Riparian Buffers include timber harvest, the construction of new roads, dispersed/developed recreation, low LWD recruitment potential, potential mass wasting, windthrow, and catastrophic fire (USFS 1995a).

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Condition		
• Land-use activities within the S.F. Snoqualmie watershed (checkerboard land allocation, timber harvest, development) have contributed to the existing land cover, as represented by the mosaic of vegetation communities and developed areas that comprise the existing vegetation conditions (USFS 1995a). • Fragmentation of forest stands, particularly old-growth western hemlock, and the loss of mature conditions in riparian stands has degraded connectivity between habitat types (USFS 1995a). Roads, housing and resort development along the mainstem S.F. Snoqualmie River have resulted in increased early seral conditions in valley bottom riparian areas (Jones & Stokes 2001). • Stand complexity is expected to increase through the maturing of early seral stands that had been initiated by timber harvest (Jones & Stokes 2001). • Fires of historical size and intensity may be inevitable in the future, as the S.F. Snoqualmie has the highest fire frequency of any watershed in the Snoqualmie River basin (USFS 1995a).	• Previous developments (timber harvest, ski area and road construction) have altered physical landscape scale feature through road construction and removal of vegetation (USFS 1995a). These alterations are generally localized to small areas within the larger watershed (see Section 4.4 – Fisheries).	• No anadromous fish species are present in the S.F. Snoqualmie watershed due to the presence of Snoqualmie Falls (USFS 1995a). • Limiting influences on fish habitat in the S.F. Snoqualmie watershed near Alpental include the extreme, natural environmental conditions (gradient, elevation, nutrient conditions), sediment from both natural sources and management activities, and LWD shortages in harvested riparian forests (Jones & Stokes 2001). Other tributaries provide poor to fair habitat because the high-gradient streams with generally unproductive waters (Jones & Stokes 2001). • There is a low number of rearing and refugia pools in major tributaries (USFS 1995a). • Fisheries impacts would be related to the effects described in Geology and Soils, Vegetation and Watershed Resources.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***
Geology and Soils	**Watershed Resources**
Site Scale	
Analysis area: 1,014 acres	
• Implementation of the Action Alternatives would increase the loss of soil productivity within the site scale. The geology and soils impacts would not result in measurable changes to riparian habitat at the site scale. • Under the Action Alternatives, the total acreage of detrimental soil conditions within the site scale would range from 114.31 acres (4% of Study Area) under Alternative 5 to 115.28 acres (4% of Study Area) under Alternative 2 (see Table 4.2.3-3C), which is below the 20 percent threshold for an activity area. Under Alternatives 3 and 4, the total detrimental soil condition would decrease to below existing conditions (see Table 4.2.3-3C).	• Clearing and grading in Riparian Buffers, road density and stream crossings associated with the Action Alternatives would affect the site scale. Impacts to watershed resources are not expected to have a measurable impact on riparian habitat at the site scale. • Under all the Action Alternatives, the total area of Riparian Buffers within the S.F. Snoqualmie watershed portion of the Study Area would be 274.18 acres, which is slightly less than the existing condition of 277.35 acres (see Table 4.3.3-12). • Under the Action Alternatives, the road density would range from 1.97 mi/mi^2 under Alternative 4 to 1.99 mi/mi^2 under Alternatives 2, 3 and 5, representing a slight increase over the existing condition of 1.96 mi/mi^2 (see Table 4.3.3-7) • The condition along the S.F. Snoqualmie River would be essentially unchanged from the existing condition under the Action Alternatives, therefore no direct reduction in LWD recruitment potential would occur along the S.F. Snoqualmie River (see Table 4.4.3-3 and Section 4.4.3.2 – South Fork Snoqualmie River Watershed). • Under the Action Alternatives, total clearing and grading in wetlands would range from 1.71 acres under Alternative 3 to 1.74 acres under Alternatives 2, 4, and Modified Alternative 5 (see Table 4.3.3-9). Grading displaces wetland area and removes all functionality of the wetland through the placement of fill material and/or soil excavation in wetlands (see Section 4.3.3.2 – South Fork Snoqualmie River Watershed). • Under the Action Alternatives, road length within Riparian Buffers would range from 1.73 miles under Alternative 4 to 1.85 miles under Alternatives 2, 3 and 5. All the Action Alternatives would represent a decrease in road length within Riparian Buffers over the existing condition of 1.87 miles (see Table 4.3.3-12). • All Action Alternatives would result in one additional stream crossing over the existing condition of 16 crossings in the Study Area. All

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
Site Scale		
Analysis area: 1,014 acres		
• Under the Action Alternatives, total long-term vegetation impacts within the S.F. Snoqualmie watershed portion of the Study Area would range from 19.81 acres under Alternative 3 to 24.74 acres under Modified Alternative 5 (see Table 4.5.3-FEIS-3). • The removal of vegetation communities at the site scale would occur predominantly in the shrub and herbaceous plant communities under all the Action Alternatives (see Section 4.5.3.2 – Upper South Fork Snoqualmie River Watershed). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 473.28 acres under Alternatives 2 and 5 to 475.84 acres under Alternative 4 (see Table 4.3.3-10). • The construction of ski trails and roads increases the potential for noxious weed transport and establishment into these areas. Under the Action Alternatives, potential for establishment of noxious weeds would be reduced by the use of BMPs (see MR28 in Table 2.4-2).	• Wildlife impacts at the site scale would be related to the effects described in Watershed Resources and Vegetation. Populations of riparian dependent wildlife would be temporarily displaced during construction activities (see Section 3.6 – Wildlife).	• Fisheries impacts would be related to the effects described in Geology and Soils, Vegetation and Watershed Resources. • BMPs and Mitigation Measures listed in Table 2.4-2 would minimize the impacts to riparian habitat.

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***
Geology and Soils	**Watershed Resources**
	Action Alternatives would have .29 mile of culverted channels over the existing .22 mile (see Table 4.3.3-7).
Finding: **Does not prevent attainment of ACSO 9**	**Finding:** **Does not prevent attainment of ACSO 9**
5th Field Scale	
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)	
• The geology and soils effects of the Action Alternatives, coupled with the cumulative actions, ranges from approximately 373.52 acres (under Alternative 3) to 375.80 acres (under Alternative 2), which equates to approximately 1.26 percent to 1.26 percent of the 5th field scale, respectively (see Section 4.2.7 – Cumulative Effects). Section 4.2 – Geology and Soils describes that the effects to Geology and Soils would not measurably affect riparian habitat at the 5th Field scale.	• The effects of the Action Alternatives, coupled with the cumulative actions, on Riparian Buffers range from approximately 461.69 acres (Alternative 4) to 463.24 acres (Alternative 2 and Modified Alternative 5), which equates to approximately 2.69 percent to 2.70 percent of the 5th field Riparian Buffers, respectively (see Section 4.3.8 – Cumulative Effects). Cumulative actions would not result in measurable changes in the timing, duration, or magnitude of low flow and peak flow events at the 5th field scale for the South Fork Snoqualmie River watershed (see Table 4.3.3-11). Therefore, no measurable effects to riparian habitat are expected (see Section 4.3 – Water and Watershed Resources).
Finding: Meets ACSO 9	**Finding: Meets ACSO 9**
Degree of impacts by alternative: **Alternative 2>5>4>3>1**	**Degree of impacts by alternative:** **Alternative 2=5>3>4>1**

Table 4.7-FEIS-1:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the South Fork Snoqualmie River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
Finding: Does not prevent attainment of ACSO 9	**Finding: Does not prevent attainment of ACSO 9**	**Finding: Does not prevent attainment of ACSO 9**
5th Field Scale		
Analysis area: South Fork Snoqualmie River Watershed (59,551 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from 575.97 acres (Alternative 3) to 589.05 acres (Alternative 2), which equates to approximately 1.95 to 1.99 percent of the 5th field scale (see Section 4.5.7 - Cumulative Effects). As discussed in Section 4.3 and 4.5, the vegetation impacts would not measurably affect riparian habitat at the 5th field scale.	• Wildlife impacts at the 5th field scale would be related to the effects described in Vegetation. As described in Section 3.6 - Wildlife, impacts to riparian-dependent species would occur from short-term noise disruptions, increased human activity, and the loss of habitat resulting from the effects of the Action Alternatives and cumulative actions. These effects are localized to small areas scattered throughout the entire 5th field. Therefore, wildlife impacts would not result in any measurable effects to riparian-dependent species at the 5th field.	• The effects of the Action Alternatives, coupled with the cumulative actions, on Riparian Buffers range from approximately 461.69 acres (Alternative 4) to 463.24 acres (Alternative 2 and Modified Alternative 5), which equates to approximately 2.69 percent to 2.70 percent of the 5th field Riparian Buffers, respectively (see Section 4.3.8 – Cumulative Effects). Cumulative actions would not result in any measurable changes in the timing, duration, or magnitude of low flow and peak flow events at the 5th field scale for the South Fork Snoqualmie River watershed (see Table 4.3.3-11). Therefore, fisheries impacts are not expected to measurably affect riparian habitat at the 5th field scale (see Section 4.3 – Water and Watershed Resources).
Finding: Meets ACSO 9	**Finding: Meets ACSO 9**	**Finding: Meets ACSO 9**
Degree of impacts by alternative: Alternative 2>5>4>3>1	**Degree of impacts by alternative: Alternative 2>5>4>3>1**	**Degree of impacts by alternative: Alternative 2=5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• The Yakima watershed is functioning at unacceptable risk for disturbance history due to a combination of previous developments, fire disturbance, timber harvest, and road building. (Jones & Stokes 2001) • Previous developments (timber harvest, ski area, road construction) have altered physical landscape features through the loss of soil productivity (USFS 1997).	• The Yakima watershed is functioning at unacceptable risk for disturbance history due to a combination of previous developments, fire disturbance, timber harvest, and road building. (Jones & Stokes 2001) • There are 979.7 miles of existing roads and 34 road crossing barriers in the Yakima watershed (Jones & Stokes 2001) • The road density in the Yakima watershed is 3.6 mi/mi^2 and is functioning at unacceptable risk. The road density of the Yakima watershed within the Study Area is 6.43 mi/mi^2 (see Table 3.3.1-4). • Within the Upper Yakima watershed, there are 1,900 stream crossings and 5.2 miles of road (27 percent of the roads in the watershed) lie within Riparian Buffers (USFS 1997). • In the Yakima watershed within the Study Area, there are 88 stream-road crossings (see Table 3.3.1-4) • In the Coal Creek watershed, there are 29 miles of roads, 10.5 miles are paved, and 18.6 miles are unpaved. 0.4 mile of road is mapped as closed (Jones & Stokes 2001).
Site Scale	
Analysis area: 1,885 acres	
• Implementation of the Action Alternatives would increase the loss of soil productivity within the site scale. The effect at the landscape scale would not result in measurable changes to the distribution, diversity, and complexity of geology and soils features. • Under the Action Alternatives, the total acreage of detrimental soil conditions within the site scale would range from 114.28 acres (4% of Study Area) under Alternative 5 to 115.28 acres (4% of Study Area) under Alternative 2 (see Table 4.2.3-3C), which is below the 20 percent threshold for an activity area. Under Alternatives 3 and 4, the	• Clearing and grading in Riparian Reserves, road density and hydrologic maturity associated with the Action Alternatives would not measurably affect landscape-scale watershed features at the site scale. • Under the Action Alternatives, the total area of Riparian Buffers within the Upper Yakima watershed portion of the Study Area would be 524.66 acres under Alternatives 2 and 4, and 606.14 acres under Alternatives 3 and 5, which is greater than the existing condition of 523.49 acres (see Table 4.3.3-6C). • Alternative 2 would result in the greatest effects to

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• The Yakima watershed is functioning at unacceptable risk for disturbance history due to a combination of previous developments, fire disturbance, timber harvest, mining and road building (USFS 1997). • Modified vegetation associated with historic timber harvest and ski area management in the Study Area has increased hydrologically immature land cover by 161 percent. Currently, approximately 600 acres of forested communities have been displaced primarily for recreational facilities (Jones & Stokes 2001). • The Yakima watershed is functioning at unacceptable risk for disturbance history; 44% is in mature vegetative condition and 58% is in immature vegetative condition (USFS 1997).	• While the distribution, diversity, and complexity of watershed and landscape scale features are important components of wildlife habitat, the physical properties on which impacts to wildlife would be measured are primarily associated with the properties described for vegetation.	• Previous developments (timber harvest, ski area and road construction) have altered physical landscape scale feature through road construction and removal of vegetation. These alterations are generally localized to small areas within the larger watershed (USFS 1997). • Existing condition of Fisheries is as described under Watershed Resources.
Site Scale		
Analysis area: 1,885 acres		
• The effects to vegetation communities associated with the Action Alternatives would not have a measurable effect on landscape-scale features at the site scale because all plant communities would continue to persist (see Section 4.5 - Vegetation). • The removal of vegetation communities at the site scale would occur predominantly in the mature, forested mixed	• Wildlife impacts at the site scale would be as described under Vegetation.	• Fisheries impacts would be as described under Geology and Soils, Vegetation and Watershed Resources.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted***
Geology and Soils	**Watershed Resources**
total detrimental soil condition would decrease to below existing conditions (see Table 4.2.3-3C).	the distribution, diversity and function of Riparian Buffers among the Action Alternatives due to the removal of mature forest along streams. Riparian function would be reduced at ski trail and bridge crossings, but would be maintained along these streams at the site scale (see Section 4.3.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, the road density would range from 6.23 mi/mi^2 under Alternative 4 to 6.29 mi/mi^2 under Alternatives 2, 3 and 5. All road densities under the Action Alternatives are less than the existing condition of 6.43 mi/mi^2 (see Table 4.3.3-1C). • Under the Action Alternatives, road length within Riparian Buffers would range from 4.72 miles under Alternative 4 to 5.38 miles under Alternative 3 and Modified Alternative 5. Alternatives 2 and 4 would result in fewer road miles than the existing condition of 5.20 miles (see Table 4.3.3-6C).
Finding: **Does not prevent attainment of ACSO 1**	**Finding:** **Does not prevent attainment of ACSO 1**
5th Field Scale	
Analysis area: Upper Yakima River Watershed (74,444 acres)	
• The geology and soils effects of the Action Alternatives, coupled with the cumulative actions, ranges from approximately 2263.88 acres (under Alternative 4) to 2265.36 acres (under Alternative 2), which equates to approximately 3.04 percent of the 5th field scale (see Table 4.2.7-2). Section 4.2 – Geology and Soils describes that the effects to geology and soils would not measurably affect the distribution and complexity of landscape-scale geology and soil features at the 5th field scale.	• The Action Alternatives, coupled with the cumulative actions, would affect approximately 2354.35 acres (under Alternative 4) to 2369.49 acres (under Alternative 2) of Riparian Reserves, which equates to approximately 5.06 percent to 5.09 percent of the 5th field scale Riparian Buffers, respectively (see Table 4.3.8-2). As discussed in Section 4.3 – Watershed Resources, the effects to Riparian Buffers would not measurably affect the distribution and complexity of watershed and landscape-scale features at the 5th field scale.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted***	
Vegetation	**Wildlife**	**Fisheries**
conifer community dominated by Pacific silver fir and mountain hemlock. Removal of mature, forested land cover would range from 12.64 acres under Alternative 4 to 44.27 acres under Alternative 2 (see Section 4.5.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, total vegetation removal within the Upper Yakima watershed portion of the Study Area would range from 72.83 acres under Alternative 4 to 120.00 acres under Alternative 2 (see Section 4.5.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 534.55 acres under Alternative 2 to 562.20 acres under Alternative 4 (see Table 4.3.3-4).		
Finding: Does not prevent attainment of ACSO 1	**Finding: Does not prevent attainment of ACSO 1**	**Finding: Does not prevent attainment of ACSO 1**
5th Field Scale		
Analysis area: Upper Yakima River Watershed (74,444 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from 2954.63 acres (under Alternative 4) to 3002.25 acres (under Alternative 2), which equates to approximately 3.97 to 4.03 percent of the 5th field scale (see Table 4.5.7-2). A majority of these effects occur outside of Riparian Reserves, and would therefore have no effect on riparian plant	• Wildlife impacts at the 5th field scale would be as described under Vegetation.	• Fisheries impacts would be as described under Geology and Soils, Vegetation and Watershed Resources. As discussed in Section 4.4 - Fisheries, the effects to fish or aquatic habitat would not measurably affect the distribution and complexity of landscape-scale features associated with fisheries at the 5th field scale.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted***
Geology and Soils	**Watershed Resources**
Finding: Meets ACSO 1	**Finding: Meets ACSO 1**
Degree of impacts by alternative: **Alternative 2>5>3>4>1**	**Degree of impacts by alternative:** **Alternative 2>5>3>>4>1**
ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas b) critical for fulfilling life history requirements of aquatic and riparian-dependent species.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Existing Geology and Soils conditions are as described under Vegetation.	• Road density in the Yakima watershed is 3.6 mi/mi^2 and is functioning at unacceptable risk (USFS 1997). • There are 979.7 miles of existing roads and 34 road crossing barriers in the Yakima watershed (USFS 1997). • There are 1,900 stream crossings (USFS 1997). • In the Coal Creek watershed, there are 29 miles of roads (10.5 miles are paved and 18.6 miles are unpaved), and 0.4 mile of road is mapped as closed (Jones & Stokes 2001).

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 1	***Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted***	
Vegetation	**Wildlife**	**Fisheries**
communities. Cumulative actions occurring within Riparian Reserves are localized to small areas that are scattered throughout the 5th field. Therefore, no measurable impacts to the distribution and complexity of landscape-scale vegetation features at the 5th field scale are expected.		
Finding: Meets ACSO 1	**Finding: Meets ACSO 1**	**Finding: Meets ACSO 1**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**	**Degree of impacts by alternative: Alternative 2>5>3>>4>1**
ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas b) critical for fulfilling life history requirements of aquatic and riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• Modified vegetation associated with historic timber harvest in the Study Area and ski area management has increased hydrologically immature land cover by 161 percent (USFS 1997). • Several natural and management-related landscape disturbances have influenced the vegetation patterns within the upper reaches of the Yakima watershed, including checkerboard land ownership, railway and road construction, commercial and residential development, wildfire, mass wasting, windthrow, avalanches, floods, insects and disease (USFS 1997).	• Existing Wildlife conditions are as described under Vegetation.	• All of the culverts on Coal Creek under I-90 are of sufficient length to be potential barriers to fish passage, especially at high flows (Jones & Stokes 2001). • Construction of the Keechelus Dam in 1913 isolated all Keechelus Lake tributaries, including Coal Creek and Mill Creek, from anadromous and Yakima River adfluvial fish populations (USFS 1997). • Other existing fish and aquatic habitat conditions are as described for Watershed Resources.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas b) critical for fulfilling life history requirements of aquatic and riparian-dependent species.***
Geology and Soils	**Watershed Resources**
Site Scale	
Analysis area: 1,885 acres	
• Effects on geology and soils are as described under Vegetation.	• Clearing in Riparian Reserves for construction and ski trail clearing would reduce forest continuity, fragmenting riparian habitat. Such clearing may create localized barriers to fish and wildlife movement along riparian corridors (see Wildlife). The Action Alternatives would not measurably affect spatial and temporal connectivity within the site scale. • Under the Action Alternatives, the total area of Riparian Buffers within the Upper Yakima watershed portion of the Study Area would be 524.66 acres under Alternatives 2 and 4, and 606.14 acres under Alternatives 3 and 5, which is greater than the existing condition of 523.49 acres (see Table 4.3.3-6C). • Alternative 2 would result in the greatest effects to the distribution, diversity and function of Riparian Reserves among the Action Alternatives due to the removal of mature forest along streams. Riparian function would be reduced at ski trail and bridge crossings, but would be maintained along these streams at the site scale (see Section 4.3.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, the road density would range from 6.23 mi/mi^2 under Alternative 4 to 6.29 mi/mi^2 under Alternatives 2, 3 and 5. All road densities under the Action Alternatives are less than the existing condition of 6.43 mi/mi^2 (see Table 4.3.3-1C). • Under the Action Alternatives, road length within Riparian Buffers would range from 4.72 miles under Alternative 4 to 5.38 miles under Alternatives 3 and 5. Alternatives 2 and 4 would result in fewer road miles than the existing condition of 5.20 miles (see Table 4.3.3-6C). • Under the Action Alternatives, the number of stream crossings would range from 86 under Alternative 4 to 89 under Alternatives 2, 3, and 5 (see Table 4.3.3-1C). All Action Alternatives would have 1.90 miles of culverted channels over the existing 1.84 miles (see Table 4.3.3-1C).

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas b) critical for fulfilling life history requirements of aquatic and riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
Site Scale		
Analysis area: 1,885 acres		
• Under the Action Alternatives, vegetation removed for the development of additional ski area facilities would affect the connectivity between watersheds at the site scale. • Under the Action Alternatives, the total area of Riparian Buffers within the Upper Yakima watershed portion of the Study Area would be 524.66 acres under Alternatives 2 and 4, and 606.14 acres under Alternatives 3 and 5, which is greater than the existing condition of 523.49 acres (see Table 4.3.3-6C). • Alternative 2 would result in the greatest effects to the distribution, diversity and function of Riparian Reserves among the Action Alternatives due to the removal of mature forest along streams. Riparian function would be reduced at ski trail and bridge crossings, but would be maintained along these streams at the site scale (see Section 4.3.3.1 – Upper Yakima River Watershed). • The removal of vegetation communities at the site scale would occur predominantly in the mature, forested mixed conifer community dominated by Pacific silver fir and mountain hemlock. Removal of mature, forested land cover would range from 12.64 acres under Alternative 4 to 44.27 acres under Alternative 2 (see	• As described in Section 3.6 – Wildlife, the Action Alternatives would have the greatest affect on connectivity for low mobility species. The removal of vegetation would reduce available connective habitat at the site scale. These effects are described under Vegetation.	• Under the Action Alternatives, no instream work in fish-bearing streams would occur, and road crossing replacements are located at least 0.5 mile upstream of confirmed fish bearing streams. No direct impacts to fish are anticipated from the Action Alternatives (see Section 4.4.3.1 – Upper Yakima River Watershed). Indirect impacts to fish may occur, and are as described under Vegetation and Watershed Resources.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas b) critical for fulfilling life history requirements of aquatic and riparian-dependent species.***
Geology and Soils	**Watershed Resources**
	• All Action Alternatives minimize clearing and grading in Riparian Reserves by locating the proposed design outside Riparian Reserves to the extent possible. Ski trail design is intended to parallel Riparian Reserves while minimizing disturbance in riparian areas (see Table 2.4-2). • All Action Alternatives would avoid and minimize impacts to streams and wetlands where possible through the implementation of Mitigation Measures, Management Requirements and Other Management Provisions, the use of BMPs, and field fitting the individual construction projects (see Section 2.4 – Mitigation).
Finding: Does Not Prevent Attainment of ACSO 2	**Finding: Does Not Prevent Attainment ACSO 2**
5th Field Scale	
Analysis area: Upper Yakima River Watershed (74,444 acres)	
• Geology and soils impacts at the 5th field are as described under Vegetation.	• The Action Alternatives, coupled with the cumulative actions, would affect approximately 2354.35 acres (under Alternative 4) to 2369.49 acres (under Alternative 2) of Riparian Buffers, which equates to approximately 5.06 percent to 5.09 percent of the 5th field scale Riparian Buffers, respectively (see Table 4.3.8-2). Watershed resource impacts would not result in any measurable changes to the connective riparian habitat at the 5th field. These actions are localized to small areas scattered throughout the entire 5th field.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas b) critical for fulfilling life history requirements of aquatic and riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
Section 4.5.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, total vegetation removal within the Upper Yakima watershed portion of the Study Area would range from 72.83 acres under Alternative 4 to 120.00 acres under Alternative 2 (see Section 4.5.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 534.55 acres under Alternative 2 to 562.20 acres under Alternative 4 (see Table 4.3.3-4).		
Finding: Does Not Prevent Attainment ACSO 2	**Finding: Does Not Prevent Attainment ACSO 2**	**Finding: Does Not Prevent Attainment ACSO 2**
5th Field Scale		
Analysis area: Upper Yakima River Watershed (74,444 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from2954.63 acres (under Alternative 4) to 3002.25 acres (under Alternative 2), which equates to approximately 3.97 to 4.03 percent of the 5th field scale (see Table 4.5.7-2). A majority of these effects occur outside of Riparian Reserves, and would therefore have no effect on riparian plant communities. Cumulative actions occurring within Riparian Reserves are localized to small areas that are scattered throughout the 5th field. Therefore, impacts to vegetation would result in no	• Impacts to connective riparian habitat are not expected to be measurable at the 5th field scale (see Vegetation). Therefore, wildlife impacts would not result in any measurable impacts to riparian-dependent species at the 5th field scale.	• Impacts to fisheries would be as described under Watershed and Vegetation. Cumulative actions would result in isolated tree removal within the 5th field Riparian Reserves. Therefore, fisheries impacts would not result in any measurable effects to connective aquatic habitat at the 5th field scale (see Section 3.4 – Fisheries).

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas b) critical for fulfilling life history requirements of aquatic and riparian-dependent species.***
Geology and Soils	**Watershed Resources**
Finding: Meets ACSO 2	**Finding: Meets ACSO 2**
Degree of impacts by alternative: **Alternative 2>5>3>4>1**	**Degree of impacts by alternative:** **Alternative 2>5>3>4>1**
ACSO 3	***Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Bed and bank erosion along stream channels is probably the largest erosion source related to the developed ski area (see Section 3.2.1.3 – Soils). • Traction sand is a source of road-related sediment that may be discharged to adjacent streams, effecting channel conditions and fish habitat (see Section 3.2.1.3 – Soils). Road sand is present in streams and on the banks of streams adjacent to I-90, SR 906, and other roads (see Section 3.4.1.3 – Fish Habitat).	• On average, streambank conditions are assumed to be functioning at risk in the Yakima watershed (USFS 1997). • There are 30 culverted stream sections in the Yakima watershed (see Table 3.3.1-2). • Some stream segments located in ski trails have been covered by railroad ties or placed in culverts, preventing these segments from providing functioning aquatic habitat (Jones & Stokes 2001). • Impassable culverts are present in Beaver Lake Creek, Tunnel Creek, and Coal Creek (Jones & Stokes 2001). • Approximately 0.89 miles of stream channels have been directly modified through excavation and re-alignment in the Study Area (see Table 3.3.1-2). • As all modified vegetation areas are either nonforested or a sapling forest, these areas have no near-term LWD recruitment potential. Since these areas are assumed to be capable of supporting mature forest vegetation, this condition represents the absence of LWD recruitment potential relative to natural conditions (see Section 3.3.1.6 – Riparian Resources). • There are 19.21 miles of streams in the Yakima watershed (see Table 3.3.1-2). • Direct channel impacts associated with ski area management are channelization and road and ski trail crossings of streams (see Section 3.3.1.2 – Hydrography).

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 2	***Maintain and restore spatial and temporal connectivity within and between watersheds. These linkages must provide chemically and physically unobstructed routes to areas b) critical for fulfilling life history requirements of aquatic and riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
measurable impacts to connective riparian habitat at the 5th field scale.		
Finding: Meets ACSO 2	**Finding: Meets ACSO 2**	**Finding: Meets ACSO 2**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**	**Degree of impacts by alternative: Alternative 2>5>3>4>1**
ACSO 3	***Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• As all modified vegetation areas are either nonforested or a sapling forest, these areas have no near-term LWD recruitment potential. Since these areas are assumed to be capable of supporting mature forest vegetation, this condition represents the absence of LWD recruitment potential relative to natural conditions (see Section 3.3.1.6 – Riparian Resources). • As immature and sapling forest areas in Riparian Buffers continue to mature, LWD recruitment potential would increase (see Section 4.4.2 – Impacts – Alternative 1 [No Action]).	• While shorelines, banks, and bottom configurations are important components of wildlife habitat, the physical properties on which the effects to wildlife would be measured are primarily detailed under Watershed Resources.	• Traction sand is a source of road-related sediment that may be discharged to adjacent streams, effecting channel conditions and fish habitat see Section 3.4.13 – Fish Habitat). • Prior development, timber harvest, and road construction have reduced the physical integrity of aquatic systems through the placement of streams in culverts (Jones & Stokes 2001). • Construction of the Keechelus Dam in 1913 isolated all Keechelus Lake tributaries, including Coal Creek and Mill Creek, from anadromous and Yakima River adfluvial fish populations (USFS 1997). • While shorelines, banks, and bottom configurations are important components of fish habitat, the physical properties on which the effects to fish would be measured are primarily detailed under Watershed Resources.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 3	***Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.***
Geology and Soils	**Watershed Resources**
	• All culverted streams have been isolated from riparian processes that provide aquatic habitat, downstream channel stability, LWD recruitment, bank cover and stability (see Section 3.3.1.2 – Hydrography).
Site Scale	
Analysis area: 1,885 acres	
• Clearing and grading activities may increase the risk of mass wasting, but these risks would be managed through the use of watershed protection management requirements (see Section 4.2.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, it is anticipated that temporary increases in soil erosion and sediment delivery to streams would probably occur with trail grading and other ground disturbances, although the use of sediment control BMPs would minimize this risk by preventing sediment mobilization and by capturing any mobilized sediment prior to delivery to streams (see Section 4.2.3.1 – Upper Yakima River Watershed and Table 2.4-2). • Slope stabilization, road obliteration, and restoration projects proposed under the Action Alternatives would reduce ongoing and potential erosion sites (see Section 4.2.3.1 – Upper Yakima River Watershed).	• The Action Alternatives would impact the physical integrity of the aquatic system through clearing and grading within Riparian Reserves. These impacts are not expected to be measurable at the site scale. • The Action Alternatives would cause a slight reduction in the amount of LWD within Riparian Reserves due to the removal of trees for ski facility construction (see Section 4.4.3.1 – Upper Yakima River Watershed). • All Action Alternatives minimize clearing and grading in Riparian Reserves by locating the proposed design outside Riparian Reserves to the extent possible. Ski trail design is intended to parallel Riparian Reserves while minimizing disturbance in riparian areas (see Table 2.4-2). • Ground disturbance would be minimized during project construction so that sediment delivery to streams and wetlands would be nominal (see Section 4.3.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, the number of stream crossings (culvert, bridge, or ford) would range from 86 under Alternative 4 to 89 under Alternatives 2, 3, and 5 (see Table 4.3.3-1C). All Action Alternatives would have 1.90 miles of culverted channels over the existing 1.84 miles (see Table 4.3.3-1C).
Finding: **Does Not Prevent Attainment of ACSO 3**	**Finding:** **Does Not Prevent Attainment of ACSO 3**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 3	***Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.***	
Vegetation	**Wildlife**	**Fisheries**
Site Scale		
Analysis area: 1,885 acres		
• In order to maintain bank stability, native shrubs and herbaceous vegetation would be planted to achieve 80% cover in five years in all areas within 10 meters of streams under all Action Alternatives (see Table 2.4-2). • The effects on the physical integrity of the aquatic system for vegetation are as described under Watershed Resources.	• While shorelines, banks, and bottom configurations are important components of wildlife habitat, the physical properties on which the effects to wildlife would be measured are primarily described under Watershed Resources.	• While shorelines, banks, and bottom configurations are important components of fish and aquatic habitat, the physical properties on which the effects to fish would be measured are primarily described under Watershed Resources.
Finding: Does Not Prevent Attainment of ACSO 3	**Finding: Does Not Prevent Attainment of ACSO 3**	**Finding: Does Not Prevent Attainment of ACSO 3**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 3	***Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.***
Geology and Soils	**Watershed Resources**
5th Field Scale	
Analysis area: Upper Yakima River Watershed (74,444 acres)	
• Geology and soils impacts at the 5th field are as described under Vegetation.	• The Action Alternatives, coupled with the cumulative actions, would affect approximately 2354.35 acres (under Alternative 4) to 2369.49 acres (under Alternative 2) of Riparian Buffers, which equates to approximately 5.06 percent to 5.09 percent of the 5th field scale Riparian Buffers, respectively (see Table 4.3.8-2). Cumulative effects to watershed resources would not result in any measurable changes to the physical integrity of aquatic systems at the 5th field scale. As described in Section 3.3 – Watershed Resources, these actions are localized to small areas scattered throughout the entire 5th field.
Finding: Meets ACSO 3	**Finding: Meets ACSO 3**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 3	***Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.***	
Vegetation	**Wildlife**	**Fisheries**
5th Field Scale		
Analysis area: Upper Yakima River Watershed (74,444 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from2954.63 acres (under Alternative 4) to 3002.25 acres (under Alternative 2), which equates to approximately 3.97 to 4.03 percent of the 5th field scale (see Table 4.5.7-2). A majority of these effects occur outside of Riparian Reserves, and would therefore have no effect on riparian plant communities. Cumulative actions occurring within Riparian Reserves are localized to small areas that are scattered throughout the 5th field. Therefore, impacts to vegetation are not expected to result in any measurable impacts to the physical integrity of aquatic systems at the 5th field scale.	• The effects to the physical integrity of aquatic systems utilized by riparian-dependent species are described in Vegetation.	• As described in Watershed Resources, no measurable impacts to the physical integrity of aquatic systems at the 5th field scale are expected.
Finding: Meets ACSO 3	**Finding: Meets ACSO 3**	**Finding: Meets ACSO 3**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**	**Degree of impacts by alternative: Alternative 2>5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Excessive soil erosion is the most common cause of water quality degradation in the Yakima watershed (USFS 1997). • 85% of the sediment in the Upper Yakima watershed is from non-forested and other developed areas (see Table 3.2.1-5).	• Water quality in the Yakima watershed is classified by the State of Washington as "extraordinary" (Class AA) (USFS 1997). • Water quality in the Yakima watershed is functioning at unacceptable risk (USFS 1997). • The Yakima watershed is generally assumed to be functioning appropriately relative to chemical contaminants and nutrients and no streams are on the 303(d) list for chemical contamination (see Section 3.3.1.4 – Surface Water Quality). • The Yakima River is impaired by temperature and dissolved oxygen exceedance and the presence of pesticides and other toxic substances (Jones & Stokes 2001). • The Yakima River is listed as impaired for temperature in two separate segments located approximately 10 and 20 miles downstream of the Keechelus Lake dam (see Section 3.3.1.4 – Surface Water Quality). • As described in Geology and Soils, excessive soil erosion is the most common cause of water quality degradation in the Yakima watershed (USFS 1997). • The turbidity standard is commonly exceeded during rain events on all of the streams monitored in the Coal Creek watershed, except Hyak Creek (Jones & Stokes 2001). • The Upper Yakima watershed within the Study Area is also impaired for temperature and dissolved oxygen (see Section 3.3.1.4 – Surface Water Quality).
Site Scale	
Analysis area: 1,885 acres	
• The Action Alternatives would result in increased sediment detachment at the site scale. Increased sediment detachment has the potential to impact water quality within streams at the site scale (see Section 4.3.3.1 – Upper Yakima River	• The Action Alternatives would result in potential impacts to water quality from increased sediment yield and increased water temperatures (see Section 4.3.3.1 – Upper Yakima River Watershed). Impacts resulting from increased sediment would

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Condition		
• As immature and sapling forest areas in Riparian Buffers continue to mature, stream channels within the subwatershed are expected to become more stable (Jones & Stokes 2001). • Herbaceous vegetation can provide sediment filtering functions and bank stability that reduce sediment yield to streams, and provide riparian shading that decreases stream temperatures (see Section 4.3.3.1 – Upper Yakima River Watershed) • Lack of shading to tributaries of Coal Creek is a primary reason for the temperature problems identified in those streams (Jones & Stokes 2001). • Non-forested and other developed areas contribute 85% of the sediment in the Upper Yakima watershed (see Table 3.2.1-5). • There are 211.29 acres of mature forested Riparian Buffers within the Upper Yakima watershed portion of the Study Area (see Table 3.4.1-4).	• While water quality is an important component of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Geology and Soils, Watershed Resources and Vegetation.	• The temperature maxima of Coal Creek is well above the appropriate range for bull trout and above the optimal range for cutthroat and rainbow trout (Jones & Stokes 2001). • While water quality is an important component of fish habitat, the physical properties on which effects to fish would be measured are primarily described under Geology and Soils, Watershed Resources and Vegetation.
Site Scale		
Analysis area: 1,885 acres		
• The removal of forested riparian areas could result in an increase in indirect thermal impacts to streams (see Section 4.3.3.1 – Upper Yakima River	• While water quality is an important component of wildlife habitat, the physical properties on which effects to wildlife would be measured are	• While water quality is an important component of fish habitat, the physical properties on which effects to fish would be measured are primarily

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***
Geology and Soils	**Watershed Resources**
Watershed). The use of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions described in Tables 2.4-2, would reduce the potential sediment yield to streams at the site scale. • Using the Water Erosion Prediction Project (WEPP) model, sediment yields for the Coal Creek and Mill Creek drainages were calculated (to represent the Upper Yakima watershed). Under the Action Alternatives, the change in sediment yields to the main stems of Coal and Mill Creek would range from -2.67 tons/year under Alternative 4 to +8.87 tons/year under Alternative 2 (see Table 4.2.3-2). • Ground disturbance would be minimized during project construction so that sediment delivery to streams and wetlands would be nominal (see Section 4.2.3 – Impacts – Alternative 2). • No access corridors, staging areas, spoils piles, or other construction related materials would be placed in Riparian Reserves. The number of vehicle trips across project sites would be limited to the minimum necessary (see Table 2.4-2). • An Erosion Control Plan would be included in the SWPPP for construction documents for proposed projects (see Table 2.4-2).	be as described in Geology and Soils. The use of BMPs and Mitigation Measures described in Tables 2.4-2 would reduce the likelihood of pollutant runoff from construction equipment to streams at the site scale. Impacts to stream temperature would occur from the removal of riparian canopy as described in Vegetation. Overall, impacts to water quality are not expected to be measurable at the site scale. • Implementation of the Action Alternatives is not expected to contribute to the listing of any stream on the Department of Ecology's 303(d) list since there would be no new point sources of pollution and water quality impacts are projected to be nominal (see Section 4.3.3.1 – Upper Yakima River Watershed) • Ground disturbance would be minimized during project construction so that sediment delivery to streams and wetlands would be nominal (see Section 4.2.3 – Impacts –Alternative 2). • All Action Alternatives would minimize clearing and grading in Riparian Reserves by locating the proposed design outside Riparian Reserves to the extent possible. Ski trail design is intended to parallel Riparian Reserves while minimizing disturbance in riparian areas (see Table 2.4-2). • Under the Action Alternatives, turbidity could increase due to sediment delivery to streams, temperature and dissolved oxygen could increase due to the removal of forest along streambanks, and pH could increase due to construction of impervious surfaces within Riparian Buffers (see Section 4.3.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, improvements to the maintenance shop at Summit East would reduce stormwater contamination (see Section 4.4.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, other water pollution, such as oil and grease, is expected to decrease due to the implementation of the Stormwater Management Plan (see Section 4.3.3.1 – Upper Yakima River Watershed).

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***	
Vegetation	**Wildlife**	**Fisheries**
Watershed). • Under the Action Alternatives, the total area of Riparian Buffers within the Upper Yakima watershed portion of the Study Area would be 524.66 acres under Alternatives 2 and 4, and 606.14 acres under Alternatives 3 and 5, which is greater than the existing condition of 523.49 acres (see Table 4.3.3-6C). • Under the Action Alternatives, temperature and dissolved oxygen could increase due to the removal of forest along streambanks (see Section 4.3.3.1 – Upper Yakima River Watershed). • In order to maintain bank stability and prevent erosion, native shrubs and herbaceous vegetation would be planted to achieve 80% cover over five years in all areas within 10 meters of a stream (see Table 2.4-2). • The Erosion Control Plan would include revegetation techniques and would be approved by the USFS prior to ground disturbance (see Table 2.4-2).	Geology and Soils, Watershed Resources, and Vegetation.	Soils, Watershed Resources, and Vegetation.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***
Geology and Soils	**Watershed Resources**
	• Under all Action Alternatives, if flooding or weather results in water quality not meeting current State standards for surface water quality, operations would stop until the conditions improve and the site stabilization has been approved by USFS personnel (see Table 2.4-2).
Finding: **Does Not Prevent Attainment of ACSO 4**	**Finding:** **Does Not Prevent Attainment of ACSO 4**
5th Field Scale	
Analysis area: Upper Yakima River Watershed (74,444 acres)	
• The Action Alternatives would result in a change in average annual sediment loading to the U. Yakima River from 1035.76 tons/year under Alternative 1 to 1033.09 tons/year (Alternative 4) to 1044.63 tons/year (Alternative 2), ranging from 1.86 to 1.88 percent of the total sediment loading of the U. Yakima River, respectively (see Section 4.3.8 – Cumulative Effects). The effects of the Action Alternatives, coupled with the cumulative actions would not result in a great variation from typical sediment loading to the U. Yakima Watershed. Therefore, no effects to geology and soils at the 5th field are expected to measurably impact water quality.	• The Action Alternatives, coupled with the cumulative actions, would affect approximately 2354.35 acres (under Alternative 4) to 2369.49 acres (under Alternative 2) of Riparian Buffers, which equates to approximately 5.06 percent to 5.09 percent of the 5th field scale Riparian Buffers, respectively (see Table 4.3.8-2). Cumulative effects to watershed resources would not result in any measurable changes to water quality at the 5th field scale. These actions are localized to small areas scattered throughout the entire 5th field. Sediment impacts to water quality would be as described under Geology and Soils.
Finding: Meets ACSO 4	**Finding: Meets ACSO 4**
Degree of impacts by alternative: **Alternative 2>5>3>4>1**	**Degree of impacts by alternative:** **Alternative 2>5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 4	***Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains the biological, physical, and chemical integrity of the ecosystem, benefiting survival, growth, reproduction, and migration of individuals composing its aquatic and riparian communities.***	
Vegetation	**Wildlife**	**Fisheries**
Finding: Does Not Prevent Attainment of ACSO 4	**Finding: Does Not Prevent Attainment of ACSO 4**	**Finding: Does Not Prevent Attainment of ACSO 4**
5th Field Scale		
Analysis area: Upper Yakima River Watershed (74,444 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from2954.63 acres (under Alternative 4) to 3002.25 acres (under Alternative 2), which equates to approximately 3.97 to 4.03 percent of the 5th field scale (see Table 4.5.7-2). A majority of these effects occur outside of Riparian Reserves, and would therefore have less of an effect on water quality as they do not occur within close proximity to waterbodies. Cumulative actions occurring within Riparian Reserves are localized to small areas that are scattered throughout the 5th field. Therefore, impacts to vegetation would result in no expected measurable impacts to water quality at the 5th field scale.	• While water quality is an important component of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Geology and Soils, Watershed Resources, and Vegetation.	• While water quality is an important component of fish habitat, the physical properties on which effects to fish would be measured are primarily described under Geology and Soils, Watershed Resources, and Vegetation.
Finding: Meets ACSO 4	**Finding: Meets ACSO 4**	**Finding: Meets ACSO 4**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**	**Degree of impacts by alternative: Alternative 2>5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Road-related erosion, in-channel erosion during high flows, mass wasting and inner gorge failures have all been identified as contributing excess sediment load to streams in the Yakima watershed with road-related erosion being the greatest out of stream source. • Non-forested and other developed areas contribute 85% of the sediment in the Upper Yakima watershed (see Table 3.2.1-5). • The Yakima River Watershed Analysis reported a high erosion potential of surface soils in the Upper Yakima watershed in the vicinity of The Summit-at-Snoqualmie (USFS 1997). • Actual surface erosion under natural conditions is common, but not extensive. Erosion from natural sources, though common, is not considered significant and is probably indistinguishable from background sediment yields (USFS 1997). • Forest-wide detrimental soil disturbance has averaged >40%, with soil compaction typically making up over 90% of the disturbance observed (USFS 1997). • Excessive soil erosion is the most common cause of water quality degradation in the Yakima watershed (USFS 1997).	• Fine sediment levels in the Yakima watershed are typically functioning appropriately (USFS 1997). • Excessive soil erosion is the most common cause of water quality degradation in the Yakima watershed (USFS 1997). • Road-related erosion, in-channel erosion during high flows, mass wasting and inner gorge failures have all been identified as contributing excess sediment load to streams in the Yakima watershed (USFS 1997). • Road-related erosion has been the greatest out of stream sediment source in the Yakima watershed (USFS 1997). • Geology and Soils describes the range of contributing factors to the sediment regime which affect Watershed Resources.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Condition		
• Herbaceous vegetation can provide sediment filtering functions and bank stability that reduce sediment yield to streams (see Section 4.3.3.1 – Upper Yakima River Watershed). • Non-forested and other developed areas contribute 85% of the sediment in the Upper Yakima watershed (see Table 3.2.1-5). • There are 211.29 acres of mature forested Riparian Buffers within the Upper Yakima watershed portion of the Study Area (see Table 3.4.1-4). • The function of modified wetlands within the Upper Yakima watershed portion of the Study Area have been reduced and in some cases eliminated because of the clearing and mowing necessary to maintain the ski trails. These activities can result in lower plant species diversity; however, most of the wetland vegetation includes native plant species that are considered dominant species (see Section 3.3.1.2 – Hydrography).	• While changes in sediment regimes can influence the quality of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Geology and Soils, Watershed Resources and Vegetation.	• Changes in the sediment regime can influence the quality of fish habitat through covering suitable spawning gravel and increasing turbidity.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***
Geology and Soils	**Watershed Resources**
Site Scale	
Analysis area: 1,885 acres	
• The Action Alternatives would result in increased sediment detachment at the site scale. Increased sediment detachment would have the potential to impact the sediment regime within streams at the site scale (see Section 4.3.3.1 – Upper Yakima River Watershed). The use of BMPs and Mitigation Measures, Management Requirements, and Other Management Provisions described in Table 2.4-2 would reduce the likely sediment yield to streams. Therefore, impacts to sediment regime and are not expected to be measurable at the site scale. • Using the Water Erosion Prediction Project (WEPP) model, sediment yields for the Coal Creek and Mill Creek drainages were calculated (to represent the Upper Yakima watershed). Under the Action Alternatives, the change in sediment yields to the main stems of Coal and Mill Creek would range from -2.67 tons/year under Alternative 4 to +8.87 tons/year under Alternative 2 (see Table 4.2.3-2). • Ground disturbance would be minimized during project construction so that sediment delivery to streams and wetlands would be nominal (see Section 4.2.3 – Impacts – Alternative 2). • No access corridors, staging areas, spoils piles, or other construction related materials would be placed in Riparian Reserves. The number of vehicle trips across project sites would be limited to the minimum necessary (see Table 2.4-2). • An Erosion Control Plan would be included in the SWPPP for construction documents for proposed projects (see Table 2.4-2).	• As described in Geology and Soils, the WEPP model indicates that long-term sediment detachment would decrease under Alternative 4, and increase under Alternatives 2, 3, and Modified Alternative 5 (see Table 4.2.3-2). Increased sediment detachment has the potential to impact the sediment regime through increased yield to streams. However, the use of BMPs and Mitigation Measures, Management Requirements and Other Management Provisions would reduce actual sediment yield. Therefore, impacts to sediment regime are not expected to be measurable at the site scale. • Ground disturbance would be minimized during project construction so that sediment delivery to streams and wetlands would be nominal (see Section 4.2.3.1 – Upper Yakima River Watershed). • All Action Alternatives would minimize clearing and grading in Riparian Reserves by locating the proposed design outside Riparian Reserves to the extent possible. Ski trail design is intended to parallel Riparian Reserves while minimizing disturbance in riparian areas (see Table 2.4-2). • Under the Action Alternatives, turbidity could increase due to sediment delivery to streams, temperature and dissolved oxygen could increase due to the removal of forest along streambanks, and pH could increase due to construction of impervious surfaces within Riparian Buffers (see Section 4.3.3.1 – Upper Yakima River Watershed).
Finding: **Does Not Prevent Attainment of ACSO 5**	**Finding:** **Does Not Prevent Attainment of ACSO 5**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***	
Vegetation	**Wildlife**	**Fisheries**
Site Scale		
Analysis area: 1,885 acres		
• The Action Alternatives would reduce the sediment filtering function of vegetation through clearing and grading in Riparian Reserves. • Under the Action Alternatives, the total area of Riparian Buffers within the Upper Yakima watershed portion of the Study Area would be 524.66 acres under Alternatives 2 and 4, and 606.14 acres under Alternative 3 and Modified Alternative 5, which is greater than the existing condition of 523.49 acres (see Table 4.3.3-6C). • In order to maintain bank stability and prevent erosion, native shrubs and herbaceous vegetation would be planted to achieve 80% cover over five years in all areas within 10 meters of a stream (see Table 2.4-2). • The Erosion Control Plan would include revegetation techniques and would be approved by the USFS prior to ground disturbance (see Table 2.4-2).	• While changes in sediment regimes can influence the quality of wildlife habitat at the site scale, the physical properties on which effects to wildlife would be measured are primarily described under Geology and Soils, Watershed Resources, and Vegetation.	• As described in Geology and Soils and Watershed Resources, changes to the sediment regime are not expected to be measurable at the site scale. Therefore, no measurable effects to the quality of fish habitat are expected at the site scale.
Finding: Does Not Prevent Attainment of ACSO 5	**Finding: Does Not Prevent Attainment of ACSO 5**	**Finding: Does Not Prevent Attainment of ACSO 5**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***
Geology and Soils	**Watershed Resources**
5th Field Scale	
Analysis area: Upper Yakima River Watershed (74,444 acres)	
• The Action Alternatives would result in a change in average annual sediment loading to the U. Yakima River from 1035.76 tons/year under Alternative 1 to 1033.09 tons/year (Alternative 4) to 1044.63 tons/year (Alternative 2), ranging from 1.86 to 1.88 percent of the total sediment loading of the U. Yakima River, respectively (see Section 4.3.8 – Cumulative Effects). The effects of the Action Alternatives, coupled with the cumulative actions would not result in a great variation from typical sediment loading to the U. Yakima Watershed. Therefore no effects to geology and soils at the 5th field are expected to measurably impact sediment regime.	• The Action Alternatives, coupled with the cumulative actions, would affect approximately 2354.35 acres (under Alternative 4) to 2369.49 acres (under Alternative 2) of Riparian Buffers, which equates to approximately 5.06 percent to 5.09 percent of the 5th field scale Riparian Buffers, respectively (see Table 4.3.8-2). Projects occurring within Riparian Buffers would not result in any measurable changes to sediment regime at the 5th field scale. As described in Section 4.3 – Water and Watershed Resources, these actions are localized to small areas scattered throughout the entire 5th field. Sediment detachment impacts would be as described under Geology and Soils. Therefore, no effects to watershed resources are expected to measurably impact sediment regime at the 5th field scale.
Finding: Meets ACSO 5	**Finding: Meets ACSO 5**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 5	***Maintain and restore the sediment regime in which the aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.***	
Vegetation	**Wildlife**	**Fisheries**
5th Field Scale		
Analysis area: Upper Yakima River Watershed (74,444 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from2954.63 acres (under Alternative 4) to 3002.25 acres (under Alternative 2), which equates to approximately 3.97 to 4.03 percent of the 5th field scale (see Table 4.5.7-2). A majority of these effects occur outside of Riparian Reserves, and would therefore have less of an effect on the sediment regime as they do not occur within a close proximity to waterbodies. Cumulative actions occurring within Riparian Reserves are localized to small areas that are scattered throughout the 5th field. Therefore, no impacts to vegetation are expected to measurably affect sediment regime at the 5th field scale.	• While changes in sediment regimes can influence the quality of wildlife habitat at the 5th field scale, the physical properties on which effects to wildlife would be measured are primarily Geology and Soils, Watershed Resources, and Vegetation.	• As described in Geology and Soils and Watershed Resources, changes to the sediment regime are not expected to be measurable at the 5th field scale. Therefore, no measurable effects to the quality of fish habitat are expected at the 5th field scale.
Finding: Meets ACSO 5	**Finding: Meets ACSO 5**	**Finding: Meets ACSO 5**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**	**Degree of impacts by alternative: Alternative 2>5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Decreased soil permeability and increases in impervious areas (e.g., facilities, parking lots, road network, timber harvest) have contributed to increased runoff within the watershed (see Section 3.3.1.3 – Surface Water Quality).	• Increased runoff has the potential to change the timing, magnitude and duration of peak, high and low flows. • The Yakima watershed is determined to be functioning at an unacceptable risk for pool frequency and quality (USFS 1997). • There are 23 culverted stream segments in the Coal Creek watershed (Jones & Stokes 2001). • All culverts within the SUP within the Coal Creek watershed appear adequately sized to handle 100-year storm events, however, several culverts are in need of repair, as damaged culverts cause isolated flow constrictions (Jones & Stokes 2001). • Pavement and developed facilities result in increased surface flow (Wright et al. 1990). • Based on the amount of development and timber harvest (see Table 3.3.1-7) that has occurred within the Study Area, the Summit North, Ski Acres, Beaver, Summit South and Lower Mill Creek drainages have experienced the greatest relative increase in low flow, mean annual flow and two-year peak flow (see Section 4.3.3.1 – Upper Yakima River Watershed).
Site Scale	
Analysis area: 1,885 acres	
• Under the Action Alternatives, additional impervious surfaces and developed areas would increase runoff within the site scale. The effects would be as described for Watershed Resources.	• Under the Action Alternatives, in-stream flows would be affected at the site scale through the removal of vegetation (which may further reduce hydrologic maturity) and increases in impervious surfaces. • Under the Action Alternatives, total clearing and grading in wetlands would range from 2.87 acres under Alternative 4 to 4.14 acres under Alternative 5 (see Table 4.3.3-3C). • Under the Action Alternatives, slight increases in streamflow are expected due to tree removal and construction of impervious surfaces. Table 4.3.3-5 summarizes the changes in flow of the 7th field

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• Modified vegetation associated with historic timber harvest in the Study Area and ski area management has increased hydrologically immature land cover by 161 percent (USFS 1997). • Reduced forest cover results in elevated discharge during spring runoff compared to a naturally occurring condition (USFS 1997). • Based on the amount of development and timber harvest (see Table 3.3.1-7) that has occurred within the Study Area, the Summit North, Ski Acres, Beaver, Summit South and Lower Mill Creek drainages have experienced the greatest relative increase in low flow, mean annual flow and two-year peak flow (see Section 4.3.3.1 – Upper Yakima River Watershed).	• While changes in instream flows can influence the quality of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Watershed Resources.	• While changes in instream flows can influence the quality of fish habitat, the physical properties on which effects to fish would be measured are primarily described under Watershed Resources.
Site Scale		
Analysis area: 1,885 acres		
• Effects of the Action Alternatives on vegetation at the site scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on wildlife at the site scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on fish at the site scale would be as described for Watershed Resources.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***
Geology and Soils	**Watershed Resources**
	drainages within the Upper Yakima watershed. It is anticipated that measurable changes to bank full discharge would not occur under the Action Alternatives. • Land conversions (ski trails and impervious surfaces) would likely generate a slight new export of water, and may indirectly affect snow accumulation and snowmelt locally (see Section 4.3.3.1 – Upper Yakima River Watershed). • Construction techniques, including the embedding of coarse woody debris within the ground surface, along with Other Management Provisions OMP25, OMP26, and OMP27 (see Table 2.4-2) would minimize localized increases in sheet flow on construction sites during and after construction (see Section 4.3.3.1 – Upper Yakima River Watershed). • Due to the implementation of source protection measures, as outlined in the MDP Implementation Plan (Appendix F), the effects of lift and trail construction would be unlikely to cause any measurable increase in flow in either Coal Creek or Mill Creek at the site scale (see Section 4.3.3.1 – Upper Yakima River Watershed). • The restoration projects listed and described in the MDP Implementation Plan (Appendix F) would benefit Riparian Buffers and indirectly beneficially impact streams and wetlands. Implementation of Management Requirements and Other Management Provisions (see Table 2.4-2) would improve riparian buffer function such as stream shading, nutrient and litter input, streambank stabilization and LWD recruitment (see Section 4.3.3.1 – Upper Yakima River Watershed).
Finding: **Does Not Prevent Attainment of ACSO 6**	**Finding:** **Does Not Prevent Attainment of ACSO 6**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***	
Vegetation	**Wildlife**	**Fisheries**
Finding: Does Not Prevent Attainment of ACSO 6	**Finding: Does Not Prevent Attainment of ACSO 6**	**Finding: Does Not Prevent Attainment of ACSO 6**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***
Geology and Soils	**Watershed Resources**
5th Field Scale	
Analysis area: Upper Yakima River Watershed (74,444 acres)	
• The geology and soils effects of the Action Alternatives, coupled with the cumulative actions would not result in a measurable increase in runoff at the 5th field scale. The geology and soils effects of the Action Alternatives, coupled with the cumulative actions, ranges from approximately 2263.88 acres (under Alternative 4) to 2265.36 acres (under Alternative 2), which equates to approximately 3.04 percent of the 5th field scale (see Table 4.2.7-2). These actions occur within small, localized areas that are scattered throughout the entire watershed. Therefore no impacts to geology and soils would result in measurable effects to in-stream flows at the 5th field scale.	• The Action Alternatives, coupled with the cumulative actions, would affect approximately 2354.35 acres (under Alternative 4) to 2369.49 acres (under Alternative 2) of Riparian Buffers, which equates to approximately 5.06 percent to 5.09 percent of the 5th field scale Riparian Buffers, respectively (see Table 4.3.8-2). The removal of vegetation and increased impervious surfaces associated with these actions would not result in any measurable changes to runoff at the 5th field scale. As described in Section 4.2 – Geology and Soils and 4.3 – Water and Watershed Resources, these actions are localized to small areas scattered throughout the entire 5th field. • Under the Action Alternatives, average annual discharge of the U. Yakima River would increase from 62.8 cfs under Alternative 1 to 63.0 cfs (Alternative 4) and 63.2 (Alternative 2 and Modified Alternative 5). The average annual discharge would increase by approximately 0.01-0.02 percent under the Action Alternatives, resulting in no noticeable changes in flow at the 5th field watershed scale (see Section 4.3.8 – Cumulative Effects). • Impacts to watershed resources would not result in measurable affects to in-stream flows at the 5th field scale.
Finding: Meets ACSO 6	**Finding: Meets ACSO 6**
Degree of impacts by alternative: **Alternative 2>5>3>4>1**	**Degree of impacts by alternative:** **Alternative 2=5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 6	***Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected***	
Vegetation	**Wildlife**	**Fisheries**
5th Field Scale		
Analysis area: Upper Yakima River Watershed (74,444 acres)		
• Effects of the Action Alternatives on vegetation at the 5th field scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on wildlife at the 5th field scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on fish at the 5th field scale would be as described for Geology and Soils and Watershed Resources.
Finding: Meets ACSO 6	**Finding: Meets ACSO 6**	**Finding: Meets ACSO 6**
Degree of impacts by alternative: Alternative 2=5>3>4>1	**Degree of impacts by alternative: Alternative 2=5>3>4>1**	**Degree of impacts by alternative: Alternative 2=5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 7	***Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Decreased soil permeability and increases in impervious areas (e.g., facilities, parking lots, road network, timber harvest) have contributed to increased runoff, potentially resulting in changes to water levels and floodplain inundation within the watershed (Jones & Stokes 2001).	• Many wetlands are seeps controlled by seasonally high groundwater, and they are generally not important in storing stormflow (Jones & Stokes 2001). • Habitat functions of mountain-slope wetlands depend on maintenance of the current groundwater conditions (Jones & Stokes 2001). • The Watershed Condition Assessment concluded that the water tables are being maintained throughout the Study Area (Jones & Stokes 2001). • Some wetlands may have been affected in terrain previously modified for ski trails; however, surface and subsurface flows meet the wetland criteria (see Section 3.3.1.2 – Hydrography). • The hydrologic conditions in the portions of wetlands that occur on both maintained ski trails and in adjacent unmodified areas indicate that clearing for ski trails has not significantly changed the timing and duration of wetland hydrology (see Section 4.3.3.1 – Upper Yakima River Watershed). • Land conversions (ski trails and impervious surfaces) would likely generate a slight new export of water, and may indirectly affect snow accumulation and snowmelt locally (see Section 4.3.3.1 – Upper Yakima River Watershed). • The restoration projects listed and described in the MDP Implementation Plan (Appendix F) would benefit Riparian Buffers and indirectly beneficially impact streams and wetlands (see Section 4.3.3.1 – Upper Yakima River Watershed). • Several seventh field drainages in the U. Yakima Watershed indicate that a high proportion of the stream segments in these drainages have been modified and disconnected from the adjacent floodplains and riparian zones (see Section 4.3.3.1 – Upper Yakima River Watershed).

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 7	***Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• Habitat functions of mountain-slope wetlands depend on maintenance of the current groundwater conditions. • Modified vegetation associated with historic timber harvest in the Study Area and ski area management has increased hydrologically immature land cover by 161 percent (USFS 1996). • There are 574.25 acres of forested hydrologically mature land cover within the Study Area (see Table 4.3.3-4).	• While changes in water levels and floodplain inundation can influence the quality of wildlife habitat, the physical properties on which effects to wildlife would be measured are primarily described under Vegetation and Watershed Resources.	• While changes in water levels and floodplain inundation can influence the quality of fish habitat, the physical properties on which effects to fish would be measured are primarily described under Vegetation and Watershed Resources.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 7	***Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands***
Geology and Soils	**Watershed Resources**
Site Scale	
Analysis area: 1,885 acres	
• Under the Action Alternatives, additional impervious surfaces and developed areas would increase runoff, but are not expected to result in measurable changes to water levels or floodplain inundation within the site scale (see Section 4.3.3.1 – Upper Yakima River Watershed). The effects would be as described for Watershed Resources.	• Under the Action Alternatives, water levels in streams, wetlands, and floodplains would be affected at the site scale through the removal of vegetation (which may further reduce hydrologic maturity) and increases in impervious surfaces (see Section 4.3.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, total clearing and grading in wetlands would range from 2.87 acres under Alternative 4 to 4.14 acres under Alternative 5 (see Table 4.3.3-3C). Grading displaces wetland area and removes all functionality of the wetland through the placement of fill material and/or soil excavation in wetlands. Grading activities can modify the hydrology of wetlands via the creation of impervious surfaces, or by changing existing drainage patterns (see Section 4.3.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, slight increases in streamflow are expected due to tree removal and construction of impervious surfaces. Table 4.3.3-5 summarizes the changes in flow of the 7th field drainages within the Upper Yakima watershed. The Action Alternatives are not expected to result in measurable changes to water levels or floodplain inundation at the site scale. • The restoration projects listed and described in the MDP Implementation Plan (Appendix F) would benefit Riparian Buffers and indirectly beneficially impact streams and wetlands (see Section 4.3.3.1 – Upper Yakima River Watershed). • The Stormwater Management Plan would reduce the transportation of stormwater and sediments to Riparian Buffers, streams and wetlands, and riparian functions would eventually return to a more natural condition (see Section 4.3.3.1 – Upper Yakima River Watershed).
Finding: Meets ACSO 7	**Finding: Meets ACSO 7**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 7	***Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands***	
Vegetation	**Wildlife**	**Fisheries**
Site Scale		
Analysis area: 1,885 acres		
• Under the Action Alternatives, the hydrologically mature forest cover type would range from 534.55 acres under Alternative 2 to 562.20 acres under Alternative 4 (see Table 4.3.3-4). Cover types such as mature forest generally retain more of the precipitation input and release the retained water slowly over time. • Other effects of the Action Alternatives on vegetation at the site scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on wildlife at the site scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on fish at the site scale would be as described for Watershed Resources.
Finding: Meets ACSO 7	**Finding: Meets ACSO 7**	**Finding: Meets ACSO 7**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 7	***Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands***
Geology and Soils	**Watershed Resources**
5th Field Scale	
Analysis area: Upper Yakima River Watershed (74,444 acres)	
• The geology and soils effects of the Action Alternatives, coupled with the cumulative actions, would not result in measurable changes to water levels or floodplain inundation at the 5th field scale. The geology and soils effects of the Action Alternatives, coupled with the cumulative actions, ranges from approximately 2263.88 acres (under Alternative 4) to 2265.36 acres (under Alternative 2), which equates to approximately 3.04 percent of the 5th field scale (see Table 4.2.7-2). These actions occur within small, localized areas that are scattered throughout the entire watershed. Therefore no effects to geology and soils are expected to result in measurable effects to water levels or floodplains at the 5th field scale.	• The Action Alternatives, coupled with the cumulative actions, would affect approximately 2354.35 acres (under Alternative 4) to 2369.49 acres (under Alternative 2) of Riparian Buffers, which equates to approximately 5.06 percent to 5.09 percent of the 5th field scale Riparian Buffers, respectively (see Table 4.3.8-2). The removal of vegetation and increased impervious surfaces associated with these actions would not result in any measurable changes to water levels or floodplain inundation at the 5th field scale. As described in Section 4.2 – Geology and Soils and 4.4 – Water and Watershed Resources, these actions are localized to small areas scattered throughout the entire 5th field.
Finding: Meets ACSO 7	**Finding: Meets ACSO 7**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**
ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Existing geology and soils conditions are as described under Vegetation.	• The Yakima watershed is functioning at an unacceptable risk for LWD (Jones & Stokes 2001). • The West Beaver and Ski Acres project-level watersheds are highly modified with little riparian canopy cover. Streamside shrubs and herbs do not provide bank stabilization in most areas, and artificial covering over streams maintains stream temperatures (Jones & Stokes 2001). • Most drainages in the Upper Yakima watershed are over threshold for the non-natural riparian buffer condition. Riparian Buffers around approximately five miles of adjacent streams and

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 7	***Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands***	
Vegetation	**Wildlife**	**Fisheries**
5th Field Scale		
Analysis area: Upper Yakima River Watershed (74,444 acres)		
• Effects of the Action Alternatives on vegetation at the 5th field scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on wildlife at the 5th field scale would be as described for Watershed Resources.	• Effects of the Action Alternatives on fish at the 5th field scale would be as described for Geology and Soils and Watershed Resources.
Finding: Meets ACSO 7	**Finding: Meet s ACSO 7**	**Finding: Meets ACSO 7**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**	**Degree of impacts by alternative: Alternative 2>5>3>4>1**
ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• The vegetation in the Yakima watershed has a long history of disturbance. The primary disturbance processes are: fire, grazing and browsing by ungulates, insect outbreaks and disease epidemics, winthrow, flooding, erosion (mass wasting), etc. (USFS 1997). • The Yakima watershed is functioning at unacceptable risk for disturbance history;	• Riparian and wetland habitat have been altered by past development activities, including vegetation removal, filling and grading activities and through modification of vegetation type (see Section 3.3.1.2 – Hydrography and 3.3.1.6 – Riparian Resources). • Other existing wildlife conditions are as described under Vegetation.	• Coal Creek is poor in the quantity of LWD. Wood makes up a very small percentage of the fish rearing cover available (Jones & Stokes 2001). • Other existing fisheries and aquatic habitat conditions are as described under Watershed Resources.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***

Geology and Soils	Watershed Resources
	riparian habitat exist in a non-natural condition because of historic development at The Summit-at-Snoqualmie. These Riparian Buffers in modified or developed conditions have resulted in degradation of stream channel conditions, temperatures, LWD input, bank cover, and inputs of fine organic matter, nutrients and insects relative to natural conditions (see Section 3.3.2.2 – Upper Yakima River Watershed).

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***		
Vegetation		**Wildlife**	**Fisheries**
44% is mature vegetative condition and 58% is immature vegetative condition (USFS 1997). • The Snoqualmie Pass area has been subjected to the introduction of various nonnative plant species (see Section 3.5.1.5 – Noxious Weeds). • Most drainages in the Upper Yakima watershed are over threshold for the non-natural riparian buffer condition. Riparian Buffers around approximately five miles of adjacent streams and riparian habitat exist in a non-natural condition within the Study Area because of historic development at The Summit-at-Snoqualmie (see Table 3.3.2-1). These Riparian Buffers in modified or developed conditions have resulted in degradation of stream channel conditions, temperatures, LWD input, bank cover, and inputs of fine organic matter, nutrients and insects relative to natural conditions (see Section 3.3.2.2 – Upper Yakima River Watershed).			

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***
Geology and Soils	**Watershed Resources**
Site Scale	
Analysis area: 1,885 acres	
• Effects on geology and soils are as described under Vegetation.	• Clearing in Riparian Reserves associated with the Action Alternatives would affect plant community composition, structure and function. • Under the Action Alternatives, total clearing and grading in wetlands would range from 2.87 acres under Alternative 4 to 4.14 acres under Alternative 5 (see Table 4.3.3-3C). • Under the Action Alternatives, the total area of Riparian Buffers within the Upper Yakima watershed portion of the Study Area would be 524.66 acres under Alternatives 2 and 4, and 606.14 acres under Alternatives 3 and 5, which is greater than the existing condition of 523.49 acres (see Table 4.3.3-6C). • The Action Alternatives would cause a slight reduction in the amount of LWD within Riparian Reserves due to the removal of trees for ski facility construction (see Section 4.3.3.1 – Upper Yakima River Watershed and 4.4.3.1 – Upper Yakima River Watershed). • All Action Alternatives minimize clearing and grading in Riparian Reserves by locating the proposed design outside Riparian Reserves to the extent possible. Ski trail design is intended to parallel Riparian Reserves while minimizing disturbance in riparian areas (see Table 2.4-2). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 534.55 acres under Alternative 2 to 562.20 acres under Alternative 4 (see Table 4.3.3-4).

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***	
Vegetation	**Wildlife**	**Fisheries**
Site Scale		
Analysis area: 1,885 acres		
• Under the Action Alternatives, vegetation removed for the development of additional ski area facilities would affect plant community structure and function in Riparian Reserves at the site scale. • Under the Action Alternatives, the total area of Riparian Buffers within the Upper Yakima watershed portion of the Study Area would be 524.66 acres under Alternatives 2 and 4, and 606.14 acres under Alternatives 3 and 5, which is greater than the existing condition of 523.49 acres (see Table 4.3.3-6C). • The greatest impact to Riparian Buffers would be the completer removal of riparian function through the creation of impervious surfaces (roads, buildings, and parking lots) and the installation of stream culverts (see Section 4.3.3.1 – Upper Yakima River Watershed). • The function of modified wetlands within the Upper Yakima watershed portion of the Study Area have been reduced and in some cases eliminated because of the clearing and mowing necessary to maintain the ski trails. These activities can result in lower plant species diversity; however, most of the wetland	• The effects to the composition, structure and function of plant communities utilized by riparian-dependent species are as described under Vegetation.	• As described in Watershed Resources, riparian community composition, structure and function would be impacted by clearing and grading associated with the Action Alternatives (see Section 4.3.3.1 – Upper Yakima River Watershed). BMPs and Mitigation Measures listed in Table 2.4-2 would minimize the impacts to streambank function and riparian communities as described under Watershed Resources.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***

Geology and Soils	Watershed Resources

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***	
Vegetation	**Wildlife**	**Fisheries**
vegetation includes native plant species that are considered dominant species (see Section 4.3.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 534.55 acres under Alternative 2 to 562.20 acres under Alternative 4 (see Table 4.3.3-4). • The removal of vegetation communities at the site scale would occur predominantly in the mature, forested mixed conifer community dominated by Pacific silver fir and mountain hemlock. Removal of mature, forested land cover would range from 12.64 acres under Alternative 4 to 44.27 acres under Alternative 2 (see Table 4.5.2-1C and Section 4.5.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, total vegetation removal within the Upper Yakima watershed portion of the Study Area would range from 72.83 acres under Alternative 4 to 120.00 acres under Alternative 2 (see Section 4.5.3.1 – Upper Yakima River Watershed). • The construction of ski trails and roads increases the potential for noxious weed transport and establishment into these areas. Under the Action Alternatives, establishment of noxious		

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***
Geology and Soils	**Watershed Resources**
Finding: **Does Not Prevent Attainment of ACSO 8**	**Finding:** **Does Not Prevent Attainment of ACSO 8**
5th Field Scale	
Analysis area: Upper Yakima River Watershed (74,444 acres)	
• Geology and soils impacts at the 5th field are as described under Vegetation.	• The Action Alternatives, coupled with the cumulative actions, would affect approximately 2354.35 acres (under Alternative 4) to 2369.49 acres (under Alternative 2) of Riparian Buffers, which equates to approximately 5.06 percent to 5.09 percent of the 5th field scale Riparian Buffers, respectively (see Table 4.3.8-2). As described in Section 4.3 – Water and Watershed Resources, these actions are localized to small areas scattered throughout the entire 5th field. Effects to watershed resources would not result in any measurable changes to the composition, structure and function of riparian plant communities at the 5th field scale.
Finding: Meets ACSO 8	**Finding: Meets ACSO 8**
Degree of impacts by alternative: **Alternative 2>5>3>4>1**	**Degree of impacts by alternative:** **Alternative 2>5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 8	***Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.***	
Vegetation	**Wildlife**	**Fisheries**
weeds would be reduced by the use of BMPs (see MR28 in Table 2.4-2).		
Finding: Does Not Prevent Attainment of ACSO 8	**Finding: Does Not Prevent Attainment of ACSO 8**	**Finding: Does Not Prevent Attainment of ACSO 8**
5th Field Scale		
Analysis area: Upper Yakima River Watershed (74,444 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from2954.63 acres (under Alternative 4) to 3002.25 acres (under Alternative 2), which equates to approximately 3.97 to 4.03 percent of the 5th field scale (see Table 4.5.7-2). A majority of these effects occur outside of Riparian Reserves, and would therefore have no effect on riparian plant communities. Cumulative actions occurring within Riparian Reserves are localized to small areas that are scattered throughout the 5th field. Therefore, no impacts to vegetation would result in measurable impacts to the composition, structure and function of riparian plant communities at the 5th field scale.	• The wildlife effects to the composition, structure and function of plant communities utilized by riparian-dependent species are as described under Vegetation.	• As described in Watershed Resources, no measurable impacts to the composition, structure and function of riparian plant communities at the 5th field scale are expected.
Finding: Meets ACSO 8	**Finding: Meets ACSO 8**	**Finding: Meets ACSO 8**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**	**Degree of impacts by alternative: Alternative 2>5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***
Geology and Soils	**Watershed Resources**
Existing Conditions	
• Previous developments (timber harvest, ski area) have altered habitat characteristics through road construction and tree removal (USFS 1997). • The vegetation in the Yakima watershed has a long history of disturbance. The primary disturbance processes are: fire, grazing and browsing by ungulates, insect outbreaks and disease epidemics, winthrow, flooding, erosion (mass wasting), etc. (USFS 1997).	• Some stream segments located in ski trails have been covered by railroad ties or placed in culverts, preventing these segments from providing functioning aquatic habitat (USFS 1997). • Impassable culverts are present in Beaver Lake Creek, Tunnel Creek, and Coal Creek (Jones & Stokes 2001). • The number of high quality pools in Coal Creek and the accessible portions of Hyak and Beaver Lake Creeks is low. Gravel quality is also poor in these streams, and LWD is limited (Jones & Stokes 2001). • The Yakima watershed is functioning at an unacceptable risk for LWD (USFS 1997). • The Yakima watershed is determined to be functioning at an unacceptable risk for pool frequency and quality (USFS 1997). • There are 979.7 miles of existing roads and 34 road crossing barriers in the Yakima watershed (Jones & Stokes 2001) • The road density in the Yakima watershed is 3.6 mi/mi^2 and is functioning at unacceptable risk. The road density of the Yakima watershed within the Study Area is 6.43 mi/mi^2 (see Table 3.3.1-4). • Within the Upper Yakima watershed, there are 1,900 stream crossings and 5.2 miles of road (27 percent of the roads in the watershed) lie within Riparian Buffers (USFS 1997). • In the Yakima watershed within the Study Area, there are 88 stream-road crossings (see Table 3.3.1-4) • In the Coal Creek watershed, there are 29 miles of roads, 10.5 miles are paved, and 18.6 miles are unpaved. 0.4 mile of road is mapped as closed (Jones & Stokes 2001).
Site Scale Effects	
Analysis area: 1,885 acres	
• Implementation of the Action Alternatives would increase the loss of soil productivity within the site scale. The geology and soils impacts would not result in measurable changes to riparian habitat at the site scale.	• Clearing and grading in Riparian Reserves, road density and stream crossings associated with the Action Alternatives would affect the site scale. Impacts to watershed resources are not expected to have a measurable impact on riparian habitat at the

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
Existing Conditions		
• The Upper Yakima watershed has been subjected to the introduction of various nonnative plant species (see Section 3.5.1.5 – Noxious Weeds). • The vegetation in the Yakima watershed has a long history of disturbance. The primary disturbance processes are: fire, grazing and browsing by ungulates, insect outbreaks and disease epidemics, winthrow, flooding, erosion (mass wasting), etc. (USFS 1997). • Land use activities (checkerboard land ownership, previous timber harvest, railroad and road construction, and development) within the Upper Yakima watershed have contributed to the existing land cover, as represented by the mosaic of vegetation communities and developed areas that comprise the existing vegetation condition (USFS 1997).	• Riparian and wetland habitat have been altered by past development activities, including vegetation removal, filling and grading activities and through modification of vegetation type (USFS 1997). • The other physical properties on which impacts influencing the distribution of invertebrate and vertebrate riparian dependent species would be measured are primarily described under Watershed Resources and Vegetation.	• Above diversions, the Yakima watershed is functioning at an unacceptable risk for anadromous fish (USFS 1997). • Coal Creek is poor in the quantity of LWD. Wood makes up a very small percentage of the fish rearing cover available (Jones & Stokes 2001). • Fish habitat quality and quantity are both limited in the Coal Creek watershed because of barriers (culverts and natural high gradient segments), sediment and lack of tree cover (Jones & Stokes 2001). • 50% of the potential spawning habitat conditions in the Yakima watershed are poor (USFS 1997). • The existing watershed condition as it relates to fish and aquatic habitat is affected by land use including ski area features, roads, and natural areas (see Section 3.4.1.3 – Fish Habitat). • Other physical properties on which impacts influencing fish habitat would be measured under Watershed Resources.
Site Scale		
Analysis area: 1,885 acres		
• The removal of vegetation communities at the site scale would occur predominantly in the mature, forested mixed conifer community dominated	• Wildlife impacts at the site scale would be related to the effects described in Watershed Resources and Vegetation. Populations of riparian	• Fisheries impacts would be related to the effects described in Geology and Soils, Vegetation and Watershed Resources.

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***
Geology and Soils	**Watershed Resources**
• Under the Action Alternatives, the total acreage of detrimental soil conditions within the site scale would range from 114.28 acres (4% of Study Area) under Alternative 5 to 115.28 acres (4% of Study Area) under Alternative 2 (see Table 4.2.3-3C), which is below the 20 percent threshold for an activity area. Under Alternatives 3 and 4, the total detrimental soil condition would decrease to below existing conditions (see Table 4.2.3-3C).	site scale. • Tthe total area of Riparian Buffers within the Upper Yakima watershed portion of the Study Area would be 524.66 acres under Alternatives 2 and 4, and 606.14 acres under Alternatives 3 and 5, which is greater than the existing condition of 523.49 acres (see Table 4.3.3-6C). • Alternative 2 would result in the greatest effects to the distribution, diversity and function of Riparian Reserves among the Action Alternatives due to the removal of mature forest along streams. Riparian function would be reduced at ski trail and bridge crossings, but would be maintained along these streams at the site scale (see Section 4.3.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, total clearing and grading in wetlands would range from 2.87 acres under Alternative 4 to 4.14 acres under Alternative 5 (see Table 4.3.3-3C). Grading displaces wetland area and removes all functionality of the wetland through the placement of fill material and/or soil excavation in wetlands (see Section 4.3.3.1 – Upper Yakima River Watershed). • The Action Alternatives would cause a slight reduction in the amount of LWD within Riparian Reserves due to the removal of trees for ski facility construction (see Section 4.3.3.1 and 4.4.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, the road density would range from 6.23 mi/mi^2 under Alternative 4 to 6.29 mi/mi^2 under Alternatives 2, 3 and 5. All road densities under the Action Alternatives are less than the existing condition of 6.43 mi/mi^2 (see Table 4.3.3-1C). • Under the Action Alternatives, road length within Riparian Buffers would range from 4.72 miles under Alternative 4 to 5.38 miles under Alternative 3 and Modified Alternative 5. Alternatives 2 and 4 would result in fewer road miles than the existing condition of 5.20 miles (see Table 4.3.3-6C). • Under the Action Alternatives, the number of stream crossings would range from 86 under Alternative 4 to 89 under Alternatives 2, 3, and 5 (see Table 4.3.3-1C). All Action Alternatives would have 1.90 miles of culverted channels over the existing 1.84 miles (see Table 4.3.3-1C).

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
by Pacific silver fir and mountain hemlock. Removal of mature, forested land cover would range from 12.64 acres under Alternative 4 to 44.27 acres under Alternative 2 (see Table 4.5.3-1 and Section 4.5.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, total vegetation removal within the Upper Yakima watershed portion of the Study Area would range from 72.83 acres under Alternative 4 to 120.00 acres under Alternative 2 (see Section 4.5.3.1 – Upper Yakima River Watershed). • Under the Action Alternatives, the hydrologically mature forest cover type would range from 534.55 acres under Alternative 2 to 562.20 acres under Alternative 4 (see Table 4.3.3-4). • The construction of ski trails and roads increases the potential for noxious weed transport and establishment into these areas. Under the Action Alternatives, potential for establishment of noxious weeds would be reduced by the use of BMPs (see MR28 in Table 2.4-2).	dependent wildlife would be temporarily displaced during construction activities (see Section 3.6 – Wildlife).	• Under the Action Alternatives, the number of stream crossings would range from 86 under Alternative 4 to 89 under Alternatives 2, 3, and 5 (see Table 4.3.3-1C). All Action Alternatives would have 1.90 miles of culverted channels over the existing 1.84 miles (see Table 4.3.3-1C). • BMPs and Mitigation Measures listed in Table 2.4-2 would minimize the impacts to riparian habitat. • The Action Alternatives would cause a slight reduction in the amount of LWD within Riparian Reserves due to the removal of trees for ski facility construction (see Section 4.4.3.1 – Upper Yakima River Watershed).

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***
Geology and Soils	**Watershed Resources**
Finding: **Does not prevent attainment of ACSO 9**	**Finding:** **Does not prevent attainment of ACSO 9**
5th Field Scale	
Analysis area: Upper Yakima River Watershed (74,444 acres)	
• The geology and soils effects of the Action Alternatives, coupled with the cumulative actions, ranges from approximately 2263.88 acres (under Alternative 4) to 2265.36 acres (under Alternative 2), which equates to approximately 3.04 percent of the 5th field scale (see Table 4.2.7-2). Section 4.2 – Geology and Soils describes that the effects to Geology and Soils would not measurably affect riparian habitat at the 5th field scale.	• The Action Alternatives, coupled with the cumulative actions, would affect approximately 2354.35 acres (under Alternative 4) to 2369.49 acres (under Alternative 2) of Riparian Buffers, which equates to approximately 5.06 percent to 5.09 percent of the 5th field scale Riparian Buffers, respectively (see Table 4.3.8-2). Cumulative actions would not result in any measurable changes in the timing, duration, or magnitude of low flow and peak flow events at the 5th field scale for the U. Yakima Watershed (see Section 4.3 – Water and Watershed Resources). Therefore, no measurable effects to riparian habitat are expected.
Finding: Meets ACSO 9	**Finding: Meets ACSO 9**
Degree of impacts by alternative: **Alternative 2>5>3>4>1**	**Degree of impacts by alternative:** **Alternative 2>5>3>4>1**

Table 4.7-FEIS-2:
Compatibility Analysis of the Aquatic Conservation Strategy Objectives at Two Scales within the Upper Yakima River Watershed

ACSO 9	***Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.***	
Vegetation	**Wildlife**	**Fisheries**
Finding: Does not prevent attainment of ACSO 9	**Finding: Does not prevent attainment of ACSO 9**	**Finding: Does not prevent attainment of ACSO 9**
5th Field Scale		
Analysis area: Upper Yakima River Watershed (74,444 acres)		
• The effects to vegetation from the Action Alternatives and cumulative actions ranges from 2954.63 acres (under Alternative 4) to 3002.25 acres (under Alternative 2), which equates to approximately 3.97 to 4.03 percent of the 5th field scale (see Table 4.5.7-2). A majority of these effects occur outside of Riparian Reserves, and would therefore have no effect on riparian plant communities. Cumulative actions occurring within Riparian Reserves are localized to small areas that are scattered throughout the 5th field. As discussed in Section 4.3 – Water and Watershed Resources and 4.5 - Vegetation, the vegetation impacts would not measurably affect riparian habitat at the 5th field scale.	• Wildlife impacts at the 5th field scale would be related to the effects described in Vegetation. As described in Section 4.6 - Wildlife, impacts to riparian-dependent species would occur from short-term noise disruptions, increased human activity, and the loss of habitat resulting from the effects of the Action Alternatives and cumulative actions. These effects are localized to small areas scattered throughout the entire 5th field. Therefore, wildlife impacts would not result in any measurable effects to riparian-dependent species at the 5th field.	• Fisheries impacts would be as described under Watershed. Cumulative actions would not result in any measurable changes in the timing, duration, or magnitude of low flow and peak flow events at the 5th field scale for the U. Yakima Watershed (see Section 4.4 – Fisheries and Section 4.3 – Water and Watershed Resources). Therefore, fisheries impacts are not expected to measurably effect riparian habitat at the 5th field scale.
Finding: Meets ACSO 9	**Finding: Meets ACSO 9**	**Finding: Meets ACSO 9**
Degree of impacts by alternative: Alternative 2>5>3>4>1	**Degree of impacts by alternative: Alternative 2>5>3>4>1**	**Degree of impacts by alternative: Alternative 2>5>3>4>1**

4.8 AIR QUALITY

The air quality analysis is presented under each alternative for the following categories: air quality standards, sources of pollution, and visibility.

4.8.1 Impact Mechanisms

For the purposes of this FEIS, the impacts of each alternative on air quality within the Study Area are discussed in terms of direct versus indirect and short versus long-term in Sections 4.8.2 – Impacts - Alternative 1 through 4.8.7 – Impacts – Modified Alternative 5. In addition, cumulative effects incorporate the long-term effects of all direct impacts with both detrimental and beneficial effects, and evaluate them at the 5th field Upper Yakima and S.F. Snoqualmie Watershed scales. They combine impacts within the Study Area with the incremental impacts of other past, present, and reasonably foreseeable projects identified within these watersheds. Cumulative effects for air quality are discussed in Section 4.2.7 – Cumulative Effects.

Impact mechanisms evaluated for the MDP alternatives are identified as construction or operational.

Construction Impacts

Construction impact mechanisms on air quality include activities that emit pollutants. These activities are associated with construction of the individual MDP projects and are typically short-term in nature (i.e., they only occur during project construction). These impact mechanisms include:

- Vehicle exhaust from construction equipment
- Fugitive dust generation
- Burning of excess slash

Operational Impacts

Operational impact mechanisms on air quality generally include any decreases in air quality that may result from normal operations of the ski area. These impact mechanisms include:

- Typical ski area maintenance operations (i.e., grooming, trail maintenance) that result in vehicle exhaust
- Use of access roads during summer months that may generate fugitive dust in dry conditions
- Wood burning fireplace emissions
- Restaurant grill emissions
- Auxiliary power unit (APU) emissions

4.8.2 Impacts - Alternative 1

4.8.2.1 Air Quality Standards and Regulations

Under Alternative 1, no new projects would be implemented. The Summit-at-Snoqualmie would continue to operate under its current SUP with no changes. Air quality standards and regulations at The Summit-at-Snoqualmie would continue to be met as described in Section 3.8 - Air Quality. I-90 and SR 906 would continue to be the main source of vehicle exhaust within the Study Area. Air quality impacts would be associated with maintaining the existing operation, including the lifts and ski trail network and associated infrastructure. Ski area maintenance would likely occur during the summer and would be short-term and temporary in nature. The Summit-at-Snoqualmie would continue to be considered an attainment area for all criteria pollutants.

Roads and Parking Lots

Under Alternative 1, there would be no change to the existing road and parking lot network. Parking capacity would remain at approximately 5,600 vehicles. The Summit-at-Snoqualmie would continue to operate a shuttle system, as described in Section 4.12 - Transportation.

Groomers and Other Maintenance Vehicles

Under Alternative 1, The Summit-at-Snoqualmie would continue to operate a fleet of 17 machine groomers. The operating schedule would continue as described in Section 3.8 - Air Quality.

Auxiliary Power Units

Under Alternative 1, The Summit-at-Snoqualmie would continue to operate APUs for evacuation purposes on all lifts. Additionally, the Central Express and Armstrong Express would continue to utilize a second 100 percent capacity diesel APU.[64]

Fireplaces, Wood Burning Devices and Restaurant Grills

Under Alternative 1, The Summit-at-Snoqualmie would continue to operate two fireplaces, one each at Summit East and Summit West. Fireplaces would be operated on a limited schedule, as described in Section 3.8 - Air Quality. Approximately two to three cords of wood would be burned during the winter ski season. Fireplace operation would continue to be considered a minor source of emissions.

The Summit-at-Snoqualmie would continue to operate existing restaurant grills.

4.8.2.2 Emissions Inventory

Existing sources of emissions and estimates of the emissions at The Summit-at-Snoqualmie are described in Section 3.8 - Air Quality. Under Alternative 1, there would be no change to the emissions inventory (see Table 4.8.4-1).

[64] 100 percent capacity implies that the APU can be used for ski area operational use, not just for evacuation purposes.

4.8.2.3 Visibility

Under Alternative 1, no additional impacts to visibility would occur. Visibility would continue to be better in winter months compared to the summer months (see Section 3.8.1 - Air Quality and Illustration 3.8.1-1 Average Annual Visibility at Snoqualmie Pass). The Forest Service would continue to operate the IMPROVE monitoring station at Snoqualmie Pass to monitor visibility conditions at Snoqualmie Pass.

4.8.3 Direct and Indirect Impacts Common to All Action Alternatives

Construction Impacts

Decreased air quality associated with the construction of trails, chairlifts, and support facilities would be anticipated with implementation of all Action Alternatives. Increased construction vehicle activity would likely result in short-term increases in vehicle exhaust and fugitive dust generation. Other Management Provisions OMP48 – 51 (see Table 2.4-2) would minimize impacts to air quality during construction of MDP projects by limiting dust emissions and minimizing smoke impacts from slash burning.

Operational Impacts

With implementation of any of the Action Alternatives, the sources of air pollution would be similar to those that are currently experienced in and adjacent to the Study Area. These include visitor vehicle exhaust, vehicle exhaust from maintenance equipment, fugitive dust generation during summer maintenance activities, wood burning fireplace and restaurant grill emissions, and APUs.

4.8.4 Impacts – Alternative 2

4.8.4.1 Air Quality Standards and Regulations

Under Alternative 2, short-term impacts to air quality within the Study Area would result from the construction projects. Construction impacts would be localized and limited to daytime hours (7 am to 8 pm) during the summer months. Although implementation of Alternative 2 would likely occur in three phases over the next 10 years, full implementation of Alternative 2 would likely result in similar air quality conditions to those that are currently experienced within the Study Area when compared to National Ambient Air Quality Standards (NAAQS). Increased emissions are described below.

Emissions Inventory

Under Alternative 2, there would be an increase in pollutants listed in Table 4.8.4-1 under the worst-case scenario. The increases in identified pollutants would be due in large part to the increase in the amount of parking available and therefore the amount of vehicle exhaust. The addition of new kitchens would also contribute to an increase in pollutant emissions.

Table 4.8.4-1:
One-Hour Emission Levels under Alternatives 1 and 2
from The Summit-at-Snoqualmie Pollutant Sources

Pollutant	Sources	Emissions[a]	Alternative 1		Alternative 2	
			Units	Output (lbs/hr)	Units	Output (lbs/hr)
PM_{10}	Fireplaces	0.17/hr	1	0.17	1	0.17
	Highway Dust	0.012/VMT	2,800	33.60	3,361	40.33
	Vehicles	0.016/hr	2,800	44.80	3,361	53.78
	Generator	0.23	1	0.23	1	0.23
	Groomers	0.23	10	2.30	10	2.30
	Kitchens	0.07	7	0.49	10	0.70
	Total			81.59		97.51
$PM_{2.5}$[b]	Fireplaces	0.088/hr	1	0.09	1	0.09
	Highway Dust	0.006/VMT	2,800	16.80	3,361	20.17
	Vehicles	0.008/hr	2,800	22.40	3,361	26.89
	Generator	0.11	1	0.11	1	0.11
	Groomers	0.11	10	1.10	10	1.10
	Kitchen	0.03	7	0.21	10	0.30
	Total			40.71		48.65
CO	Fireplaces	1.27/hr	1	1.27	1	1.27
	Vehicles	6.32/hr	2,800	17,696.00	3,361	21,241.52
	Generator	4.87/hr	1	4.87	1	4.87
	Groomers	4.87/hr	10	48.70	10	48.70
	Kitchens	0.51/hr	7	3.57	10	5.10
	Total			17,754.41		21,301.46
NOx	Fireplaces	0.01	1	0.01	1	0.01
	Vehicles	0.2	2,800	560.00	3,361	672.20
	Generator	3.95	1	3.95	1	3.95
	Groomers	3.95	10	39.50	10	39.50
	Kitchens	0.07	7	0.49	10	0.70
	Total			603.95		716.36
SOx	Fireplaces	0.002	1	0.00	1	0.00
	Vehicles	0.009	2,800	25.20	3,361	30.25
	Generator	0.454	1	0.45	1	0.45
	Groomers	0.454	10	4.54	10	4.54
	Kitchens	0.001	7	0.01	10	0.01
	Total			30.20		35.26

[a] Emission Factor Source – USDA Forest Service 1995
[b] $PM_{2.5}$ emissions estimated at 0.5 PM_{10}.

As shown in Table 4.8.4-2, criteria pollutant increases under Alternative 2 would be well below prevention of significant deterioration (PSD) significant emission rates, with the exception of CO, which

is a reflection of vehicle; operations on I-90 and in parking lots.[65] Due to the low level of emissions associated with Alternative 2, complex modeling was deemed unnecessary. The emission outputs in Table 4.8.4-2 have been extended from one-hour to the one-day and annual levels for comparison with PSD significant emission rates.

Assumptions made for the "Worst Case Scenario" in Tables 4.8.4-1 and 4.8.4-2 include:

- Fireplaces run for six hours per day and 90 days per year for all alternatives.
- Highway dust is in the air for four hours per day and highway dust occurs 40 days per year.
- Vehicles run within the Study Area for one hour per day and for 40 days per year.
- The generator is run two hours per day and two days per year.
- On average, The Summit-at-Snoqualmie runs 10 groomers each day for about eight hours over an assumed 90 day season.
- Kitchens all run for 8 hours per day over a 90 days season.
- There is parking space for 5,600 vehicles; worst case scenario would have one-half of all vehicles leave in one hour, which is 2,800 vehicles.

[65] Prevention of Significant Deterioration (PSD) regulations do not apply to this project but PSD significant emission rates were used as an indicator of whether more detailed emissions modeling would be required.

Table 4.8.4-2:
Increased Air Quality Emission Rates by Alternative for The Summit-at-Snoqualmie Study Area

Pollutant	PSD Significant Emission Rate[a]	Alternative 1 (tons/year)	Alternative 2 (tons/year)	Increase (tons/year)
PM_{10}				
1-hour	- -	0.04	0.05	0.01
1-day	- -	0.09	0.10	0.02
Annual	15 tons/yr	4.01	4.68	0.67
$PM_{2.5}$				
1-hour	- -	0.02	0.02	0.00
1-day	- -	0.04	0.05	0.01
Annual	Not Established	1.97	2.30	0.33
CO				
1-hour	- -	8.88	10.65	1.77
1-day	- -	2.87	3.41	0.54
Annual	100 tons/yr	125.35	147.17	21.82
NOx				
1-hour	- -	0.30	0.36	0.06
1-day	- -	0.25	0.27	0.02
Annual	40 tons/yr	17.77	18.52	0.75
SOx				
1-hour	- -	0.02	0.02	0.00
1-day	- -	0.02	0.02	0.00
Annual	40 tons/yr	1.79	1.82	0.03

[a] USDA 1995b

Due to the low level of additional emissions under Alternative 2, it is unlikely that the Proposed Action will significantly degrade existing air quality at The Summit-at-Snoqualmie.

Roads and Parking Lots

Under Alternative 2, the construction of access roads and parking lot expansions would lead to increases in vehicle exhaust and fugitive dust generation. Approximately 0.58 mile of new roads (native surface) would be constructed to access lift terminals at Creek Run and Rampart. Use of the roads during summer months would lead to the generation of additional fugitive dust from maintenance vehicle activity as compared to Alternative 1.

Under Alternative 2, approximately 0.37 mile of roads would be obliterated. Road obliteration would likely result in construction impacts from vehicle exhaust and dust generation, however operational impacts resulting in fugitive dust generation would be reduced in these areas.

Under Alternative 2, Alpental Parking Lots 3, 4, 5, 6, and 7, Summit West Parking Lots 1 and 2, the maintenance shop parking lot area, and Silver Fir Parking Lot 1 would be paved. The paving of gravel parking lots would eliminate fugitive dust sources during dry summer months.

Under Alternative 2, the total car parking capacity would increase by 1,109 spaces to a total of 6,721 parking spaces, representing an approximate 20 percent increase over the existing 5,612 parking spaces. In addition, CCC would increase from 10,020 to 13,630, (see Table 2.3–1). As described in Section 3.12 - Transportation, peak use of I-90 and SR 906 at Snoqualmie Pass occurs during the summer months (see Illustration 3.12.2-1). As such, the increase in winter Peak Hour Volumes anticipated under Alternative 2 would continue to be less than overall peak use, which occurs in the summer. Although, the increase in parking capacity and CCC would increase CO, hydrocarbons and fire particulate emissions during winter ski operations from vehicle exhaust, as compared to existing conditions, emissions would continue to be less than peak use during summer months.

There would be no anticipated changes to the operations of the shuttle service.

Groomers and Other Maintenance Vehicles

Under Alternative 2, The Summit-at-Snoqualmie would continue to operate their existing fleet of groomers and other maintenance equipment. The operating schedule of groomers would not change as a result of the implementation of Alternative 2. Impacts to air quality from groomers and maintenance equipment would be as described under Alternative 1.

Auxiliary Power Units

Under Alternative 2, The Summit-at-Snoqualmie would add 100 percent capacity APUs at the proposed *Mt. Hyak* and *Pulse Gondola* lifts. There would be no anticipated long-term impacts to air quality associated with the proposed APUs. APUs would continue to operate on an emergency basis, as necessary. Anticipated use would be similar to existing conditions - less than 10 days/year.

Fireplaces, Wood Burning Devices and Restaurant Grills

Under Alternative 2, the construction of the mountain-top restaurants and base area facilities would add 2-3 new wood burning fireplaces within the SUP at Alpental and Summit East. Use of the fireplaces would be consistent with the current use of fireplaces described in Section 3.8 - Air Quality. The fireplaces would continue to be considered a minor source of air pollution.

The Summit-at-Snoqualmie would add 6 new restaurant grills within the Study Area. Two grills would be located at the mountain-top restaurant at Summit East, the renovated Thunderbird Lodge, and the mountain-top restaurant at Alpental. Grills would be operated during the winter ski season in accordance with current use. Additionally, the Alpental mountain-top restaurant would operate throughout the summer. Impacts to air quality would slightly increase due to the number of new grills, however these

increase are not expected to be measurable considering background emissions, as discussed in Section 3.8 - Air Quality.

The increase in use of fireplaces, grills and potential increases in air quality impacts would occur during the winter months. Peak use of the adjacent Alpine Lakes Wilderness Area occurs during the summer months (see Section 3.11 - Recreation). Therefore, potential impacts to air quality from The Summit-at-Snoqualmie to the adjacent wilderness area occur when use is low. Anticipated impacts to air quality resulting from the use of fireplaces, wood burning devices, and restaurant areas would continue to be less during the winter, as compared to summer months.

Slash Burning

Under Alternative 2, excess slash from the tree clearing would be stockpiled and burned according to the guidance provided in the Implementation, Operations, Restoration and Monitoring Plan for The Summit-at-Snoqualmie MDP (see Appendix F). Slash burning would impact air quality through CO and particulate matter emissions. Based on the amount of clearing and grading under Alternative 2, air quality impacts from slash burning would be the greatest of any Action Alternative. Impacts to air quality from slash burning would be direct and short-term during construction.

4.8.4.2 Visibility

Under Alternative 2, short-term impacts to visibility would be associated with implementation of the projects, including excavation and construction of new chairlifts, trails, roads, and buildings. The Forest Service would continue to operate the IMPROVE visibility monitoring station at Snoqualmie Pass. The implementation of Other Management Provision OMP50 (see Table 2.4-2) would limit burning activities during the weekends from July 1 to Labor Day when summer visitors are present. Considering impacts from Alternative 2 would occur during winter months when use along I-90 and SR 906 are at their lowest, also considering visibility is at its greatest during the winter months (see Illustration 3.8.1-1). Visibility Impacts would be similar to those discussed in Section 3.8 - Air Quality.

4.8.5 Impacts – Alternative 3

4.8.5.1 Air Quality Standards and Regulations

Impacts to air quality under Alternative 3 would be similar to, but less than Alternative 2. The *Pulse Gondola* at Alpental would not be constructed, nor would the mountain-top restaurant. As a result, no particulate matter would be generated at the Alpental summit from kitchen operations during the summer. Vehicle emission would be proportionately lower than Alternative 2. The *Creek Run* chairlift and associated trails would not be constructed and therefore slash would not be burned in the Creek Run area.

Roads and Parking Lots

Under Alternative 3, impacts to air quality from road construction/obliteration would be as described under Alternative 2. Impacts to air quality from the paving of existing gravel parking lots would also be as described under Alternative 2.

Impacts to air quality from increases in parking capacity and CCC would be proportionately less than as described under Alternative 2. CCC increases to 12,610, as compared to 13,630 in Alternative 2 because the *Creek Run* lift and *Pulse Gondola* are not included in the CCC calculation (see Table 2.3–1). Increases in parking capacity would be as described under Alternative 2. Considering the CCC would be lower in Alternative 3 than 2, reducing visitation and trips generated, it is assumed that impacts to air, which are dominated by vehicle emission, would be lower than Alternative 2.

Groomers and Other Maintenance Vehicles

Under Alternative 3, the operation of groomers and maintenance equipment is not anticipated to change. Impacts to air quality would be as described under Alternatives 1 and 2.

Auxiliary Power Units

Under Alternative 3, the impacts to air quality from proposed APUs would be as described under Alternative 2, except that the *Pulse Gondola* and *Creek Run* chairlift would not be constructed. Even though APUs would run less than 10 days/year, impacts to air quality would be slightly less with the absence of the proposed APU for the *Pulse Gondola* and *Creek Run* chairlift under Alternative 3, as compared to Alternative 2.

Fireplaces, Wood Burning Devices and Restaurant Grills

Under Alternative 3, no mountain-top restaurant would be constructed at Alpental. As such, the wood-burning fireplaces and restaurant grills associated with the Alpental mountain-top restaurant would not generated emission during the winter operating season, and no summer operations would take place at the Alpental summit. As such, air quality impacts from fireplaces and restaurant grills would be proportionately less than Alternative 2, including the elimination of summer emissions at Alpental.

Slash Burning

Under Alternative 3, slash burning would be less than Alternative 2 because clearing in the Creek Run area would not occur in Alternative 3. Considering the amount of clearing under Alternative 3, air quality impacts from slash burning would be less than under Alternatives 2 and Modified Alternative 5 but more than Alternative 4.

4.8.5.2 Emissions Inventory

Under Alternative 3, the emissions inventory would be similar to that described under Alternative 2.

4.8.5.3 Visibility

Under Alternative 3, impacts to visibility would be as described under Alternative 2.

4.8.6 Impacts – Alternative 4

4.8.6.1 Air Quality Standards and Regulations

Impacts to air quality under Alternative 4 would be similar to, but less than Alternative 3. Under Alternative 4, the Creek Run and Rampart pods would not be constructed and therefore no access road construction would be required in Section 16. Parking lots 4, 5, and 6 at Alpental would be reduced in size due to the relocation of Alpental Road. The increase in CCC would be less than Alternatives 2 or 3 because the Creek Run and Rampart lifts would not be installed.

Roads and Parking Lots

Under Alternative 4, 0.35 mile of access road would be constructed at Summit West. Paving of parking lots would be as described for Alternative 2 except lots 4, 5 and 6 at Alpental would be reduced in size and Lot 7 would be removed. Operational use of the roads during summer months would be minimal and would lead to generation of fugitive dust from maintenance vehicle activity.

Under Alternative 4, impacts to air quality from road obliteration would be as described under Alternative 2.

Under Alternative 4, Parking Lot 7 would be abandoned and restored at Alpental removing a potential fugitive dust and vehicle emission source. Additionally, Parking Lots 4, 5, and 6 would be reduced in size and paved, ultimately lowering the overall parking capacity, thereby removing a potential fugitive dust and vehicle emission source.

Total car parking capacity would increase by 987 spaces to a total of 6,599 parking spaces, representing an approximate 17.5 percent increase over the existing 5,612 parking spaces. CCC would increase to 12,280, which is lowest of all Action Alternatives. Impacts to air quality from transportation due to increased winter visitation would be proportionately less than those described for Alternatives 2 and 3 as the parking capacity and CCC increase the least of the Action Alternatives. However, similar to Alternative 2, Alternative 4 would include summer operations at Alpental due to the presence of the Pulse Gondola and mountain-top restaurant. As a result, Alternative 4 would cause similar summer emissions at Alpental as Alternative 2.

Groomers and Other Maintenance Vehicles

Under Alternative 4, the operation of groomers and maintenance equipment is not anticipated to change. Impacts to air quality would be as described under Alternative 1.

Auxiliary Power Units

Under Alternative 4, the impacts to air quality from proposed APUs would be as described under Alternative 2, except APU would not be installed for the *Creek Run* and *Rampart* lifts, as they would not be constructed under Alternative 4. Therefore APU related emissions would not occur in Section 16.

Fireplaces, Wood Burning Devices and Restaurant Grills

Under Alternative 4, impacts to air quality from new wood-burning fireplaces would be as described under Alternative 2. Impacts from proposed restaurant grills would also be as described under Alternative 2.

Slash Burning

Under Alternative 4, impacts from slash burning from the tree clearing would be similar to Alternative 2. However, based on the amount of clearing and grading proposed under Alternative 4, air quality impacts from slash burning would be lowest of any Action Alternative, as the *Creek Run* and *Rampart* lift/trails would not be altered.

4.8.6.2 Emissions Inventory

Under Alternative 4, the emissions inventory would be similar to that described under Alternative 2.

4.8.6.3 Visibility

Under Alternative 4, impacts to visibility would be as described under Alternative 2.

4.8.7 Impacts – Modified Alternative 5

4.8.7.1 Air Quality Standards and Regulations

Under Modified Alternative 5, short-term impacts to air quality within the Study Area would result from construction projects as described under Alternative 2.

Roads and Parking Lots; Groomers and Other Maintenance Vehicles; Auxiliary Power Units; Fireplaces, Wood Burning Devices and Restaurant Grills

Under Modified Alternative 5, impacts to air quality from roads and parking lots; groomers and maintenance equipment; APUs; and wood-burning fireplaces and restaurant grills would be as described under Alternative 2.

Slash Burning

Under Modified Alternative 5, excess slash from the tree clearing would be similar to Alternative 2. However, because of the reduction in clearing associated with the Creek Run design, as compared to Alternative 2, air quality impacts from slash burning would be slightly less than under Alternative 2.

4.8.7.2 Emissions Inventory

Under Modified Alternative 5, the emissions inventory would be similar to that described under Alternative 2.

4.8.7.3 Visibility

Under Modified Alternative 5, impacts to visibility would be as described under Alternative 2.

4.8.8 Cumulative Effects

For this analysis, the cumulative effect to air quality results from the implementation of The Summit-at-Snoqualmie's projects and impacts due to other past, present, and reasonably foreseeable projects on private and public lands in the project area (see Table 4.8.8-1 and 4.8.8-2 for the U. Yakima and S.F. Snoqualmie Watershed cumulative effects). Population increases in adjacent communities may result in additional vehicular traffic along I-90 and SR 906; potential increase resulting from ski area visitation would be insignificant and discountable with respect to current traffic levels on these roadways (see Section 4.10 - Social and Economic Factors and Section 4.12 - Transportation). Additional residential development in the area could also result in short-term air quality impacts during the summer months. Aside from developments identified in Tables 4.8.8-1 and 4.8.8-2, no formal proposals have been submitted to the local government for approval. It is not possible to precisely quantify impacts because future growth in the area is speculative. However, given the size and nature of these types of projects, air quality impacts would be short-term.

Tables 4.8.8-1 and 4.8.8-2 describe the impacts to air quality from known past, present and reasonably foreseeable future projects occurring within the Snoqualmie Pass area. In total, these projects are not expected to individually or cumulatively effect attainment of NAAQS in the Snoqualmie Pass area, or to reduce visibility beyond existing conditions (see Illustration 3.8.1-1).

Table 4.8.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Air Quality in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Air Quality
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last 5 years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately 2 per year.	Approximately 0.01 acre around each culvert would be impacted by construction equipment. Spatially, these culvert replacements would substantially overlap with the proposed MDP. Culvert replacement would overlap in time with MDP projects, resulting in short-term air quality impacts associated with construction activity, in particular fugitive dust from road use and vehicle emissions.

Table 4.8.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Air Quality in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Air Quality
Projects Not Associated with The Summit-at-Snoqualmie		
Kachess Vegetation Management	The campground contained old growth trees suffering from various stages of root rot. Hazard trees were identified in the Kachess Lake Campground through an exhaustive survey. All identified trees were removed during the winter of 2004. A small amount of timber was sold as merchantable, the rest was disposed of through firewood sales, lop and scatter, or burned.	Implementation of the vegetation management plan resulted in localized soil impacts associated with tree removal, yarding, lopping/scattering, and burning. Spatially, the vegetation removal was limited to the campground site, and did not overlap with the MDP or other identified cumulative effects. Temporally, the work has been completed and would not overlap with the MDP.
Plum Creek Road Restoration	The Cle Elum Ranger District is performing a road analysis covering approximately 50-70 miles of harvest roads on 65,000 acres of land acquired in the last 5 years from Plum Creek Timber lands. Currently, approximately 18 miles of roads that were acquired and deemed to be unsafe or were already closed have been decommissioned by the Forest Service. Under the Proposed Action, approximately 30.57 miles of road would be decommissioned.	Currently, approximately 26.2 acres of roads have been decommissioned within the watershed. Both spatially and temporally, this road decommissioning would overlap with the proposed road obliteration, and other restoration projects identified in the MDP alternatives. As a result, the road obliteration under the MDP and the Cle Elum Roads Analysis would cumulatively increase fugitive dust during construction in the U. Yakima 5th field watershed. However, these impacts would be mitigated through the elimination of road mileage and the associated fugitive dust over time.
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	Depending on which alternative is selected, approximately 50.9 acres of soils would be impacted by road expansions. This project would directly overlap with the MDP in both space and time. Alternatives 2 and Modified Alternative 5 would increase detrimental soil conditions in the Study Area, cumulatively increasing the potential for fugitive dust in the vicinity of Snoqualmie Pass. Alternative 3 and 4 would reduce detrimental soil conditions. The project would cumulatively add to vehicle emissions at the site and 5th field scales during construction from equipment. Additionally, long-term operational impacts to air quality from vehicle emissions would result from a projected increased in daily traffic on I-90.

Table 4.8.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Air Quality in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Air Quality
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	The management of these former timberlands for late seral forest would overlap in both space and time with the MDP. Coupled with other efforts to improve late seral habitat in the Snoqualmie Pass Area, Alternative 3 and Modified Alternative 5, with a 390-acre land donation, would cumulatively reduce the potential for liberation of fugitive dust and emissions from timber equipment on these lands.
Keechelus Dam Repairs	The Keechelus Lake dam was repaired in 2003. The existing dam was rebuilt in place to correct structural problems. The project has been completed. Approximately 70 acres of vegetation was cleared to provide a work corridor. The project impacted 3.8 acres of wetlands.	During construction, fugitive dust and construction vehicle emissions likely increased in the construction site. With completion of the dam, no long-term impacts to air quality are evident. The construction did not overlap in space or time with the MDP. Therefore, no cumulative effects have been identified.
Gold Creek Pond Trail Development	A native surface foot trail was constructed approximately 100 feet long. This project was completed in 2001.	Temporary impacts to 0.005 acre occurred during trail construction. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space or time with any projected air quality impacts under the MDP.
U.S. West Telephone line	Installation of an underground telephone line in old road prism. This project was completed in 2001.	Temporary impact of 1.82 acres to install an underground line created disturbance to an already modified soil profile in the road prism. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space or time with any projected air quality impacts under the MDP.
WSDOT I-90 Maintenance	WSDOT maintains continuous custodian operations of the existing I-90 roadways. Maintenance includes application of sand and chemical deicers to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile are applied to I-90 within the Snoqualmie Pass area (WSDOT 1999, 2001).	Permanent and temporary impacts result from sanding and de-icing operations. Impacts to air quality result from vehicle exhaust and particulate matter from sanding operations. During summer months, sand remaining on the roadway is a constant source of fugitive dust as passing vehicles disturb the sand. I-90 Maintenance would overlap with the MDP in both space and time at the site scale and 5th field scale.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	The management of these former timberlands for late seral forest would overlap in both space (at the 5th field) and time with the MDP. Coupled with other efforts to improve late seral habitat in the Snoqualmie Pass Area, Alternative 3 and Modified Alternative 5, with a 390-acre land donation, would cumulatively reduce the potential for liberation of fugitive dust and emissions from timber equipment on these lands.

Table 4.8.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Air Quality in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Air Quality
Plum Creek Cascade Habitat Conservation Plan	A HCP was developed for the Plum Creek Timber Company to manage timber harvest and protect wildlife habitat over several 5th field watersheds in the vicinity of Snoqualmie Pass.	Approximately 52,100 acres of land is managed under the HCP. Protection of wildlife habitat would temporally and spatially (within the 5th field) overlap with the MDP, resulting in cumulative reductions in timber-related air quality impacts, particularly when coupled with Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange (described above) and the other private land acquisitions (described above) would also contribute to a reduction in fugitive dust and emissions associated with timber management activities.
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of the Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in both space and time with the MDP development at the site and 5th field scales. Impacts would result from construction vehicle emissions, new wood fireplaces, and increased daily traffic. No violations of NAAQS are anticipated.
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the Upper Yakima River watershed to accelerate the development of late-successional forest structure. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	The commercial thinning projects would overlap spatially in the 5th field and temporally with the proposed MDP. Vehicle emissions from logging equipment and fugitive dust liberation would result in short-term air quality impacts.
Snoqualmie Pass AMA Plan	Land management plan for the AMA emphasizing late-successional habitat maintenance and enhancement	The emphasis on late-successional habitat maintenance and enhancement through the SPAMA would overlap spatially and temporally with the MDP. This project, coupled with other efforts to improve later seral habitat in the Snoqualmie Pass area, and Alternative 3 and Modified Alternative 5, with a 390-acre land donation, would cumulatively reduce the potential for liberation of fugitive dust and emissions from timber harvests on these lands.

Table 4.8.8-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Air Quality in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Air Quality
Cle Elum RD roads analysis	Analysis of road system to determine long-term need. Implementation is expected in 2010.	The Cle Elum RD Roads Analysis would overlap spatially at the 5th field and temporally with the proposed MDP. Implementation
WSDOT road de-icing	Application of sand and chemical deicers to roadway surfaces	Deicing and sanding of roadways overlaps spatially and temporally with the MDP. Impacts to air quality result from vehicle exhaust and particulate matter from sanding operations. During the summer months, sand remaining on the roadway is a constant source of fugitive dust as passing vehicles disturb the sand.
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (West Keechelus subwatershed). The proposed project includes thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	The acceleration of late-successional forest conditions in plantations would overlap spatially (at the 5th field) and temporally with the MDP. Coupled with other efforts to improve later seral habitat in the Snoqualmie Pass area described in other projects, Alternative 3 and Modified Alternative 5, with a 390-acre land donation, would cumulatively reduce the potential for liberation of fugitive dust and emissions from timber harvests on these lands. In the short-term, during the commercial and pre-commercial thinning, fugitive dust liberation and vehicle exhaust from logging equipment would result in temporary air quality impacts.
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (E. Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and fish passage improvements, and other restoration projects.	The acceleration of late-successional forest conditions in plantations would overlap spatially (at the 5th field) and temporally with the MDP. This project, coupled with other efforts to improve late-seral habitat in the Snoqualmie Pass area, Alternative 3 and Modified Alternative 5, with a 390-acre land donation, would cumulatively reduce the potential for liberation of fugitive dust and emissions from timber harvests on these lands. Temporarily, during the commercial and pre-commercial thinning, fugitive dust liberation and vehicle exhaust from logging equipment would result in localized short-term air quality impacts.

Table 4.8.8-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Air Quality in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Air Quality
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last 5 years at the Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately 2 per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	Approximately 0.01 acre around each culvert would be impacted by construction equipment. Spatially, these culvert replacements would overlap with the MDP at the site scale. Culvert replacement would overlap in time with MDP projects, resulting in short-term air quality impacts associated with construction activity, particularly fugitive dust from road use and vehicle emissions.
Alpental Covered Bridge Replacement	The existing covered footbridge at Alpental washed out during a storm in 2003. The Summit-at-Snoqualmie has replaced the bridge as of October 2005.	No new permanent impacts occurred as the new bridge was placed within the footprint of the old bridge. Temporary soil disturbance occurred during construction and riparian vegetation has been re-established during the Spring of 2006. Spatially, the bridge replacement occurs within the MDP Study Area. With the re-establishment of riparian vegetation, the bridge construction and stabilizations will not overlap in time with the MDP proposal and therefore would not cumulatively affect air quality at the site scale
Projects Not Associated with The Summit-at-Snoqualmie		
FS Road 58 Bridge Replacement	An existing steel bridge over the South Fork Snoqualmie River was replaced on Forest Service Road 58 due to structural problems. The new bridge was expanded from one to two lanes with upgraded load capacity. Construction of the bridge was completed in spring 2005.	Approximately 0.05 acre was graded to provide an expanded roadway approach. Bridge footings were installed below the ordinary high water mark and required temporary flow diversion structures to create a dry work zone. With completion of the project in 2005, the bridge replacement does not overlap with the MDP in either space or time. Thus the bridge replacement would not cumulatively affect air quality in the 5th field scale.
Huckleberry Land Exchange	Exchange of NFSL for 6,798 acres of Weyerheauser lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	Approximately 6,798 acres of Weyerhaeuser land was received by the Forest Service. Approximately 702 acres are managed as Late Successional Reserves. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP. Coupled with other efforts to improve late seral habitat in the Snoqualmie Pass Area, the Huckleberry Land Exchange would cumulatively reduce the potential for liberation of fugitive dust and emissions from timber equipment on these lands.

Table 4.8.8-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Air Quality in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Air Quality
WSDOT 1-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical deicers to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile is applied to I-90 within the Snoqualmie Pass area.	Permanent and temporary impacts result from sanding and de-icing operations. Impacts to air quality result from vehicle exhaust and particulate matter from sanding operations. During summer months, sand remaining on the roadway is a constant source of fugitive dust as passing vehicles disturb the sand. I-90 Maintenance would overlap with the MDP in both space and time at the site and 5th field scales.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The management of these former timberlands as Late Successional Reserve would overlap in both space (in the 5th field) and time with the MDP. Coupled with other efforts to improve late-seral habitat in the Snoqualmie Pass area, Alternative 3 or Modified Alternative 5, with a 390-acre land donation, would cumulatively reduce the potential for liberation of fugitive dust and emissions from timber equipment on these lands.
U.S. West Telephone line	Installation of an underground telephone line in the I-90 corridor	Temporary impact to install an underground line created disturbance to an already modified soil profile in the road prism of I-90. This project is assumed to have been stabilized and therefore does not overlap spatially or temporally with any projected air quality impacts under the MDP.
WSDOT road de-icing	Application of sand and chemical deicers to roadway surfaces	Deicing and sanding of roadways overlaps spatially and temporally with the MDP at the site and 5th field scales. Impacts to air quality result from vehicle exhaust and particulate matter from sanding operations. During the summer months, sand remaining on the roadway is a constant source of fugitive dust as passing vehicles disturb the sand.
BPA Proposed Additional Power Lines	Supplemental DEIS to examine development of an additional powerline. Options include adding lines to existing towers or adding new towers.	Development of additional powerline along I-90 would overlap spatially (in the 5th field) and temporally with the MDP. Impacts to air quality could result from fugitive dust due to soil disturbance (if new towers are added) and construction vehicle emissions.
McClellan Butte Trail Reconstruction Project	The project will relocate approximately 1.5 miles of trail to newly constructed trail or old road bed, abandon 1.5 miles of trail, and rehabilitate tread, drainage and switchbacks as required along the remainder of the 4.4-mile trail.	Temporary air quality impacts along approximately 5.9 miles of trail occurred due to trail relocation and rehabilitation. This project is assumed to have been stabilized and therefore does not overlap spatially or temporally with any projected air quality impacts under the MDP.

Table 4.8.8-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Air Quality in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Air Quality
Bandera Mountain/Mason Lake Trail Relocation Project	This project reorganized trail access to Mason Lake and Bandera Mountain in order to minimize social and resource impacts associated with the existing trails. The project involved construction of 1.5 miles of new trail, reconstructing 2.0 miles of existing trail and decommissioning 2.3 miles of existing trail.	Temporary air quality impacts along approximately 3.5 miles of trail occurred due to trail construction. This project is assumed to have been stabilized and therefore does not overlap spatially or temporally with any projected air quality impacts under the MDP.
High Lakes Trail #1012 and Snow Lake Trail #1013 Reconstruction	This project repaired seven switchbacks on the Snow Lake Trail and reconstructed 2 miles on the High Lakes Trail from Snow to Gem Lake.	Temporary air quality impacts along approximately 2 miles of trail occurred due to trail reconstruction. This project is assumed to have been stabilized and therefore does not overlap spatially or temporally with any projected air quality impacts under the MDP.
South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project	This project involves the redcution in maintenance level (ML) on 11 roads (26.3 miles). 19.4 miles would be reduced to ML 1 (closed to motorized access) and utilized as loop and destination trail routes; 2.7 miles would be closed - placed in storage for future forest management; 1.1 mile would be removed from the transportation system and converted to trail; approximately 22.2 miles of spur roads mostly associated with roads proposed for reduction to ML 1 would be closed and removed from the Forest Road Transportation System.	The closure of roads to motorized access and the decommissioning of roads would overlap spatially (at the 5th field scale) and temporally with the MDP. Reduction of motorized access to Forest Service roads would reduce the amount of fugitive dust and vehicle exhaust, improving the overall air quality of the area.
Denny Salvage	This project would salvage approximately 50 mbf of trees utilizing a ground based logging system. All undamaged trees with secure root systems would be left.	The salvage of approximately 50 mbf would overlap spatially (at the 5th field scale) and temporally with the MDP. Temporary air quality impacts due to fugitive dust liberation and vehicle emissions from logging equipment would result.
Annual Road Maintenance	Brushing/blading of roads on a rotating schedule as funds allow. Includes roads 55, 5510, 58, and road 9030 and 9031 systems.	The brushing and blading of Forest Service roads overlaps spatially (at the 5th field scale) and temporally with the MDP. Temporary air quality impacts due to fugitive dust liberation and vehicle emissions would result.

Table 4.8.8-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Air Quality in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects to Air Quality
Road 9020 ERFO Repair	This project proposes to either replace the culvert at Alice Creek or reduce the ML of Road 9020 past Alice Creek to 1 (no motorized access).	Replacement of a culvert or closure of the road to motorized vehicles would overlap spatially (at the 5th field) and temporally with the MDP. Replacement of the culvert would result in temporary ground disturbance and fugitive dust. Closure of the road to motorized vehicles would reduce fugitive dust liberation and vehicle exhaust air quality impacts in the future.
I-90 Corridor Thin	The project involves commercially thinning approximately 338 acres in the I-90 Corridor. About 4.3 mmbf would be thinned from 14 units.	The commercial thinning of approximately 338 acres would overlap spatially (at the 5th field scale) and temporally with the MDP. Temporary air quality impacts would result due to fugitive dust liberation and vehicle exhaust from logging equipment.
Snoqualmie Pass Utility District Permit Amendment	The project would extend water and sewer lines along Forest Service Road 4832 from the I-90 Hyak interchange for approximately 3,000 feet. The new lines would stop before reaching Gold Creek. Lines would be laid within the existing road right of way.	The extension of water and sewer lines would overlap spatially (in the 5th field) and temporally with the MDP. Temporary air quality impacts during construction would occur due to soil disturbance and construction equipment, resulting in fugitive dust liberation and vehicle emissions.
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	The construction of a trail and parking facilities would overlap spatially (at the 5th field scale) and temporally with the MDP. Temporary air quality impacts due to construction would occur due to soil disturbance and construction equipment, resulting in fugitive dust liberation and vehicle emissions.

The proposed expansion of I-90 from Snoqualmie Pass to Easton is considered a reasonably foreseeable project that would impact air quality. I-90 would be widened to provide additional travel lanes in each direction. Impacts to air quality would occur within the project area from the operation of construction equipment. Indirect impacts to air quality would result from vehicle emissions from increased traffic on the road. Future traffic planning for I-90 takes into account a Peak Hour Traffic Volume of 6,148 vehicles by 2015 representing an 18 percent increase from existing conditions, as described in Section 4.12 - Transportation.

Additional impacts to air quality from The Summit-at-Snoqualmie are likely to be immeasurable in context with other projects and its location near I-90 (Peterson 2004 pers. comm.).

4.8.9 Irreversible and Irretrievable Commitments of Resources

Impacts to air quality by itself do not consume resources (e.g., water, vegetation, etc.); it is a byproduct of increased development (e.g., construction of MDP projects, traffic to the site, increased maintenance, etc.). To the extent that increased development increases overall air quality impacts around the project site, then the project could reduce the quality of the recreation experience from an air quality perspective. Consequently, decreased air quality represents an irretrievable commitment of recreation resources during the construction of MDP projects. These effects, however, would be reversible in that air quality would return to existing conditions after project completion. Irreversible commitments of air quality resources are not anticipated from The Summit-at-Snoqualmie's Action Alternatives.

4.9 HERITAGE RESOURCES AND RESERVED TREATY RIGHTS

This section describes the potential effects of the Master Development Plan Alternatives on heritage resources within the area of potential effect. Traditional cultural heritage resources, a type of heritage resource that may be significant in the beliefs, customs and practices of a community, are discussed as a separate category. Tribal rights and interests reserved in the Indian Treaties for the use and benefit of Tribal members are also addressed in this section. Only Congress may abolish or modify treaties or treaty rights. This section acknowledges that certain Tribes have reserved treaty rights that may be exercised on lands within the Study Area. Physical actions associated with specific MDP projects may affect treaty resources (e.g., deer, elk, berries) and their habitats.

4.9.1 Impacts – Alternative 1 (No Action Alternative)

As required by NEPA, a No Action Alternative is analyzed as a benchmark against which the Action Alternatives can be compared. The No Action Alternative also serves as a means of analyzing the effects of "no future development" within the Study Area. If additional projects or activities are proposed, they would require NEPA review, Government-to-Government consultation with Indian Tribes, and review and approval under applicable Historic Preservation laws before implementation.

Heritage Resources

Under Alternative 1, heritage resources would continue to deteriorate naturally, primarily from weather, erosion and recreational uses in the permit area. Although it is not currently an official mountain biking or hiking trail, the Milwaukee railroad grade has been used as a trail by mountain bikers and perhaps by hikers, and could be further eroded or otherwise damaged by continued recreational use. Objects made of organic materials would continue to decompose (e.g., telegraph poles associated with the Milwaukee Road High Line). Non-organic artifacts (e.g., metal cable) would not be disturbed, and would deteriorate over time. The Snoqualmie Pass Guard Station (06-05-05-00063) would continue to be maintained for its current use. Resources that are considered eligible or potentially eligible for the National Register would be monitored and managed in accordance with laws, rules and regulations for historic preservation, within available funding. Additional resources, which contribute to our understanding of history and/or prehistory, may be identified in the future.

Traditional Cultural Heritage Resources (TCHRs)

The USFS has requested information regarding traditional cultural resources and uses of the area from the Tulalip Tribes, Yakama Indian Nation and Snoqualmie Tribe (see Section 1.6.1 – Tribal Government Consultation), and no TCHRs have been identified. Therefore, there are no known ongoing effects to TCHRs. Consultation with Indian Tribes will continue, as appropriate, throughout the processes prescribed by NHPA, NEPA and National Forest policy (FSM 1563).

Reserved Treaty Rights

Because the Snoqualmie Tribe was federally recognized in 1999 through the Federal Acknowledgement Process (25 CFR 83), its rights to hunt, fish, and gather in traditional places are undetermined. However, the USFS has requested information from the Snoqualmie Tribe about their use of the project area for hunting, gathering, fishing, or other traditional purposes. The Tulalip Tribes and the Yakama Indian Nation retain treaty rights to obtain traditional resources in the Snoqualmie Pass vicinity, which is within the traditional use area of each of these peoples (U.S. v Washington 1974). The USFS requested information from the Tulalip Tribes and Yakama Indian Nation about their exercise of reserved rights in the project area as part of government-to-government consultations for the Proposed MDP. To date, neither has responded. Consultation with Indian Tribes will continue, as appropriate, throughout the processes prescribed by NHPA, NEPA and National Forest policy (FSM 1563).

Wildlife species sought as part of treaty-reserved rights include deer, elk, and mountain goat. For a specific discussion of effects of this Alternative to wildlife, see Section 4.6 – Wildlife.

4.9.2 Impacts Common to All Action Alternatives

Heritage Resources

Under all Action Alternatives, non-eligible heritage resources (The Milwaukee Road High Line RR Grade 06-05-05-00091; Snoqualmie Pass Guard Station 06-05-05-00063; and locations of lithic isolates) may be affected, directly or indirectly, by development activities. For resources determined to be ineligible, mitigation measures are not required, and none are proposed. The historic site, 06-05-05-00087, which may be eligible for the NRHP, is not expected to be affected by any of the action Alternatives, as it is beyond the clearing limits of proposed construction. Site 06-05-05-00064 is also located beyond the clearing limits of all proposed development, however, a professional archaeological monitor will be on-site during any ground disturbing activity that is within 80 meters of a positive shovel probe. Development, including vegetation removal, and equipment staging, will be excluded within 50 meters of these sites in all of the action Alternatives. However, if surface erosion is a concern, hand seeding and mulching could occur after coordination with the MBSNF archaeologist (Table 2.4-2, MR1, MR39).

Development at Summit West will be visible from the Cascade Crest Trail (06-05-05-00088), which has been recommended eligible to the NRHP as a discontinuous linear resource. No unequivocal evidence of the historic trail was found in the APE, although the portion of the PCNST outside the modified ski slopes and parking areas appears to be in the same location as the original CCT. The portion of the CCT within the cleared and graded ski slopes and the parking lots has been extensively disturbed and was rebuilt for the PCNST. Therefore, it does not retain historic integrity and is recommended as a non-contributing segment of the historic CCT.

Under all Action Alternatives, two lifts (*Dodge Ridge* and *Julie's Chair*) will be relocated and replaced. A new lift, *Baby Double*, would be built and SW Parking Lot 1 would be expanded. The new *Dodge Ridge*

and *Julie's Chair* lifts will physically cross over the former route of the CCT, while the *Baby Double* lift will be just north of the trail. The only new element is the *Baby Double* chair; the other two lifts are replacements for existing structures, which would be removed. This portion of the CCT has been disturbed by past ski area developments, however, and does not retain physical integrity. Visually, the effects to the CCT are considered not adverse because the trail would still retain its ability to convey to the public the sense of a continuous border to border trail along the crest of the Cascade Mountains. Although the segment of the CCT that passes through the project APE is not consistent with the intended characteristics of the trail, to emphasize wilderness and remote areas, it is consistent with the time period of the trail's significance (1920-1950). The original CCT crossed the railroad and State Highway 10, and passed through the developed Snoqualmie Summit ski area. The development of the MDP would remain visually subordinate (0-1/2-mile viewshed) to the surrounding landscape as one descends from Beaver Lake through the Summit West ski area. From a viewpoint east of I-90, the vegetation cover would continue to screen the developed facilities from users of the CCT (now the PCNST).

Traditional Cultural Heritage Resources

The USFS has requested information regarding traditional cultural resources and uses of the area from the Tulalip Tribes, Yakama Indian Nation and Snoqualmie Tribe (see Section 1.6.1 – Tribal Government Consultation), and no TCHRs have been identified. Therefore, there are no known effects to TCHRs from implementation of any of the Action Alternatives. At their request, the Snoqualmie Tribe will be notified of the implementation and construction schedule for upcoming projects in order to have an opportunity for a Tribal monitor to be present on-site during project construction. Consultation with Indian Tribes will continue, as appropriate, throughout the processes prescribed by NHPA, NEPA and National Forest policy (FSM 1563).

Section 106 Consultation

The Regional Forester has entered into a Programmatic Agreement with the Washington State Historic Preservation Officer and the Advisory Council on Historic Preservation (ACHP) regarding cultural resources management on NFSL in Washington State (PA 1997). In accordance with the Programmatic Agreement, the USFS must consult with the SHPO in the evaluation of properties that may be affected by an undertaking, and on determinations of "No Adverse Effect". The USFS must consult with both the SHPO and ACHP on findings of "Adverse Effect".

The USFS has completed consultation with the SHPO on the determination that no eligible heritage resources would be adversely affected by the Action Alternatives. The SHPO provided concurrence in a letter dated July 28, 2008.

Reserved Treaty Rights

Treaty rights remain unchanged, thus there would be no direct effect to treaty rights under any of the Action Alternatives. However, indirect and cumulative effects to treaty resources could occur as a result

of implementation of any of the Action Alternatives (see Section 4.4 – Fisheries, 4.5 – Vegetation, and 4.6 - Wildlife). The Snoqualmie Pass area was used for hunting, fishing, and gathering by people whose descendants are now members of the Snoqualmie Tribe, Tulalip Tribes, and Yakama Indian Nation. Ethnohistoric and ethnographic sources mention that Indian people used huckleberries, beargrass, fish, deer, elk, mountain goats, and smaller game in the Snoqualmie Pass area during the nineteenth and early twentieth centuries (see Section 3.9.2 – Existing Conditions for discussion).

Huckleberries, an important food resource for American Indian peoples of the region, are present in the APE, and could be affected by the Action Alternatives. Under the MDP, shrubs on the modified ski slopes will be retained except where full grading is planned.

The USFS has requested information regarding current use of the project area to obtain treaty resources from the Tulalip Tribes and Yakama Indian Nation. The Snoqualmie Tribe was acknowledged as An Indian Tribe in 1999 through the Federal Acknowledgement Process (25 CFR 83), and its rights to hunt, fish, and gather traditional resources are undetermined. The Snoqualmie Tribe has been consulted about its interests in the project area regarding traditional uses, practices, and resources, however. Consultation with Indian Tribes will continue, as appropriate, throughout the processes prescribed by NHPA, NEPA and National Forest policy (FSM 1563).

4.9.3 Impacts – Alternative 2

Heritage Resources

Under Alternative 2, effects to the heritage resources would be the same as described in Section 4.9.2 - Impacts Common to All Action Alternatives.

Traditional Cultural Heritage Resources

As described in Section 4.9.2 - Impacts Common to All Action Alternatives, the USFS has requested information regarding traditional cultural heritage resources and uses of the area from the Tulalip Tribes, Yakama Indian Nation and Snoqualmie Tribe (see Section 1.6.1 – Tribal Government Consultation), and no TCHRs have been identified. Therefore, there would be no known effects on TCHRs under Alternative 2. Consultation with the Tulalip Tribes, Yakama Indian Nation, and Snoqualmie Tribe will continue, as appropriate, throughout the processes prescribed by NHPA, NEPA and National Forest policy (FSM 1563).

Reserved Treaty Rights

As described in Section 4.9.2 - Impacts Common to All Action Alternatives, treaty rights remain unchanged, thus there would be no direct effect to treaty rights under Alternative 2. However, indirect and cumulative effects to treaty resources could occur as a result of implementation of Alternative 2, which involves the greatest amount of habitat disturbance of any of the Action Alternatives. For a specific

discussion of effects of this Alternative to wildlife, and other resources, see Section 4.4 – Fisheries, 4.5 – Vegetation, and 4.6 – Wildlife.

4.9.4 Impacts – Alternative 3

Heritage Resources

Under Alternative 3, effects to the heritage resources would be the same as described in Section 4.9.2 - Impacts Common to All Action Alternatives.

Traditional Cultural Heritage Resources

As described in Section 4.9.2 - Impacts Common to All Action Alternatives, the USFS has requested information regarding traditional cultural heritage resources and uses of the area from the Tulalip Tribes, Yakama Indian Nation and Snoqualmie Tribe (see Section 1.6.1 – Tribal Government Consultation), and no TCHRs have been identified. Therefore, no known effects to TCHRs will occur under Alternative 3. Consultation with the Tulalip Tribes, Yakama Indian Nation, and Snoqualmie Tribe will continue, as appropriate, throughout the processes prescribed by NHPA, NEPA and National Forest policy (FSM 1563).

Reserved Treaty Rights

As described in Section 4.9.2 - Impacts Common to All Action Alternatives, treaty rights remain unchanged, thus there would be no direct effect to treaty rights under Alternative 3. However, indirect and cumulative effects to treaty resources could occur as a result of implementation of Alternative 3 (see Sections 4.4 – Fisheries, 4.5 – Vegetation, and 4.6 – Wildlife).

4.9.5 Impacts – Alternative 4

Heritage Resources

Under Alternative 4, effects to the heritage resources would be the same as described in Section 4.9.2, Impacts Common to All Action Alternatives.

Traditional Cultural Heritage Resources

As described in Section 4.9.2 - Impacts Common to All Action Alternatives, the USFS has requested information regarding traditional cultural heritage resources and uses of the area from the Tulalip Tribes, Yakama Indian Nation and Snoqualmie Tribe (see Section 1.6.1 – Tribal Government Consultation), and no TCHRs have been identified. Therefore, no known effects to TCHRs will occur under Alternative 4. Consultation with the Tulalip Tribes, Yakama Indian Nation, and Snoqualmie Tribe will continue, as appropriate, throughout the processes prescribed by NHPA, NEPA and National Forest policy (FSM 1563).

Reserved Treaty Rights

As described in Section 4.9.2 - Impacts Common to All Action Alternatives, treaty rights remain unchanged, thus there would be no direct effect to treaty rights under Alternative 4. However, indirect and cumulative effects to treaty resources could occur as a result of implementation of Alternative 4 (see Sections 4.4 – Fisheries, 4.5 – Vegetation, and 4.6 – Wildlife).

4.9.6 Impacts – Modified Alternative 5

Heritage Resources

Under Modified Alternative 5, effects to the heritage resources would be the same as described in Section 4.9.2 - Impacts Common to All Action Alternatives.

Traditional Cultural Heritage Resources

As described in Section 4.9.2 - Impacts Common to All Action Alternatives, the USFS has requested information regarding traditional cultural heritage resources and uses of the area from the Tulalip Tribes, Yakama Indian Nation and Snoqualmie Tribe (see Section 1.6.1 – Tribal Government Consultation), and no TCHRs have been identified. Therefore, no known effects to TCHRs will occur under Modified Alternative 5. Consultation with the Tulalip Tribes, Yakama Indian Nation, and Snoqualmie Tribe will continue, as appropriate, throughout the processes prescribed by NHPA, NEPA and National Forest policy (FSM 1563).

Reserved Treaty Rights

As described in Section 4.9.2 - Impacts Common to All Action Alternatives treaty rights remain unchanged, thus there would be no direct effect to treaty rights under Modified Alternative 5. However, indirect and cumulative effects to treaty resources could occur as a result of implementation of Modified Alternative 5 (see Sections 4.4 – Fisheries, 4.5 – Vegetation, and 4.6 – Wildlife).

4.9.7 Cumulative Effects

There are no identified cumulative effects of adding the MDP to past, present or reasonably foreseeable projects in the S.F. Snoqualmie River or U. Yakima River Watersheds, because no significant heritage resources would be adversely impacted by the MDP under any of the alternatives.

An unknown number of prehistoric, ethnohistoric, and historic heritage resources have been damaged or destroyed as a result of previous development of I-90 and its predecessors, past ski area development, and the construction of commercial and private structures, roads, and the railroad. Future projects that involve surface or subsurface disturbance of native sediments, such as the excavation of trenches, drain fields, and building foundations, or clearing and grading for road improvement projects, could affect undiscovered heritage resources. Heritage resource surveys conducted prior to project implementation reduce the potential for impacts to undiscovered resources; however, topography may limit the ability to conduct

pedestrian transects, or forest undergrowth or duff may obscure resources. In addition, tribal representatives may be reluctant to identify TCHRs or locations of traditional activities.

Tables 4.9.7-1 and 4.9.7-2 describe the past, present, and reasonably foreseeable projects in the U. Yakima and S.F. Snoqualmie River Watersheds and identify the potential impact of each project on heritage resources. Among the recent and on-going effects to heritage resources eligible for the NRHP in the S.F. Snoqualmie Watershed, the South Fork Snoqualmie River Bridge, a National Register-eligible property on FS Road 58, was removed after Historical American Building Survey/Historical American Engineering Record (HABS/HAER) documentation. The Forest Service entered into a Programmatic Agreement for management of historic recreation residences and has approved maintenance projects on recreation residences occupied under SUP in the Snoqualmie Pass area. The Denny Creek and Snoqualmie Pass East Recreational Residence Tracts have been determined eligible for the NRHP as historic districts (Gassaway 2006). East of Snoqualmie Pass, the Keechelus Lake Dam, an NRHP-eligible property, was rebuilt after HAER documentation was completed. The Dam Construction Camp, also eligible to the NRHP, was also affected by that project; mitigation consisted of data recovery excavations in the areas of potential disturbance (DeLeon 2005).

Implementation of the MDP under any of the Action Alternatives would add to previous alterations to the setting of the CCT in the Summit West area. This wilderness setting of the CCT, a characteristic for which its development was envisioned, has been greatly altered from the 1920s to the present, and would be altered further by reasonably foreseeable actions. Ski area development at Snoqualmie Pass, however, already existed when this trail concept was adopted by federal agencies, as did the Milwaukee Railroad, State Route 10 across Snoqualmie Pass, and logging in the National Forests and on private lands.

Effects resulting from the implementation of the MDP, including clearing and revegetation, along with other factors unrelated to the MDP such as increased traffic resulting from increased recreational opportunities, regional population growth, and other factors, could affect population levels of deer, elk, or other treaty resources, thus affecting opportunities for the Tulalip Tribes and Yakama Indian Nation to practice reserved treaty hunting activities and gathering in the Snoqualmie Pass vicinity. See Section 4.4 – Fisheries, 4.5 – Vegetation, and 4.6 – Wildlife regarding cumulative effects on fish, wildlife and vegetation resources.

Table 4.9.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Heritage Resources in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Heritage Resources and Reserved Treaty Rights
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last 5 years at The Summit at Snoqualmie. Generally, culverts are replaced at a rate of approximately 2 per year.	Spatially, the culvert replacements would take place within the APE for the MDP, however no impacts to known significant heritage resources have been identified. Approximately 0.01 acre of vegetation around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would likely be beneficial, i.e., reduced sediment delivery and erosion would allow for maintenance/re-establishment of habitat along streams. Spatially, these culvert replacements would not substantially overlap with other projects, but would, as a whole, improve the culvert conditions throughout the site scale. As the culverts occupy several hundred square feet within the watershed, they would directly contribute to improved sediment conditions, and therefore, habitat conditions (treaty resources) downstream. Temporally, the culvert replacements would iteratively improve downstream conditions.
Projects Not Associated with The Summit-at-Snoqualmie		
Kachess Vegetation Management	The campground contained old growth trees suffering from various stages of root rot. Hazard trees were identified in the Kachess Lake Campground through an exhaustive survey. All identified trees were removed during the winter of 2004. A small amount of timber was sold as merchantable, the rest was disposed of through firewood sales, lop and scatter, or burned.	Heritage resource surveys were conducted at the campground and there are no impacts to known significant heritage resources. The removal of hazard trees has reduced the canopy cover within the treated areas of the campground. Spatially, the vegetation removal was limited to the campground site, and did not overlap with the MDP or other identified cumulative effects. Temporally, the work has been completed and would not overlap with the MDP.

Table 4.9.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Heritage Resources in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Heritage Resources and Reserved Treaty Rights
Plum Creek Road Restoration	The Cle Elum Ranger District is performing a road analysis covering approximately 50-70 miles of harvest roads on 65,000 acres of land acquired in the last 5 years from Plum Creek Timber lands. Currently, approximately 18 miles of roads that were acquired and deemed to be unsafe or were already closed have been decommissioned by the Forest Service. Under the Proposed Action, approximately 30.57 miles of road would be decommissioned.	The area has been partially surveyed for heritage resources, and additional surveys will take place. No impacts to known significant heritage resources have been identified. Currently, approximately 26.2 acres of roads have been decommissioned within the watershed. Both spatially and temporally, this road decommissioning would overlap with the proposed road obliteration, and other restoration projects identified in the MDP Alternatives. As a result, the road obliteration under the MDP and the Cle Elum Roads Analysis would cumulatively reduce the available road mileage in the U. Yakima 5th field watershed. The reduction in road mileage would improve downstream riparian habitat and allow for the re-establishment of vegetation on the obliterated roads, thereby improving treaty resources.
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	Heritage resources surveys have been completed and heritage resources located. WSDOT is consulting with the Washington SHPO to avoid, minimize or mitigate impacts to heritage resources, if any is found to be significant.
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	The land exchange resulted in an adverse effect on two NRHP-eligible historic railroad logging properties. However, impacts to these properties do not overlap spatially (at the 5th field) or temporally with the proposed MDP.
Keechelus Dam Repairs	The Keechelus Lake dam was repaired in 2003. The existing dam was rebuilt in place to correct structural problems. The project has been completed. Approximately 70 acres of vegetation was cleared to provide a work corridor. The project impacted 3.8 acres of wetlands.	Mitigative measures consisted of HAER documentation of the historic dam. The Dam Construction Camp, also NRHP-eligible, was also affected by the project. Effects were mitigated by data recovery. This project overlaps spatially in the 5th field scale with the proposed MDP.
Gold Creek Pond Trail Development	A native surface foot trail was constructed approximately 100 feet long. This project was completed in 2001.	Temporary impacts to 0.005 acre occurred during trail construction. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space or time with the MDP. No recorded heritage resources were affected.
U.S. West Telephone line	Installation of an underground telephone line in old road prism. This project was completed in 2001.	Temporary impact of 1.82 acres to install an underground line created disturbance to an already modified road prism. This project is assumed to have been stabilized as of 2005 and therefore does not overlap in space or time the MDP.

Table 4.9.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Heritage Resources in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Heritage Resources and Reserved Treaty Rights
WSDOT I-90 Maintenance	WSDOT maintains continuous custodian operations of the existing I-90 roadways. Maintenance includes application of sand and chemical deicers to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile are applied to I-90 within the Snoqualmie Pass area (WSDOT 1999, 2001).	On-going maintenance is not affecting known significant heritage resources.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	Land acquisitions have potential beneficial effects to unknown heritage resources by adding federal historic preservation protections to these lands. The recent purchase of Sections 5, 17, and 25 of Township 21N Range 11E occur within portions of the U. Yakima Watershed. These acquired lands would be allocated to the SPAMA and managed with an emphasis for late-seral habitat preservation. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP, resulting in cumulative benefits to fish and wildlife habitat and connectivity under Alternative 3 and Modified Alternative 5 (with a 390-acre Land Donation). Under Alternatives 2 and 4 (with no Land Donation), the Plum Creek Land Exchange (described above) and the other private land acquisitions would also contribute to overall improvement in wildlife habitat and connectivity in the vicinity of Snoqualmie Pass.
Plum Creek Cascade Habitat Conservation Plan	A HCP was developed for the Plum Creek Timber Company to manage timber harvest and protect wildlife habitat over several 5th field watersheds in the vicinity of Snoqualmie Pass.	Undiscovered heritage resources could be affected by surface and subsurface disturbance associated with land management practices of private timber company. This projects overlaps spatially (in the 5th field) and temporally with the MDP.

Table 4.9.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Heritage Resources in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Heritage Resources and Reserved Treaty Rights
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of The Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in both space and time with the MDP development. Alternatives 2 and 4 would increase detrimental soil conditions in the Study Area, and in conjunction with the private land developments and other ground disturbing activities, would cumulatively affect wildlife habitat and connectivity (treaty resources). Clearing and construction could affect undiscovered heritage resources in areas not previously disturbed.
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the Upper Yakima River watershed to accelerate the development of late-successional forest structure. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	Heritage resource surveys are partially completed. No known significant heritage resources will be adversely affected. A total of 210 acres of forest would be commercially thinned to accelerate the development of late-successional forest structure. This impacts of this project overlap spatially (in the 5th field) and temporally with the MDP. Short term impacts resulting in soil disturbance would occur. Protection of wildlife habitat would temporally and spatially overlap with the MDP resulting in cumulative benefits to wildlife habitat and connectivity under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange (described above) and the other private land acquisitions (described above) would also contribute to overall improvement in wildlife habitat (treaty resources).
Snoqualmie Pass AMA Plan	Land management plan for the AMA emphasizing late-successional habitat maintenance and enhancement	The emphasis on maintenance and enhancement of late-successional habitat under SPAMA would overlap spatially and temporally with the MDP. Coupled with other land acquisitions and Alternative 3 and Modified Alternative 5, with a 390-acre land donation, SPAMA would contribute to an overall improvement in wildlife habitat (treaty resource) and connectivity in the Snoqualmie Pass area.
WSDOT road de-icing	Application of sand and chemical deicers to roadway surfaces	Deicing and sanding of roadways overlaps spatially at the site and 5th field scale and temporally with the MPD. Coupled with the other projects in this table and the Action Alternatives, road deicing could result in cumulative effects to aquatic habitat conditions (treaty resource).

Table 4.9.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Heritage Resources in the 5th Field Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects to Heritage Resources and Reserved Treaty Rights
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the Okanogan-Wenatchee National Forest Land and Resource Management Plan.	The study of lands to determine suitability for preservation as wilderness would overlap spatially and temporally with the MDP. As this project has the potential to change land allocations of the Okanogan-Wenatchee National Forest, it could result in an overall improvement in wildlife habitat (treaty resource) if new lands are designated as wilderness.
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (West Keechelus subwatershed). The proposed project includes thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	The acceleration of late-successional forest conditions through thinning would overlap spatially (in the 5th field) and temporally with the MDP. No known heritage resources will be adversely affected. Soil disturbance due to logging equipment could potentially affect currently unknown heritage resources. In the long-term, and coupled with other projects improving late-successional habitat, this project would result in an overall improvement in wildlife habitat (treaty resource) in the Snoqualmie Pass area.
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (E. Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and fish passage improvements, and other restoration projects.	The acceleration of late-successional forest conditions through thinning would overlap spatially (in the 5th field) and temporally with the MDP. No known heritage resources will be adversely affected. Soil disturbance due to logging equipment could potentially affect currently unknown heritage resources. In the long-term, and coupled with other projects improving late-successional habitat, this project would result in an overall improvement in wildlife habitat (treaty resource) in the Snoqualmie Pass area.
Snoqualmie Pass Summer Home Tract Permit Reissuance	This project proposes to authorize continued recreation residence use of the 14 cabins located in the Snoqualmie Pass Tract for a 20-year period beginning January 1, 2009 with no change to the current authorized use.	The authorization and continued use of the recreation residences in the Snoqualmie Pass East Tract would overlap spatially and temporally with the MDP. The Tract has been determined eligible for the NRHP as a historic district. To address avoid adverse effects to the residences, the FS developed a Programmatic Agreement with the SHPO identifying preservation standards that would apply to maintenance and repair projects.

Table 4.9.7-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Heritage Resources in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Heritage Resources and Reserved Treaty Rights
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last 5 years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately 2 per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	These activities would take place within the APE for the MDP, and no impacts to known significant heritage resources have been identified. Approximately 0.01 acre of vegetation around each culvert would be impacted by construction equipment. Long-term impacts of culvert replacement would likely be beneficial (i.e., reduced sediment delivery and erosion would allow for maintenance/re-establishment of habitat along streams). Spatially and temporally, these culvert replacements would overlap with the MDP at the site scale, and would, as a whole, improve the culvert conditions throughout the Study Area. As the culverts occupy several hundred square feet within the watershed, they would directly contribute to improved sediment conditions, and therefore, habitat conditions (treaty resources) downstream.
Alpental Covered Bridge Replacement	The existing covered footbridge at Alpental washed out during a storm in 2003. The Summit-at-Snoqualmie has replaced the bridge as of October 2005.	No effects to known heritage resources resulted due to the bridge replacement. No new permanent impacts occurred as the new bridge was placed within the footprint of the old bridge. Temporary soil and vegetation disturbance occurred during construction and riparian vegetation was re-established during the Spring of 2006. Spatially, the bridge replacement occurred within the MDP Study Area, and buildings would be constructed within several hundred feet of the bridge under the Action Alternatives. As the re-establishment of riparian vegetation has been completed, this project does not overlap in time with the MDP proposal at the site scale.
Cave Ridge Land Donation	The Summit at Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	The donation of 138 acres to the National Forest would overlap spatially and temporally with the MDP at the site scale. Combined with other land acquisitions and the donation of 390 acres under Alternative 3 and Modified Alternative 5, this project would contribute to the overall improvement in wildlife habitat (treaty resource) and connectivity in the Snoqualmie Pass area.

Table 4.9.7-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Heritage Resources in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Heritage Resources and Reserved Treaty Rights
Projects Not Associated with The Summit-at-Snoqualmie		
FS Road 58 Bridge Replacement	An existing steel bridge over the South Fork Snoqualmie River was replaced on Forest Service Road 58 due to structural problems. The new bridge was expanded from one to two lanes with upgraded load capacity. Construction of the bridge was completed in spring 2005.	The historic bridge was evaluated and determined eligible to NRHP. HABS/HAER documentation was completed and the bridge was removed. With completion of the project in 2005, the bridge replacement does not overlap with the MDP in either space or time. Thus the bridge replacement would not cumulatively affect heritage resources in the 5th field scale.
Huckleberry Land Exchange	Exchange of NFSL for 6,798 acres of Weyerheauser lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	No impacts to known significant heritage resources would occur from the approximately 6,798 acres of Weyerhaeuser land received by the Forest Service. Approximately 702 acres are managed as Late Successional Reserves. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP, resulting in cumulative benefits to wildlife habitat and connectivity (treaty resources) under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange, Cave Ridge Land Donation, and the other private land acquisitions contribute to overall improvement in wildlife habitat and connectivity in the Snoqualmie Pass area.
WSDOT 1-90 Maintenance	WSDOT maintains continuous custodial operations of the existing I-90 roadways. Maintenance includes application of sand and chemical deicers to roadway surfaces during winter months. Approximately 189.9 tons of sand per lane-mile is applied to I-90 within the Snoqualmie Pass area.	On-going maintenance is not affecting known significant heritage resources.

Table 4.9.7-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Heritage Resources in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Heritage Resources and Reserved Treaty Rights
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The recent purchase of Section 19 of Township 22N Range 11E occurs within portions of the S.F. Snoqualmie River Watershed, and overlaps spatially (in the 5th field). Manegement of the aquired land would temporally overlap with the MDP. These lands will be allocated to Late Successional Reserve. Coupled with other land acquisitions in the Snoqualmie Pass area, cumulative fish and wildlife habitat (treaty resources) conditions would improve in the area, with a greater improvement under Alternatives 3 or Modified Alternative 5 (with a 390-acre land donation).
U.S. West Telephone line	Installation of an underground telephone line in the I-90 corridor	Temporary impacts due to installation of an underground phone line created disturbance to an already modified road prism and did not affect any known heritage resources. This project is assumed to have been stabilized and therefore does not overlap spatially or temporally with the MDP.
WSDOT road de-icing	Application of sand and chemical deicers to roadway surfaces	Deicing and sanding of roadways overlaps spatially at the site and 5th field scale and temporally with the MPD. Coupled with the other projects in this table and the Action Alternatives, road deicing could result in cumulative effects to aquatic habitat conditions (treaty resource).
BPA Proposed Additional Power Lines	Supplemental DEIS to examine development of an additional powerline. Options include adding lines to existing towers or adding new towers.	The construction of new powerline towers would overlap spatially (in the 5th field) and temporally with the MDP. Ground disturbance associated with installation of the towers could affect undiscovered heritage resources.
McClellan Butte Trail Reconstruction Project	The project will relocate approximately 1.5 miles of trail to newly constructed trail or old road bed, abandon 1.5 miles of trail, and rehabilitate tread, drainage and switchbacks as required along the remainder of the 4.4-mile trail.	Construction of this project overlapped with the MDP at the 5th field scale, however no impacts to heritage resources occurred

Table 4.9.7-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Heritage Resources in the 5th Field South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Heritage Resources and Reserved Treaty Rights
Bandera Mountain/Mason Lake Trail Relocation Project	This project reorganized trail access to Mason Lake and Bandera Mountain in order to minimize social and resource impacts associated with the existing trails. The project involved construction of 1.5 miles of new trail, reconstructing 2.0 miles of existing trail and decommissioning 2.3 miles of existing trail.	Construction of this project overlapped with the MDP at the 5th field scale, however no impacts to heritage resources occurred
High Lakes Trail #1012 and Snow Lake Trail #1013 Reconstruction	This project repaired seven switchbacks on the Snow Lake Trail and reconstructed 2 miles on the High Lakes Trail from Snow to Gem Lake.	Construction of this project overlapped with the MDP at the 5th field scale, however no impacts to heritage resources occurred
Denny Salvage	This project would salvage approximately 50 mbf of trees utilizing a ground based logging system. All undamaged trees with secure root systems would be left.	The salvage of approximately 50 mbf would overlap spatially (at the 5th field scale) and temporally with the MDP. No known significant heritage resources would be adversely affected. However, soil disturbance due to timber salvage could affect undiscovered heritage resources that were previously undisturbed.
I-90 Corridor Thin	The project involves commercially thinning approximately 338 acres in the I-90 Corridor. About 4.3 mmbf would be thinned from 14 units.	The thinning of approximately 338 acres in the I-90 corridor would overlap spatially (at the 5th field scale) and temporally with the MDP. No significant heritage resources would be adversely affected. However, soil disturbance due to thinning could affect undiscovered heritage resources that were previously undisturbed.
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	The construction of a trail and parking facilities would overlap spatially (at the 5th field scale) and temporally with the MDP. There is a potential effect to a segment of the Snoqualmie Pass Wagon Road. Soil disturbance could affect undiscovered heritage resources that were previously undisturbed.
Denny Creek Recreation Residence Permit Reissuance	Authorize continued recreation residence use of the 21 recreation residences located in the Denny Creek Tract for a 20-year period beginning January 1, 2009 with no change in the current authorized use.	The authorization and continued use of the recreation residences in the Denny Creek Tract would overlap spatially and temporally with the MDP. The Tract has been determined eligible for the NRHP as a historic district. To address avoid adverse effects to the residences, the FS developed a Programmatic Agreement with the SHPO identifying preservation standards that would apply to maintenance and repair projects.

4.9.8 Irreversible and Irretrievable Commitments of Resources

No irreversible commitments of known heritage resources that are eligible or potentially eligible to the NRHP would occur under any of the Alternatives. The modifications to the setting of the CCT would be irretrievably lost during the life of the ski area. However, if the time came that the resort was no longer desired or viable in the SUP area, the facilities could be removed and the area re-vegetated or allowed to return to a natural state. Pre-development conditions would not be achieved within the foreseeable future; however, some ski area development was already underway at the time the CCT was built.

Undiscovered heritage resources could be irreversibly committed in areas where native sediments will be disturbed. Heritage resources are limited, essentially non-renewable resources, an unknown number of which have been destroyed by road and railroad construction, recreational facility construction, logging, dam building, and other activities, as well as by natural forces. Damage to the integrity of these resources represents a permanent loss of scientific and cultural information and the potential to increase understanding of regional prehistory and history. Traditional cultural heritage resources are also limited due to past and present land alterations and development, among other factors. In the project area, highways, campground construction and use, logging, trail, and ski area development have affected the quality and accessibility of those resources. The USFS has requested information regarding traditional cultural heritage resources and uses of the area from the Tulalip Tribes, Yakama Indian Nation and Snoqualmie Tribe (see Section 1.6.1 – Tribal Government Consultation), and no TCHRs have been identified, therefore no irreversible or irretrievable commitments of TCHRs are known.

Irretrievable commitments of treaty resources would occur under all Action Alternatives. These are losses that span a period of time but that can be restored at a later time. Forested habitat could be replaced once the period of use is ended, and wildlife populations could recover. However some habitat types (mature forest) would not be restored for several hundred years. Elk, deer, and mountain goats, as well as huckleberries and many medicinal plants inhabit subalpine areas or the edge between forested and non-forested communities, and the period of habitat recovery for these treaty resources would be somewhat shorter than for mature forest communities.

4.10 SOCIAL AND ECONOMIC FACTORS

Potential social and economic impacts are presented for each alternative under the following categories: population; housing; employment; income; spending and economic characteristics; public services; and Environmental Justice.

4.10.1 Alternative 1 - No Action

The No Action Alternative serves as a means of analyzing the effects of "no future development" within the analysis area. All facilities, infrastructure and services would remain unchanged under the No Action Alternative, and it would not be expected to attract new market segments to the ski area. Because selection of the No Action Alternative would not change The Summit-at-Snoqualmie's services as a regional day-use resort, no new or measurable social and economic impacts would be expected.

With the exception of the *Mt. Hyak* quad chairlift at Summit East that has been approved but remains uninstalled, no previously-approved, unimplemented projects remain that would be constructed under this alternative. Any future developments/modifications proposed to occur on NFS lands at The Summit-at-Snoqualmie would require project-specific approval from the USFS or appropriate regulatory agency(s).

4.10.1.1 Population

No in-migration would be directly attributable to selection of Alternative 1. Full-time, year-round employment opportunities are more likely than seasonal jobs to attract new residents to an area; however, no such positions would be created under Alternative 1.

4.10.1.2 Housing

Selection of the No Action Alternative would not create any full time employment and therefore, as stated, this alternative would not sponsor in-migration to the area, or affect housing supplies in the impact communities.

Lack of on-site, large-scale employee housing is not currently an issue at The Summit-at-Snoqualmie. The Alpental facility currently does not house employees, nor is there a need to do so in the future under the No Action Alternative. Resort-wide housing capacity would continue to accommodate 19 employees. Therefore, under the No Action Alternative, most employees of the ski area would likely continue to choose to reside in the nearby communities of North Bend and Cle Elum and commute to work. Issaquah, Roslyn, and Ellensburg would continue to provide some housing opportunities. Employees in supervisory positions would continue to use The Summit's limited dormitory space in emergency situations or during interstate closures.

4.10.1.3 Employment

As noted in Section 3.10 – Social and Economic Factors, The Summit-at-Snoqualmie is not considered to be a major employer on a regional level. The Summit-at-Snoqualmie employees make up approximately 0.08 and 3.0 percent, respectively, of King and Kittitas counties' civilian workforces. Full-time, year-round employees make up approximately three percent of The Summit-at-Snoqualmie's entire workforce and part-time, seasonal positions would continue to make up the overwhelming bulk of ski area's staff.

Selection of Alternative 1 would not sponsor any short- or long-term employment at The Summit-at-Snoqualmie because no development or increases in ski area-related services would occur. Total peak employment at the ski area would continue to hover around 1,500 positions on an annual basis. On a county level (both King and Kittitas) The Summit-at-Snoqualmie would continue to constitute a relatively minor proportion of the total civilian workforce. No impacts to regional employment could be attributable to Alternative 1.

4.10.1.4 Income

Individual income levels in the impact communities described in Chapter 3 would not be affected by Alternative 1, in terms of base salaries and wages. This is true both for resort and non-resort jobs. Due to the seasonal and unskilled nature of the majority of jobs at the ski area, the pay scale would likely remain unchanged, while reflecting current economic trends (e.g., inflation, cost of living, etc.). Incentives, such as bonuses based on a returning employee's length of service, or a new employee remaining at the resort through specified dates, would likely continue.

4.10.1.5 Economic Characteristics and Visitor Spending

Under Alternative 1, it is expected that The Summit-at-Snoqualmie would remain an important source of regional winter recreation while constituting a small component of the regional winter economy. With no improvements or additional service offerings, Alternative 1's overall impact on spending and the economic characteristics of the area would be less than under the Action Alternatives.

Under Alternative 1, due to the lack of infrastructure or capacity additions, The Summit-at-Snoqualmie may choose to increase lift ticket prices beyond the standard rate of inflation in order to control weekend and holiday crowds, as well as to enhance profitability over the long-term. Skier visit projections under Alternative 1 are shown in Section 4.11 – Recreation. Skier visit assumptions are provided in Appendix J – Assumptions Used in the Recreation, Social and Economic Analysis.

With so many ski areas to choose from, more than ever, skiers are demanding value, quality and diversity when it comes to choosing where to spend their money. Alternative 1 represents no improvements to the recreational experience, capacity and/or variety to meet skier demands over the long-term. In this regard, Alternative 1 could indirectly promote the economic success of other ski areas in the region that have, or are proposing, facility improvements.

Visitor spending under the No Action Alternative would not be expected to increase. Overall, it is expected that off-site summer visitor spending sponsored by The Summit-at-Snoqualmie under the No Action Alternative would continue to be relatively small since it is expected that the majority of visitors using the resort in summer would be passing through the area for other reasons. Limited developed summer recreational opportunities currently exist at the ski area, consisting of the following: dispersed hiking, mountain biking, and summer concerts at Alpental (one in July and one in August). Lift-served hiking, mountain biking and scenic chairlift rides are no longer offered at The Summit-at-Snoqualmie. These summer activities have not historically represented a measurable economic impact to the ski area or impact communities.

4.10.1.6 Public Services

No changes in public services would be anticipated under the No Action Alternative.

4.10.1.7 Environmental Justice

Selection of the No Action Alternative would not disproportionately affect any identified low-income or minority populations in the impact communities.

4.10.2 Impacts and Assumptions Common to All Action Alternatives

Alternatives 2 through Modified Alternative 5 include a range of facility enhancements at The Summit-at-Snoqualmie that would allow the resort to maintain and broaden its appeal in the regional skiing marketplace. Improvements are proposed to improve circulation between Summit East, Central and West and increase skier circulation efficiency at the ski areas. These improvements would make The Summit-at-Snoqualmie a more cohesive, efficient ski area, thereby increasing the distribution of CCC throughout the various base area portals and on-mountain focal points. However, the ski area's role as a regional day-use resort is not expected to change.

As is currently the case, the ski area would not be expected to represent much of a contribution to the regional (King and Kittitas Counties) civilian workforce or economy under any of the Action Alternatives. These improvements would be expected to generate some modest economic growth in the Snoqualmie Pass area, as well as spin-off socioeconomic effects within the nearby impact communities along Interstate 90 west of the Pass (North Bend, in King County) and east of the Pass (Cle Elum, South Cle Elum, and Easton, in Kittitas County). However, given the size of the economies of both King and Kittitas counties, measurable impacts are not expected to be produced at the county or regional level under any alternative.

The majority of additional visitation generated by improvements proposed in Alternatives 2 through Modified Alternative 5 would occur at the ski area in the winter, and the majority of the spending generated by resort visitors would be expected to take place at the resort itself. For these reasons, the

Snoqualmie Pass area would be expected to experience most of the direct economic effects of implementing any approved projects.

Because, in regards to potential social and economic effects, the differences between the four Action Alternatives are assumed to be only minor, the bulk of potential impacts are addressed in this discussion of impacts and assumptions common to all alternatives. Specific social and economic impacts for each alternative are accounted for under subsequent headings.

4.10.2.1 Population

Table 4.10.2-1 provides population projections for King and Kittitas counties through 2025. Between 2005 and 2010, the populations of King and Kittitas counties are projected to increase by approximately 4.0 percent and 7.0 percent, respectively. Furthermore, between 2010 and 2025, the populations of King and Kittitas counties area projected to increase by 11 and 18 percent, respectively.

Table 4.10.2-1:
Population Projections for King and Kittitas Counties

	2005	2010	2015	2020	2025
King	1,787,000	1,861,000	1,940,000	2,019,000	2,092,000
Kittitas	34,300	36,700	39,500	41,800	44,000

Source: Washington Office of Financial Management 2002.

Little, if any, in-migration to the impact communities would be directly attributable to any of the Action Alternatives. The seasonal nature and relatively low pay scales of the vast majority of ski resort jobs generally attract few new full-time residents to an area. Most of the seasonal jobs are typically filled either by transient employees staying only through the season, or by residents already living in the area or moving to the area for reasons other than seasonal resort employment opportunities. Full-time, year-round employment opportunities are more likely than seasonal jobs to attract new residents to an area; however, few full-time, year-round positions would be created as a result of any of the Action Alternatives.

4.10.2.2 Housing

As described in Section 3.10 – Social and Economic Resources, based on 2002/03 data, county of residence for The Summit-at-Snoqualmie's employees was broken down according to the following percentages: 61 percent in King, 31 percent in Kittitas, six percent in Pierce, and two percent in Snohomish (see Table 3.10.6-1). Proportionally, under all Action Alternatives the county of residence would be expected to remain similar to existing conditions. While additional employment opportunities at the ski area would be created under each of the Action Alternatives, no additional employee housing units are proposed.

As with the No Action Alternative, most employees of the ski area would likely continue to choose to reside in the nearby communities of North Bend and Cle Elum under the Action Alternatives, and

commute to work. Issaquah, Roslyn, and Ellensburg would also continue to provide some housing opportunities. Therefore implementation of the projects proposed in Alternatives 2 through Modified Alternative 5 would not be expected to increase the Snoqualmie Pass area's year-round or seasonal population. Resort management would continue the existing employee housing program under all Action Alternatives - principally for supervisory employees and for emergency situations created by weather-related interstate closures.

The most significant effect on housing in the impact communities is the potential for a shortage of affordable housing within a reasonable commuting distance of The Summit-at-Snoqualmie for the majority of the ski area's workforce – those with non-supervisory positions.

Additional jobs created under each of the Action Alternatives could potentially heighten demand for, and price of, homes within a reasonable commuting distance of the resort. However, the majority of jobs would be seasonal in nature, intuitively increasing demand for short-term, seasonal rentals instead of home sales.

Additionally, buildout of any approved suite of projects at the ski area could heighten interest in property at the Pass, indirectly increasing residential development there.

4.10.2.3 Employment

The number of seasonal employment opportunities at The Summit-at-Snoqualmie would increase under each alternative. For the purposes of this analysis, Ski Lifts, Inc. management estimates that additional employment opportunities at The Summit-at-Snoqualmie generated under each Action Alternative would correspond more or less proportionally to the increase in CCC at the ski area (see Table 4.11-1).[66]

Short-term impacts reflect county-wide employment associated with the construction of the proposed improvements, including jobs at the construction site, as well as jobs with affected suppliers, manufacturers, and service providers. Long-term employment impacts reflect jobs supported by visitor and employee spending both at the resort, and at unrelated businesses of all types in King and Kittitas counties (i.e., gas stations, hotels, restaurants). However, increases in short- and long-term employment are expected to be absorbed by regional population increases projected for King and Kittitas counties, making an accurate quantification of the economic effects associated with each of the Action Alternatives difficult to ascertain.

Short-Term, Construction-Related Employment

Short-term employment projections are based on a three-phased implementation plan for each alternative and estimated costs for each phase of development.[67] Generally, these projections reflect expected total

[66] Since The Summit-at-Snoqualmie represents such a small proportion of the local workforce economic modeling was not used to determine on- and off-site, long- and short-term employment impacts of the Action Alternatives.
[67] Each phase would consist of more than one construction season.

development costs, inclusive of expenditures for some specialized equipment such as lifts, snowmaking equipment, and grooming machines. Though labor costs associated with lift installations would be primarily local, the majority of hard costs for specialized ski area equipment would be paid to businesses outside of King or Kittitas counties (i.e., lift manufacturers).

Table 4.10.2-2 estimates construction costs by alternative through Phase 3.

Table 4.10.2-2:
Estimated Construction Costs by Alternative (millions)[a]

Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
0	~62.1	~51.7	~60.5	~57.1

Source: SE GROUP 2007.
[a] Estimates for construction costs are based on standard industry construction methodologies and costs. Construction costs have been adjusted for inflation at 3 percent per year to year 10. Costs of restoration projects are included.

Table 4.10.2-3:
Estimated Short-Term Construction Employment Generated by Alternative (in Full-Time Equivalent)[a]

	Alt 1	Alt 2	Alt 3	Alt 4	Mod Alt 5
Lifts	0	138	121	125	138
Trails	0	8	8	8	8
Night Lighting	0	6	6	6	6
Buildings	0	190	182	190	190
Utilities	0	16	7	16	16
Roads	0	5	5	3	5
Parking	0	5	5	5	5
Total	**0**	**368**	**334**	**353**	**368**

Source: Ski Lifts, Inc. and SE Group 2004
[a] All estimates for short-term construction related employment are based on typical ski area construction methodologies. Depending on ultimate phasing of construction projects (e.g., multiple lifts being erected at the same time), economies of scale may increase efficiencies and therefore reduce short-term employment generated.

Long-Term Employment

Under all Action Alternatives, increased visitation would sponsor employment increases, both on-site and off-site. Alternatives 2 through Modified Alternative 5 would sponsor increases in long-term employment at The Summit-at-Snoqualmie as a result of additional lifts, new and expanded facilities and guest services, additional grooming, and expanded ski school and ski patrol operations. Most of the newly created positions would be seasonal in nature. Table 4.10.2-4 approximates direct, long-term employment generated at The Summit-at-Snoqualmie under each alternative, in relation to increased CCC.

Table 4.10.2-4:
Estimated Direct Employment Generated Under Each Alternative

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
CCC	10,020	13,630	12,610	12,280	13,930
Projected Total Employees[a]	~1,515	~2,100	~1,950	~1,890	~2,100
Percent Increase in Direct Employment	No Change	~39%	~29%	~25%	~39%
% of King County Civilian Workforce (1,363,000)[b]	~0.06%	~0.09%	~0.09%	~0.08%	~0.09%
% of Kittitas County Civilian Workforce (14,920)[b]	~3.0%	~4.2%	~3.9%	~3.8%	~4.2%

[a] Based on 2002/03 and 2003/04 seasonal averages of 1,515 employees. Assumes full build-out, and that the proportions of employees who reside in King and Kittitas counties would remain at approximately 60 percent and 30 percent, respectively. It is expected that approximately three percent of total employment at the ski area would be full-time, year-round with the remaining 97 percent composed of full-time and part-time seasonal employees.
[b] Based on Washington State Employment Security Department, 2002.

As indicated in Table 4.10.2-4, given the sizes of the King and Kittitas County economies, none of the alternatives represents a sizable impact on total employment (percentage of civilian workforce) of the region.

4.10.2.4 Personal Income

Individual income levels described in Section 3.11 – Social and Economic Factors (i.e., base salaries and wages) are not likely to be impacted by the proposals in the Action Alternatives. This is true both for resort and non-resort jobs.

Spending generated by the ongoing operations of the proposed expanded resort could support additional off-site jobs in the impact communities (i.e., indirect labor). These jobs would result in personal income for new members of the workforce, or additional personal income for current members of the workforce through additional hours worked.

Overall, given the size of the King and Kittitas County economies, increases in total personal income sponsored by Alternatives 2 through Modified Alternative 5 would be negligible.

4.10.2.5 Spending and Economic Characteristics

Annual resort expenditures for operating costs such as land use fees and taxes (property and sales) would be expected to increase in accordance with visitation and revenue increases under each alternative. These payments generally would return to the community and generate additional spending and employment within the impact area.

Visitor Spending

Annual visitation and visitor spending are expected to increase under each Action Alternative, as related to improved recreational offerings, and are expected to vary slightly by alternative, depending on the proposed amenity mix (winter and summer), CCC under each of the alternatives, and construction/implementation phasing over the course of any approved build-out. As is the current case, visitors would be expected to purchase fuel closer to home and spend more of their food dollars before driving to Snoqualmie Pass. Skier spending in the impact communities as part of overall economic spending throughout the year at North Bend or Cle Elum is assumed to be marginal in light of the overall size of the two counties' economies.

It is expected that off-site summer visitor spending sponsored by The Summit-at-Snoqualmie would be relatively small under all alternatives, since it is expected that the majority of visitors using the resort in summer would be passing through the area for other reasons. Existing developed summer recreational opportunities, including hiking (lift-served and dispersed), lift-served mountain biking, summer concerts at Alpental (typically one in July and one in August), and scenic chairlift rides on the Central Express would continue, and would be complimented by construction of the Pulse Gondola (Alternatives 2, 4 and Modified Alternative 5), which would provide year-round ADA-accessible transport to the summit of Alpental for various recreational activities.

Assuming a ten-dollar ticket for a ride on the Pulse gondola under Alternatives 2, 4 and Modified Alternative 5 and ridership of approximately 80,000/year at the end of the alternative period (see Illustration 4.11-1), the Pulse gondola would represent an opportunity for The Summit-at-Snoqualmie to realize an estimated $800,000 is gross revenues over the no action or Alternative 3.[68]

Tax Distributions and Use Fees

Retail sales and local sales and use tax revenues would be expected to increase in accordance with visitation and visitor spending. Though sales tax does not apply to all sales, it is charged on a majority of consumer products associated with resort visitation, such as equipment sales and rentals, and restaurant meals.

As a result of new lifts, lodges, parking and utility development, each of the Action Alternatives would sponsor substantial increases in property tax revenues over the long-term. Forest Service land use fees would increase under all Action Alternatives, commensurate with visitation and gross ski area revenues.

Economic Viability of The Summit-at-Snoqualmie

Each alternative is economically viable in the short- and long-term, with differences depending upon the actual timing of construction phases, method of financing, pricing structure, market response to improvements, and the degree to which the alternative connects Summit East to Summit Central. Ski

[68] This does not include incidental spending that may occur as a result of the gondola (i.e., restaurant sales).

Lifts, Inc., operator of The Summit-at-Snoqualmie, is an established, well-funded company that has investigated financing and return on investment for the projects proposed under each alternative.

4.10.2.6 Public Services

Fire Protection

In the short-term, each of the Action Alternatives represents increased potential for wild-land fires during construction due to greater human activity and use of construction equipment. With use of BMPs, increased fire threat under all Action Alternatives would be reduced to a level of insignificance.

Each of the Action Alternatives represents increased potential for structural fire ignition due to increased building square footage and use levels. However, more stringent fire codes, automatic sprinkling systems, and employee training would tend to offset the potential for increased fire incidence and demand for fire protection services.

During the summer months, marginal increases in visitation to The Summit-at-Snoqualmie would also increase the potential for structural and wild-land fire ignition within the SUP boundary. As indicated above, potential increases in structural fires would be offset by meeting fire codes and fire protection equipment. Over the long-term, ski trail clearing and/or glading under the Action Alternatives would reduce overall fuel accumulation within the ski area boundary, reducing wild-land fire risk.

Overall, it is expected that the Action Alternatives would pose no significant increase in demand for local agency fire protection services, as compared to Alternative 1.

Police Protection

Potential increases in winter demand for police protection/services at The Summit-at-Snoqualmie would be tied to additional visitation to the area. Such demand would be related to increased potential for traffic accidents and other infractions along Interstate 90, as well as increased potential for theft, search and rescue calls, or other related events in the vicinity of the ski area.

Emergency Medical

The anticipated increases in terrain and visitation under the Action Alternatives could result in a need for increased emergency medical facilities at The Summit-at-Snoqualmie. The projects proposed under each of the Action Alternatives include both an increased number of ski patrol duty stations throughout the resort, and an expanded amount of floor space for duty stations and the first aid station.

It is impossible to predict how many visitors in any given season would require emergency medical care. Emergency medical response would continue to be provided via a local volunteer fire department located in Snoqualmie Pass. None of the alternatives would be expected to cause levels of emergency medical demand beyond the capabilities of the current providers.

4.10.2.7 Environmental Justice

No disproportionate impacts to low-income and/or minority populations in the impact communities have been identified with selection of any of the Action Alternatives. While the anticipated increase in housing demand as a result of increased employment under the Action Alternatives may have the effect of decreasing the amount of affordable housing available within commuting distance of The Summit-at-Snoqualmie, increasing direct and indirect employment opportunities in the impact communities would be an economic benefit.

4.10.2.8 Capital Investments and Returns

In response to public comments received on the DEIS, this social and economic analysis has been updated to include a break-even analysis. As described below, the purpose of this analysis is to compare the revenues and expenses associated with each alternative and to determine the "break-even point."

The five alternatives include differences in capital investments based on the level of development proposed. Alternative 1 (No Action) includes no improvements or new facilities at The Summit-at-Snoqualmie. The Action Alternatives include capital investments in lifts, buildings and other facilities. The costs of improvements for the Action Alternatives range from $51.7 million to $62.1 million (see Table 4.10.2.2).

The current and future lift ticket revenue would become the main source of funds to support these investments. Lift ticket revenue is also augmented by income from the sale of food and beverage, ski rentals/repairs and ski school. The upgrade of lifts, terrain and facilities in each Action Alternative would improve the skiing experience and thereby increase the ability of The Summit-at-Snoqualmie Ski Area to attract more skiers, and to a certain extent increase lift ticket prices to cover the cost of improvements. Increases in both skier visitation, displayed in Table 4.10.2-FEIS 1, and lift ticket revenues throughout the projection period ultimately determine the investment returns for the project (see Appendix J – Assumptions Used in the Recreation, Social and Economic Analysis).

Table 4.10.2-FEIS 1:
The Summit-at-Snoqualmie Visitation Projection Comparisons

Visitor Projections	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Mod. Alt. 5
Year 1	490,860	507,058	504,113	497,241	507,058
Year 10	536,846	633,803	622,823	597,698	633,803
Percent Increase from Alt. 1/Year 1	9%	23%	21%	18%	23%

The revenue associated with each visitor at The Summit-at-Snoqualmie was used to estimate future revenue per skier visit based on current trends and adjusted by the skier improvements associated with that alternative. In a similar manner the cost associated with each alternative was calculated based on the

projected costs of the lifts, facilities, and infrastructure as well as additional expenses for operations (e.g., wages, insurance, cost of goods sold).

These numbers were then used to determine the number of visitors needed to reach operational break-even. Operational break-even represents the number of skiers needed in any given year to cover all costs that the mountain incurs in that year. The determination of a break-even point is an important measure used to assess the economic feasibility of each alternative.

The break-even analysis was completed using the current operational characteristics of The Summit-at-Snoqualmie and adding projected increases in skier visits and revenues per skier visit. Future yearly expenses were estimated using the current operational costs at The Summit-at-Snoqualmie and dividing these costs into fixed, variable and semi-variable expenses. The allocation of costs into these expense categories was important because the proposed alternatives affect these costs to a different degree.

- Fixed expenses occur regardless of skier volume and still remain when the mountain is closed or when there are fewer skiers at the mountain. Fixed expenses include depreciation expense, debt service, insurance, overhead and administrative costs.

- Semi-variable expenses are those that vary with both the length of the operating season and the volume of skiers at the mountain. These expenses include some portion of salaries and wages, slope grooming, maintenance, ski patrol, visitor services.

- Variable expenses include those that are directly tied to the number of skiers at the mountain and include items such as salaries and wages, food and bar, sales tax, etc.

The debt service on capital investments for the proposed alternatives is, to a large extent, fixed operating expenses. These assets (lifts and buildings) are expensed (depreciated) using a fixed schedule, while other items such as terrain clearing are expensed as they occur and are also not dependent on skier visits. Some of the alternatives also add significant semi-variable and variable expenses due in part to increased wages and salaries associated with new lifts, slope grooming and other items associated with the improvements.

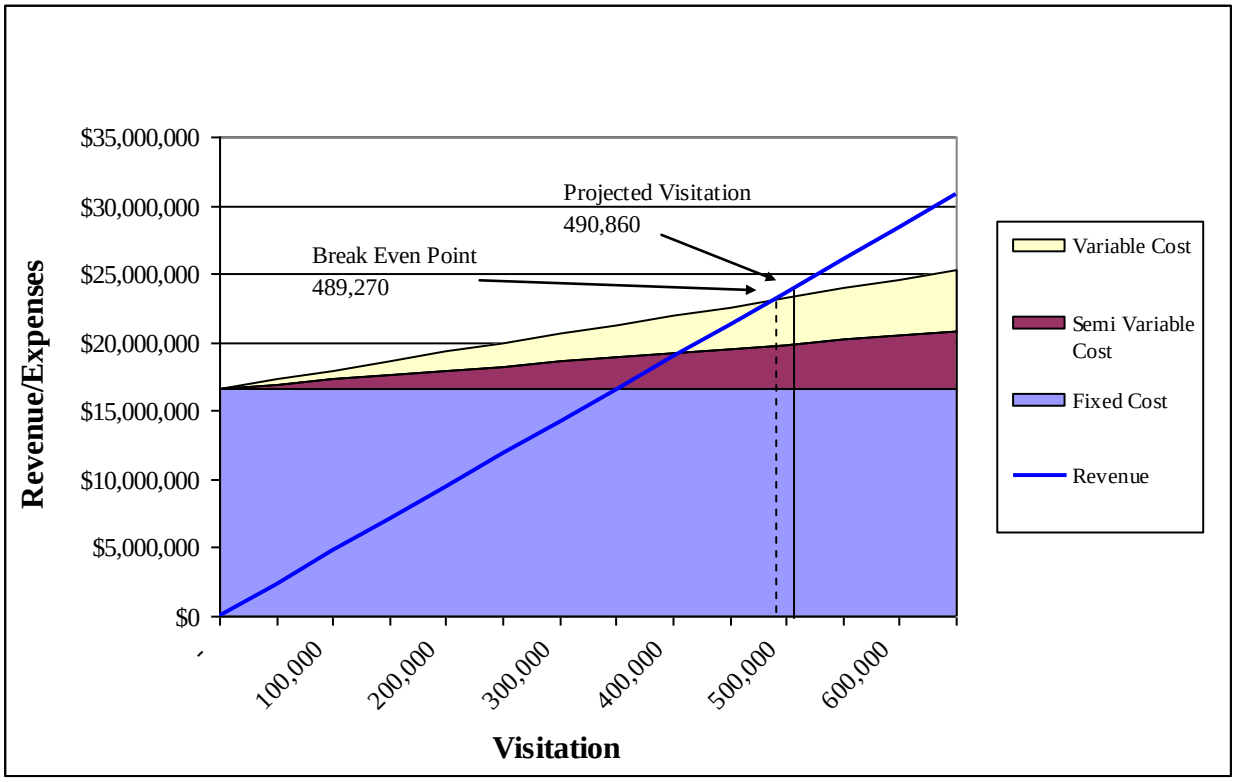
The break-even analysis was completed for a ten-year period following the implementation of the alternatives by evaluating the revenue received per skier visit. The costs tied to each skier visit (variable and semi-variable expenses) were subtracted from the revenue per skier visit to determine a contribution margin. This number represents the amount the mountain would receive per skier visit to cover fixed operational costs. An operational break-even point was then computed as the number of skier visits needed to cover all fixed, semi-variable and variable expenses.

Alternative 1 (No Action)

Under the No-Action Alternative, the operating break-even would be attained at 489,270 skier visits (see Illustration 4.10.2-FEIS-1). During the past ten ski seasons (1997/98 to 2006/07), The Summit-at-

Snoqualmie Ski Area averaged 463,384 skier visits, which is below the break-even point.[69] As shown in Table 4.10.2-FEIS 1, skier visitation would increase by approximately nine percent under Alternative 1, to a total of 490,860. As a result, the ski area operation would exceed the break-even point by approximately 1,590 visits per year.

Illustration 4.10.2-FEIS-1:
Alternative 1 Break-Even Analysis (No Action Alternative)

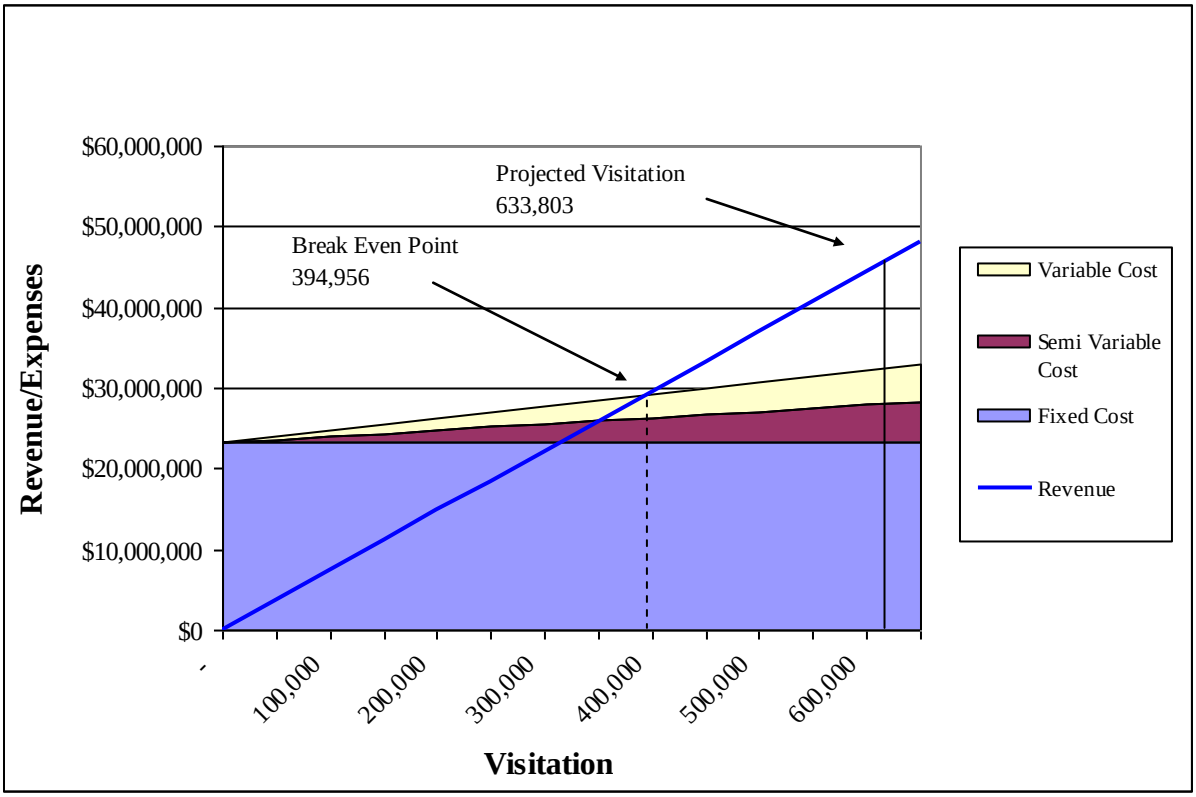


Alternative 2 and Modified Alternative 5

Under Alternative 2 and Modified Alternative 5, The Summit-at-Snoqualmie would be positioned to increase revenue per skier visit (see Appendix J – Assumptions Used in the Recreation, Social and Economic Analysis). With increased revenue per skier visit, the operating break-even point for The Summit-at-Snoqualmie would decrease to 394,956 skier visits. As shown in Table 4.10.2-FEIS 1, visitation is projected to increase to approximately 633,803 in ten years under Alternative 2 and Modified Alternative 5. As a result, Alternative 2 and Modified Alternative 5 would exceed the break-even point by roughly 239,000 visits (see Illustration 4.10.2-FEIS-2).

[69] This average incorporates the 2004/05 season, when The Summit-at-Snoqualmie Ski Area was open for business a total of 34 days out of a usual average of 134 days per season (averaged from 2001/2002 to 2006/07 ski seasons, excluding 2004/05 ski season). Excluding 2004/05, the FEIS ten-season average (1997/98 – 2006/07), totaled 508,741 skier visits, which is above the break-even point.

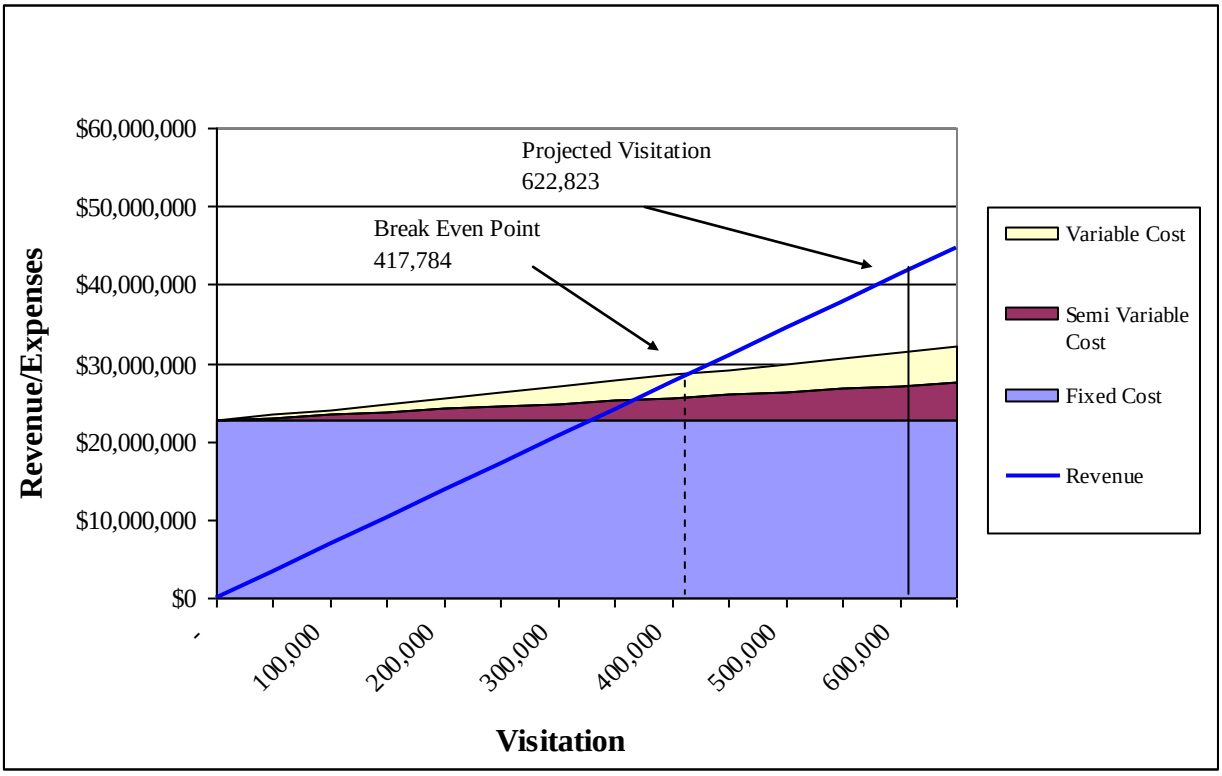
Illustration 4.10.2-FEIS-2:
Alternative 2 and Modified Alternative 5 Break-Even Analysis



Alternative 3

Alternative 3 provides for less capital investment and operating expenses than Alternative 2 and Modified Alternative 5. As a result, as Alternative 3 provides fewer new facilities than Alternative 2 and Modified Alternative 5, the increase in revenue per skier visit is smaller. Resulting in the break-even point of 417,784 skier visits, which is higher than Alternative 2 and Modified Alternative 5. Overall, skier visit response to improvements under Alternative 3 would be less than the response to Alternative 2 due to the absence of the *Creek Run* chairlift at Summit East and the *Pulse Gondola* at Alpental. As shown in Table 4.10.2-FEIS 1, annual visitation under Alternative 3 is projected to increase to 622,823 visits, roughly 205,000 visits higher than the break-even point, as illustrated in Illustration 4.10.2-FEIS 3.

Illustration 4.10.2-FEIS-3:
Alternative 3 Break-Even Analysis

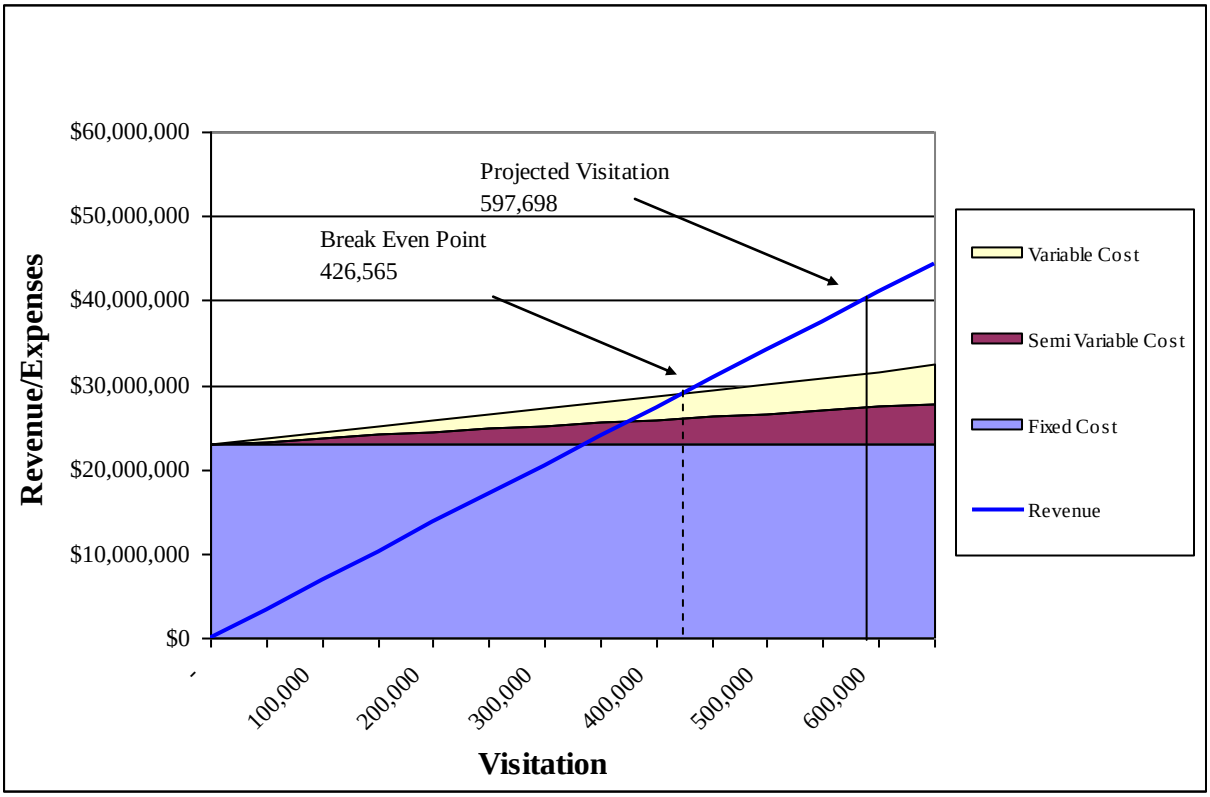


Alternative 4

Alternative 4 provides for less capital investment and operating expenses than Alternative 2, Alternative 3 and Modified Alternative 5. Overall, skier visit response to improvements under Alternative 4 would be less than any of the Action Alternatives, as neither the *Creek Run* nor the *Rampart* chairlifts and associated trails would be developed (see Table 4.10.2-FEIS-1 and Appendix J – Assumptions Used in the Recreation, Social and Economic Analysis).

As a result, the increase in revenue per skier visit is smaller than any of the Action Alternatives, causing the break-even point to be higher than under the other alternatives (see Appendix J – Assumptions Used in the Recreation, Social and Economic Analysis). Annual visitation under Alternative 4 is projected to increase to 597,698 visits, roughly 171,000 visits higher than the break-even point of 426,565 visits, as illustrated in Illustration 4.10.2-FEIS 4.

Illustration 4.10.2-FEIS-4:
Alternative 4 Break-Even Analysis



4.10.3 Alternatives 2 and Modified Alternative 5

For all practical purposes, from a socioeconomic perspective Alternatives 2 and Modified Alternative 5 can be considered identical. Estimated costs of construction of these alternatives are identical. Under both Alternatives 2 and Modified Alternative 5, the increased capacity would be achieved through the replacement of existing lifts, installation of new lifts, development of new ski terrain and construction of additional support facilities.

Over the ten-year projection period (across three development phases), annual visitation at The Summit-at-Snoqualmie is projected to increase from an average of 486,000 between 1999/00 and 2003/04 to 633,8003– a 22 percent increase (see Table 4.11-2 and Appendix J – Assumptions Used in the Recreation, Social and Economic Analysis).

In Phase 1, the *Rampart* and *Creek Run* development would stimulate increased visitation due to offering new lifts and ski trails, in combination with lift replacements, improved crossover trails (e.g., Summit East-Summit Central crossover) and added parking facilities. As the first new terrain offering in many years, overall visitation is projected to increase by 10 percent at the end of Phase 1, representing an annual increase of 3.3 percent. During Phase 2, the new *Internationale* lift at Alpental, coupled with lift replacements and new skier support facilities located throughout the facility would further stimulate

visitation growth, although at a lower rate than forecast in Phase 1. Skier visitation is projected to increase at a rate of two percent annually during Phase 2. In combination with upgrades from Phase 1 and 2, the Phase 3 improvements for skiers (lift replacements, base area and mountain-top skier support facilities, parking and the *Pulse Gondola* at Alpental), would continue to generate increased visitation growth of 2.5 percent annually.

The *Pulse Gondola* and mountain-top restaurant at Alpental are expected to become a year-round attraction and foster non-skier visits on a year-round basis. Proximity to the Puget Sound market area, the convenient location off of I-90, and views of the surrounding Cascade Range are all positive attributes that are expected to generate non-skier visitation. Similar to other operations at ski areas, the new facility is expected to generate 70,000 non-skiing visits in its first year of operation and grow at a rate of six percent during the final three years of Phase 3.

All socio-economic effects are assumed to be as described under "Impacts and Assumptions Common to All Action Alternatives" with the following exceptions.

4.10.3.1 Employment

As indicated above in Tables 4.10.2-3 and -4, Alternatives 2 and Modified Alternative 5 represent identical employment increases, and projected short- and long-term employment under Alternatives 2 and Modified Alternative 5 are the highest of all Action Alternatives. Estimated short-term employment supported by construction projects in these alternatives total 368 (full time equivalent) across the three-phase build-out period. Direct, long-term employment at the ski area would be expected to increase by approximately 39 percent (585 employees).

4.10.3.2 Spending and Economic Characteristics

Compared to Alternatives 1, 3 and 4 visitor spending under the Proposed Action and Modified Alternative 5 would be expected to be the highest, as would resort payroll, sales and property taxes. Likewise, SAPRC fees collected by the Forest Service would be expected to be the highest under these alternatives. This is due to the most widespread terrain and infrastructural improvements, coupled with higher projected annual visitation for Alternatives 2 and Modified Alternative 5.

Improved access and terrain diversity offered by the addition of the Creek Run and Rampart pods, as well as the re-establishment of skiing in the *Mill Creek* pod, would incorporate Summit East into the overall The Summit-at-Snoqualmie operation. As a result, skier access to and from Summit East, and thus, the viability of Summit East would be substantially improved as compared to the other Action Alternatives.

4.10.4 Alternative 3

Alternative 3 includes reduced development in Section 16 and addresses concerns to late-successional habitat and wildlife connectivity and Riparian Reserves, as compared to Alternative 2. The major

difference between Alternative 3 and the Proposed Action is that the *Pulse Gondola*, *Creek Run* Chairlift and mountain-top restaurant at Alpental would not be constructed. The ski area's CCC would increase from 10,020 to 12,610 (21 percent).

Accordingly, the number of lifts The Summit would operate is 21 (17 chairlifts and 4 surface lifts). The trail network at The Summit would increase by approximately six acres, from the existing 70 named trails on approximately 545 acres, to 76 trails on approximately 551 acres, as compared to existing conditions. The Summit's CCC would increase from 8,140 to 9,990 skiers (720 less than proposed in Alternative 2).

Overall, the skier visit response to improvements under Alternative 3 would be less than the response to Alternative 2 due to the absence of the *Creek Run* chairlift at Summit East and the *Pulse Gondola* at Alpental (see Table 4.11-2, Illustration 4.11-1 and Appendix J – Assumptions Used in the Recreation, Social and Economic Analysis).

In Phase 1, two new lifts (*Internationale* chairlift at Alpental and the *Rampart* chairlift at Summit East), in combination with other lift replacements and other visitor improvements throughout the ski facility, are expected to generate an overall increase in visitation of eight percent by the end of Phase 1 (year 3 of the projection period), representing an annual increase of 2.7 percent. During Phase 2, replacement lifts, additional skier support facilities and parking expansion would further stimulate visitation growth, although at a slightly lower rate than under Phase 1. Skier visitation would increase at a rate of two percent annually during Phase 2. The Phase 3 improvements under Alternative 3 provide for continued lift replacements and the construction of additional skier support facilities. It is expected that these improvements would continue to stimulate visitation growth at a rate of 2.5 percent annually.

4.10.4.1 Employment

Alternative 3 represents less direct employment than either Alternative 2 or Modified Alternative 5, but slightly more than Alternative 4 due to its mix of proposed amenities (omission of the *Pulse Gondola*, *Creek Run* chairlift and mountain-top restaurant). Short-term construction related employment could be expected to be the lowest (334 [full time equivalent]) of all Action Alternatives.

4.10.4.2 Spending and Economic Characteristics

Alternative 3 would be expected to induce lower winter visitor spending than either Alternative 2 or Modified Alternative 5, but higher spending than Alternative 4. Summer visitation under Alternative 3 would be similar to the No Action Alternative, potentially resulting in the lowest summer visitation among the Action Alternatives. As a result, resort payroll, sales and property taxes, and SAPRC fees collected by the Forest Service would be expected to be lower than the other Action Alternatives.

With the *Creek Run* lift not developed and no new egress route from *Silver Fir* to Summit East, it is expected that public demand for recreation at Summit East would be less, mainly due to the limited access to the area. Specifically, Trail 49, the access trail from the *Silver Fir* lift to Summit East would remain in

its current location. As a result, Trail 49 would continue to inhibit efficient access between Summit Central and Summit East, largely due to inadequate slope gradients that require skiers to pole and snowboarders to dismount.

The addition of the Rampart lift would improve skiing conditions on some trails (e.g., Trails 61 and 63 – see Figure 2.3.4-1, Alternative 3 Proposed Conditions – The Summit) by providing fall-line skiing on trails that currently do not follow the fall-line. This improvement would not add any new intermediate trails to Summit East. The re-establishment of skiing in the *Mill Creek* pod would improve the diversity of terrain at Summit East, including the addition of two new intermediate trails. However, the long-term economic viability of Summit East as an integrated component of The Summit-at-Snoqualmie would be reduced, as compared to alternatives that include the development of the *Creek Run* pod (Alternative 2 and Modified Alternative 5).

At Alpental, elimination of the pulse gondola would substantially reduce the ability to generate revenue during the summer season as compared to the other Action Alternatives.

4.10.5 Alternative 4

Next to the No Action Alternative, CCC under Alternative 4 would be lowest of the Action Alternatives. The Summit-at-Snoqualmie's CCC would increase from 10,020 to 12,280.

Overall, skier visit response to improvements under Alternative 4 would be less than Alternatives 2 and 3 as neither the *Creek Run* nor the *Rampart* chairlifts and associated trails would be developed (see Table 4.11-2, Illustration 4.11-1 and Appendix J – Assumptions Used in the Recreation, Social and Economic Analysis).

During Phase 1, the installation of the new *Internationale* lift at Alpental and the replacement lifts at Summit East, Central and West, would stimulate visitation growth by four percent at the end of Phase 1 (year 3 of the projection period), representing an annual increase of 1.3 percent. The Phase 2 improvements (lift replacements at Alpental and Summit West as well as additional skier support facilities) would continue to increase visitation at a rate of two percent annually. Finally, in Phase 3, new facilities and improvements would be similar to those proposed under Alternative 2, providing for increased visitation growth of 2.5 percent annually.

Similar to Alternative 2, the pulse gondola and mountain-top restaurant at Alpental are expected to become a year-round attraction during Phase 3, and would generate 70,000 non-skiing visits in its first year of operation and grow at a rate of six percent during the final 3 years of Phase 3.

4.10.5.1 Employment

Projected short- and long-term employment under Alternative 4 would be the lowest of all Action Alternatives (however, only slightly lower than Alternative 3) due to the omission of the *Creek Run* and

Rampart chairlifts and reduction in parking. Estimated short-term employment supported by construction projects in this alternative is projected at 353 (full time equivalent) across the three-phase build-out period – slightly less than Alternatives 2 or 5. Direct, long-term employment at the ski area would be expected to increase by approximately 25 percent, to 1,890 under Alternative 4.

4.10.5.2 Spending and Economic Characteristics

Winter time visitor spending under Alternative 4 would be expected to be the slightly less than Alternative 3, mainly due to decreased projected annual visitation associated with fewer facilities. Summer visitation would be similar to Alternatives 2 and Modified Alternative 5. As a result, resort payroll, sales and property taxes, and SAPRC fees collected by the Forest Service would be expected to the slightly higher than Alternative 3, but lower than Alternatives 2 and Modified Alternative 5.

With the *Creek Run* and *Rampart* lifts not developed and no new egress routes between Summit East and Summit Central, it is expected that public demand for recreation at Summit East would be less than any other Action Alternative, due to the limited access to the area. As a result, the crossover trails would continue to inhibit efficient access between Summit Central and Summit East, largely due to inadequate slope gradients that require skiers to pole and snowboarders to dismount.

With no development of the *Rampart* lift, skiers would use the *Mt. Hyak* lift to access the existing trail network, requiring that skiers negotiate off fall-line slopes to return to the bottom of the lift, as described for the existing condition (see Section 3.11 – Recreation). The re-establishment of skiing in the *Mill Creek* pod would improve the diversity of terrain at Summit East, including the addition of two new intermediate trails. Overall, the long-term economic viability of Summit East as an integrated component of The Summit-at-Snoqualmie would be the lowest among the Action Alternatives because the lack of access and terrain at Summit East would essentially maintain the existing condition, described in Section 3.11 – Recreation.

4.10.6 Cumulative Effects

Population and economic growth in the communities near Snoqualmie Pass is inevitable. Growth in King and Kittitas counties, as well as at a regional level, will affect development pressures in the Snoqualmie Pass area. This can be expected to occur in two ways: population growth will spread to new areas (primarily east of Seattle); and residents of the region will demand sources of recreation. The addition of new, up-scale housing developments near Snoqualmie Pass could drive up the price of real estate and rental properties.

As stated, in Chapter 3, development pressures on Kittitas County are expected to increase as the capacities of east King County communities (e.g., Issaquah and North Bend) are further taxed. The Snoqualmie Pass area and communities to the east represent a next logical tier along the I-90 corridor to accept development pressures emanating from the greater Seattle-Tacoma area. Growth at Snoqualmie

Pass is, on one hand, enabled by the existence of basic infrastructure (e.g., water, power and sewer) and ease of access via I-90 and, on the other hand, inhibited by the amount of private land available for development.

SNOPAC has undertaken steps in community planning for the Snoqualmie Pass area. The first step was the Snoqualmie Pass Comprehensive Plan, completed in 1993 and subsequently adopted by Kittitas and King Counties as a sub-area plan for their respective comprehensive plans. The second step is the 1999 Snoqualmie Pass Design and Development Plan. The goals of both plans include:

- Encourage the development of community support uses in appropriate areas.
- Facilitate cooperation and participation of Federal, State and local agencies in planning and implementation.
- Encourage a mix of residence types to enhance the resort atmosphere of Snoqualmie Pass.
- Provide for commercial development in appropriate locations to serve the needs of the community, visitors, and the traveling public, and to enhance the economic vitality of the Pass.
- Encourage the development of all-season, multi-option recreational facilities on public and private land.
- Recognize the economic importance of the area's natural resources and promote the optimal use of these resources by public and private interests.

As of publication of this FEIS, the 1999 Snoqualmie Pass Design and Development Plan is in draft form and has yet to be adopted or implemented.

As the Snoqualmie Pass area's largest private property owner, Ski Lifts, Inc. is a major stakeholder in the future of the community. There are four PUDs zoned in the vicinity of The Summit-at-Snoqualmie covering a total of 798 acres: 1) Hyak Estates (79 acres); 2) Ski Acres Estates (19 acres); Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 and 2 (221 acres). No formal development applications are currently filed with Kittitas County for any of the PUDs. However, it is likely that development of single- and multi-family housing units, condominiums, and retail will eventually occur, thereby increasing the population and changing the character of the immediate Snoqualmie Pass area.

Suncadia is a new master-planned resort community presently under development on a 6,300-acre site in the foothills of the Cascade Mountains, adjacent to the town of Roslyn. Suncadia is fully permitted and is planned to be developed in three phases. As envisioned, the resort will be developed as an upscale destination resort community primarily serving residents of the Central Puget Sound Region, but also serving residents of Central and Eastern Washington and elsewhere. Plans include a mountain-style lodge and resort village, at least three 18-hole golf courses, a large recreation center, 40 miles of multiple use trails, approximately 2,300 second-home units and homesites, about 170 fractional units, and about 150 timeshare units. Suncadia has the potential to alter the character of the communities east of Snoqualmie

Pass by increasing the population and property values, but will also create direct, indirect, short and long-term, seasonal and full-time employment opportunities.

Located approximately 31.5 miles east of The Summit-at-Snoqualmie, Suncadia represents a reasonably foreseeable future source of additional development and population growth in Kittitas County, and a potential new source of visitation at The Summit-at-Snoqualmie.

In 1998, approximately 32,000 acres of private land, owned by Plum Creek Timber, were exchanged for approximately 11,600 acres of NFSL. The long-term impacts are focused on creating a multi-age forest ecosystem. In addition, the USFS has recently acquired lands in Sections 5, 7 and 25 of Township 21N and Zone 11E. In 2001, approximately 6,798 acres of land in the I-90 corridor were received by the USFS from Weyerhaeuser. In total, these activities result in a significant reduction in checkerboard ownership in the Snoqualmie Pass area, allowing for USFS Management of the NFSL for development of a multi-age forest ecosystem and reducing the amount of private lands available for future residential/commercial development.

Tables 4.10-1 and 4.10-2 summarize the cumulative effects of past, present and reasonably foreseeable projects in the U. Yakima and S.F. Snoqualmie Watersheds, and describes the effect each project will have on social and economic resources.

Table 4.10-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Social and Economic Resources

Project Name	Project Summary	Cumulative Effects on Social and Economic Factors
Projects Not Associated with The Summit-at-Snoqualmie		
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	The management of newly acquired lands will be beneficial to the forest ecosystem and will provide additional social/recreational opportunities. Implementation of the I-90 Land Exchange will overlap both spatially and temporally with the Action Alternatives and other land management type projects (described below). Alternative 3 and Modified Alternative 5, with a 390-acre land donation, would cumulatively improve the social and recreational opportunities in the Snoqualmie Pass area.
Gold Creek Pond Trail Development	A native surface foot trail was constructed approximately 100 feet long. This project was completed in 2001.	Construction of the native surface foot trail provides additional social/recreational opportunities in the Snoqualmie Pass area. When coupled with the Pulse Gondola at Alpental, this trail provides additional capacity for the increasing summer recreation in the Snoqualmie Pass area. This impacts of this project overlap temprally and spatially (within the 5th field) with the MDP.

Table 4.10-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Social and Economic Resources

Project Name	Project Summary	Cumulative Effects on Social and Economic Factors
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	The acquisition and management of these areas will benefit management of NFSL and provide additional social/recreational opportunities. The land acquisitions will overlap both spatially (at the 5th field) and temporally with the Action Alternatives and other land management type projects Alternative 3 and Modified Alternative 5, with a 390-acre land donation, would cumulatively improve the social and recreational opportunities in the Snoqualmie Pass area.
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of The Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in space and time with the MDP at the site and 5th field scales. This will cumulatively increase the year-round and seasonal population of The Summit-at-Snoqualmie MDP.
Cle Elum RD roads analysis	Analysis of road system to determine long-term need. Implementation is expected in 2010.	Analysis of road systems to determine long-term needs for motorized transportation and recreation and implementation of this project would overlap spatially (in the 5th field) and temporally with the MDP. This project would affect access to and motorized use of NFSL due to the potential closure or limits on motorized use of certain roads.
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the Okanogan-Wenatchee National Forest Land and Resource Management Plan.	Analysis of lands to determine suitability for preservation as wilderness overlaps spatially and temporally with the MDP. This project has the potential to change land allocations, and therefore could affect acces to and use of NFSL. The management of these lands as wilderness will be beneficial to the forest ecosystem and will provide additional social/recreational opportunities.

Table 4.10-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Social and Economic Resources

Project Name	Project Summary	Cumulative Effects on Social and Economic Factors
Pro Guiding Service Area Expansion	Pro Guiding has requested expansion of their area of operation to include the Cascade crest area from Kendall Lakes to Mt. Daniel, plus the Alta Mountain area. They are not requesting an increase in number of service days.	The expansion of the area of operation for Pro Guiding would overlap spatially (in the 5th field) and temporally with the MDP. Coupled with the Action Alternatives, this project would provide additional social/recreational opportunities in the Snoqualmie Pass area.
Development of Suncadia Resort Community Near Roslyn	Suncadia is fully permitted and is planned to be developed in three phases. Plans include a mountain-style lodge and resort village, three 18-hole golf courses, a recreation center, 40 miles of multiple use trails, approximately 2,300 second-homes, 170 fractional units, and 150 timeshares.	Ongoing development of Suncadia will continue, overlapping with MDP implementation over time. Because Suncadia is located along the I-90 corridor, its development occupies the same socio-economic space as the MDP alternatives. In conjunction with Suncadia, the Action Alternatives have the potential to cumulatively alter the character of the communities east of the Pass by increasing the population and property values. Similarly, both developments would cumulatively create direct, indirect, short-/long-term, seasonal and full-time employment opportunities.

Table 4.10-2:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed on Social and Economic Resources

Project Name	Project Summary	Cumulative Effects to Social and Economic Factors
Projects Associated with The Summit-at-Snoqualmie		
Cave Ridge Land Donation	The Summit-at-Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	The donation of 138 acres of private land to the National Forest would overlap spatially and temporally with the MDP at the site scale. Coupled with the 390-acre land donation under Alternative 3 and Modified Alternative 5, this project would alter access to and use of NFSL and social/recreational opportunities in the Snoqualmie Pass area.

Table 4.10-2:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed on Social and Economic Resources

Project Name	Project Summary	Cumulative Effects to Social and Economic Factors
Projects Not Associated with The Summit-at-Snoqualmie		
Huckleberry Land Exchange	Exchange of NFSL for 6,798 acres of Weyerheauser lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	Approximately 6,798 acres of private land previously owned by Weyerhaeuser was received by the Forest Service. The acquisition and management of these areas will benefit management of NFSL and provide additional social/recreational opportunities. The land acquisitions will overlap both spatially (at the 5th field) and temporally with the Action Alternatives. This project, combined with the other land management projects, and Alternative 3 and Modified Alternative 5, with a 390-acre land donation, would cumulatively improve the social and recreational opportunities in the Snoqualmie Pass area.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The acquisition of these areas will result in a beneficial impact from management in the NFSL system. The acquisition and management of these areas will provide additional social/recreational opportunities. The land acquisitions will overlap both spatially (in the 5th field) and management of the acquired land would temporally overlap with the Action Alternatives and other land management projects. This project, coupled with Alternative 3 or Modified Alternative 5, with a 390-acre land donation, would cumulatively improve the social and recreational opportunities in the Snoqualmie Pass area. This will result in a reduced tax base for lands that were previously privately owned.
South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project	This project involves the redcution in maintenance level (ML) on 11 roads (26.3 miles). 19.4 miles would be reduced to ML 1 (closed to motorized access) and utilized as loop and destination trail routes; 2.7 miles would be closed - placed in storage for future forest management; 1.1 mile would be removed from the transportation system and converted to trail; approximately 22.2 miles of spur roads mostly associated with roads proposed for reduction to ML 1 would be closed and removed from the Forest Road Transportation System.	Closure to motorized access and decommissioning of roads would overlap spatially (at the 5th field scale) and temporally with the MDP. This project would alter access to and use of NFSL.

Table 4.10-2:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed on Social and Economic Resources

Project Name	Project Summary	Cumulative Effects to Social and Economic Factors
Road 9020 ERFO Repair	This project proposes to either replace the culvert at Alice Creek or reduce the ML of Road 9020 past Alice Creek to 1.	The replacement of a culvert or closure of the road to motorized access would overlap spatially (in the 5th field) and temporally with the MDP. Closure of the road to motorized access would affect access to and use of NFSL and social/recreational opportunities in the Snoqualmie Pass area.
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	Construction of a trail and parking facilities would overlap spatially (at the 5th field scale) and temporally with the MDP. Coupled with the Action Alternatives, the new interpretive loop trail would increase social/recreational opportunities in the Snoqualmie Pass area.

4.10.7 Irreversible and Irretrievable Effects

No irreversible or irretrievable commitments of economic resources related to this proposal have been identified in this analysis.

4.11 RECREATION

The range of alternatives would provide a variety of types and amounts of alpine skiing and summer-use opportunities within the Study Area. While visitation data for alpine skiing at The Summit-at-Snoqualmie is regularly monitored, data for non-alpine skiing recreation uses on both private and public lands within the Snoqualmie Pass area (within and outside of the SUP area) is not available. As a result, impacts to dispersed recreation are presented in general terms, relative to existing conditions.

For purposes of this analysis, direct impacts are generally considered those that would occur within The Summit-at-Snoqualmie Study Area; indirect impacts are those that would occur off-site, but which are stimulated by proposed ski area and other recreational development and uses at The Summit-at-Snoqualmie. For example, any additional summer and winter visits to The Summit-at-Snoqualmie or the development of new lifts and ski trails would be considered direct impacts, while increases in dispersed recreation (i.e., hiking, backcountry skiing) in areas outside The Summit-at-Snoqualmie SUP as a result of ski area development would be considered an indirect impact.

4.11.1 Impacts – Alternative 1 (No Action Alternative)

Recreation Opportunity Spectrum

On NFSL at and around Alpental and Summit West, the ROS classifies lands as *Rural, Roaded Natural.* Under Alternative 1, conditions would continue to meet the designated ROS criteria. For NFSL at and around Summit Central and Summit East, conditions under Alternative 1 would continue to meet the designated ROS criteria for *Roaded Natural*. See Section 3.11 - Recreation for more discussion on the ROS classifications at The Summit-at-Snoqualmie.

Developed Winter Recreation

Under Alternative 1, no additional developed winter recreation facilities are proposed by the proponent at either at The Summit or Alpental. See Figure 2.3.2-1, Alternative 1 Existing Conditions - The Summit and Figure 2.3.2-2, Alternative 1 Existing Conditions – Alpental.

<u>The Summit</u>

Under Alternative 1, The Summit would continue to operate at a CCC of 8,140 utilizing 16 chairlifts and 4 surface lifts. The existing terrain at The Summit would be maintained, including 70 named trails on approximately 545 acres, with no new projects being proposed or implemented (see Table 4.11-1). Any future lift replacements or trail development would require project-specific approval from the USFS and appropriate regulatory agency(s).

Table 4.11-1:
The Summit-at-Snoqualmie MDP FEIS Range of Alternatives

Master Plan Components	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Alpine Ski Area Capacity for The Summit (CCC)[a,b]	8,140	10,710	9,990	9,360	10,710
Alpine Ski Area Capacity for Alpental (CCC)	1,880	2,920	2,620	2,920	3,220
Night Skiing Capacity for The Summit (CCC)	6,210	9,870	9,870	9,240	9,870
Night Skiing Capacity for Alpental (CCC)	1,550	2,170	2,170	2,170	2,170
Total Number of Chairlifts for The Summit	16	18	17	16	18
Peak Nordic Skier Capacity	500	500	500	500	500
Peak Tubing Capacity	2,500	2,500	2,500	2,500	2,500
Total Number of Magic Carpets for The Summit	1	2	2	2	2
Total Number of Chairlifts for The Summit	16	18	17	16	18
Total Number of Surface Lifts for The Summit	3	2	2	2	2
Total Number of Magic Carpets for Alpental	0	1	1	1	1
Total Number of Chairlifts for Alpental	4	6	5	6	6
Total Number of Surface Lifts for Alpental	1	0	0	0	0
Number of Trails for The Summit	70	80	75	75	80
Number of Trails for Alpental	25	27	27	27	27
Formal Ski Terrain for The Summit (acres)	545	599	551	554	593
Formal Ski Terrain for Alpental (acres)	206	217	217	217	217
Formal Night Skiing Terrain for The Summit (acres)	420	544	543	481	545
Formal Night Skiing Terrain for Alpental (acres)	95	112	112	112	112
Nordic Ski Trails (km/mi)	43/69	43/69	43/69	43/69	43/69
Food Service Seats for The Summit	1,386	4,234	4,234	4,234	4,234
Food Service Seats for Alpental	528	813	528	813	813
Parking – The Summit (acres)	39.6	49.4	49.4	49.4	49.4
Parking – Alpental (acres)	7.8	7.8	7.8	6.9	7.8
Total Parking (acres)	47.4	57.2	57.2	56.3	57.2

[a] A detailed description of the CCC for The Summit-at-Snoqualmie is contained in Section 2.3.1.1 - Capacity.
[b] The rope tows for the Tubing Center are included in the CCC

Under Alternative 1, the trails and lifts comprising The Summit would not change. The quality of the recreational experience would continue to be reduced by inefficiently aligned lifts and trails. Users would continue to be required to hike uphill to access lift terminals and base area facilities and beginner areas would not be easily accessible to lower level skiers. Skier circulation would continue to be poor due to ill-defined trail boundaries and routes to chairlifts/facilities, largely due to the lack of trees and surrounding vegetation. Separation between beginner areas/trails and more advanced terrain would continue to be poor and skiers would continue to be required to traverse across active ski trails to reach their destination. The existing lift network would continue to experience occasional mechanical problems due to wear and tear and need repair.

Trail 61 (Summit West-Summit Central crossover) would continue to be utilized by skiers traversing from Summit West to Summit Central. Trail 61 ends on Trail 42 (Parachute) at Summit Central, an expert run.

Lower level skiers on Trail 61 would continue to be required to negotiate terrain that is above their ability/comfort level to access Summit Central from Summit West. These skiers would typically stop at the end of Trail 61 to assess the conditions and to develop a plan for getting down. This stop point would continue to create a potential conflict with other skiers wishing to access the trail. Upon entering Trail 42, lower level skiers would tend to traverse across the steeper slope in order to reach the bottom. Overall, the experience would continue to be daunting for non-expert skiers, and a source of potential conflict for expert skiers who would be required to negotiate Trail 42 with lower level skiers in their way.

Trails 49 and 71 would continue to be utilized by skiers/snowboarders to traverse from Summit Central to Summit East and Summit East to Summit Central, respectively. Trails 49 and 71 would not be modified and skiers would continue to either pole along the low-gradient portions of the trails or remove their equipment in order to traverse between Summit Central and Summit East. As a result of its inaccessibility, the existing lack of skier interest in Summit East would continue under Alternative 1, resulting in increased densities at Summit West and Summit Central, as compared to Alternatives 2, 3, and Modified Alternative 5.

Under Alternative 1, guest service facilities would continue to be provided at the Summit West and Summit Central base areas. Lack of guest service facilities throughout the mountain would continue to inhibit the out-of-base efficiency at all three areas, resulting in poor overall mountain circulation and crowded lift lines near base area facilities at Summit West and Summit Central. Coupled with the difficulties in circulation between Summit East and Summit Central, the lack of skier facilities at Summit East would increase pressure for guest services at Summit Central and Summit East.

Considering the lack of convenient egress between Summit East and Summit Central, along with the lack of facilities and diverse and challenging terrain at Summit East, it is unlikely that existing night skiing infrastructure would be utilized at Summit East under Alternative 1, as is the case under existing conditions. Existing night skiing operations at Summit West and Summit Central would continue. It is expected that night skiing would continue to represent approximately 20-30 percent of skier visits at The Summit (see Appendix J - Assumptions used in the Recreation, Social and Economic Analysis).

The majority of The Summit-at-Snoqualmie's beginner terrain would continue to be located at The Summit, particularly Summit West and Summit Central. Beginner lifts would continue to be a considerable distance from base area facilities and lack of definitive trail boundaries would continue to not separate beginner terrain from more advanced terrain. As a result, the beginner terrain at The Summit would continue to be daunting for lower ability level beginners/novices.

Overall, with the inability of skiers to circulate between Summit East and Summit Central, the lack of skier facilities at Summit East, and the lack of night skiing at Summit East, the incorporation of the Summit East facility in the overall operation at The Summit would continue to present a problem for Ski Lifts, Inc. As a result, the viability of the operation at Summit East would continue to be uncertain.

Alpental

Under Alternative 1, Alpental would continue to operate at a CCC of 1,880 utilizing four chairlifts and one surface lift. The existing terrain at Alpental would be maintained, including 25 named trails on approximately 206 acres with no projects being proposed or implemented (see Table 4.11-1). Any future lift replacements and trail development would require project-specific approval from the USFS and/or appropriate regulatory agencies.

Alpental would continue to provide access to the majority of The Summit-at-Snoqualmie's advanced terrain. Alpental's lifts would continue to be utilized by backcountry skiers within Alpental's SUP boundary. All lift served, accessible backcountry at Alpental would continue to be served solely by the *Edelweiss* chair contributing to crowded lift lines at the base terminal and crowded off-loading at the Denny Mountain summit.

Beginner facilities at Alpental would continue to be underutilized due to a lack of appropriate slope gradients and access from the base area.

Visitation

Historic visitation patterns at The Summit-at-Snoqualmie over the past 10 years show an average annual visitation growth rate of approximately 1 percent. Much lower than the population growth rates for King and Kittitas Counties during the same time period (see Section 3.10 - Social and Economic Factors).

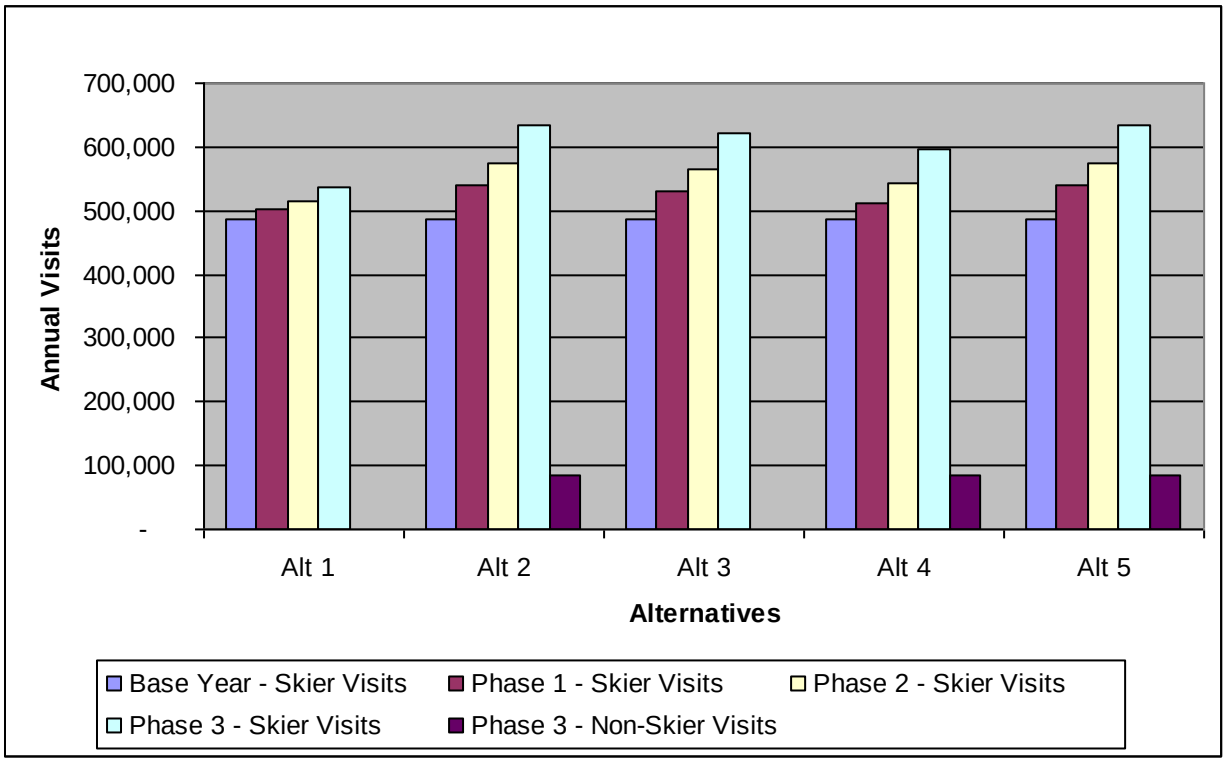
King and Kittitas County populations are expected to increase 4.1 percent and 7.1 percent, respectively, over the next 15 years (see Section 4.11 - Social and Economic Factors). It is anticipated that visitation at The Summit-at-Snoqualmie under Alternative 1 would continue to rise at an average rate of 1 percent over the next 10-15 years due to an expanding population base in King and Kittitas Counties, the continued growth of housing starts in eastern King County (North Bend area), and the convenient location of the ski facility to the major population centers.

In conjunction with projected population growth, visitation at The Summit-at-Snoqualmie is expected to increase from an average of 486,000 annual skier visits to approximately 537,000 annual skier visits over the next ten years under Alternative 1 (see Table 4.11-2 and Illustration 4.11-1).

Table 4.11-2:
The Summit-at-Snoqualmie Visitation Projections

Year	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
1	490,860	507,058	504,113	497,241	507,058
2	495,769	523,791	517,724	503,705	523,791
3	500,726	541,076	531,703	510,253	541,076
4	505,734	551,898	542,337	520,459	551,898
5	510,791	562,936	553,184	530,868	562,936
6	515,899	574,195	564,247	541,485	574,195
7	521,058	588,549	578,353	555,022	588,549
8	526,268	603,263	592,812	568,898	603,263
9	531,531	618,345	607,633	583,120	618,345
10	536,846	633,803	622,823	597,698	633,803

Illustration 4.11-1:
The Summit-at-Snoqualmie Visitation Projections



See Appendix J – Assumptions used in the Recreation, Social and Economic Analysis, for a discussion of assumptions used in determining visitation projections.

Dispersed Winter Recreation

From Alpental

Under Alternative 1, skiers and snowboarders would continue to utilize facilities at Alpental to access the Great Scott Traverse and The Bluffs, as described in Section 3.11.3 – Developed Winter Recreation. The groomed traverse leading from Alpental Lot 6 would continue to be closed to uphill traffic, including backcountry skiers and snowshoers.

Sledding, ice-climbing and snowshoeing would continue to be accessed along Alpental Road under Alternative 1.

From The Summit

Under Alternative 1, Nordic facilities, including rentals and equipment, would continue to be located within Summit East's base area and provide access to areas adjacent to Summit Central and Summit East, including Nordic Pass (see Figure 2.3.2-5, Nordic Trail Network). In addition, the *Mt. Hyak* chairlift would continue to be used by Nordic skiers and snowshoers to access Nordic Pass. Due to the projected increase in skier visitation under Alternative 1, conflicts between Nordic, backcountry and alpine skiers will likely continue and may worsen as higher volumes of skiers use trails and facilities that overlap.

Nordic programs at Summit East would continue to contribute approximately 1 to 2 percent of the overall revenue for The Summit-at-Snoqualmie. Users of the Nordic Pass Trail would continue to enjoy a high quality recreational experience due to the available solitude, lack of motorized vehicles, amount of backcountry, low avalanche danger, mature forest, lakes, moderately gentle terrain, good snow, available winter parking, Nordic facilities, and proximity to the Seattle metropolitan area. Development of new facilities would not take place under Alternative 1, so there would be no effect to Nordic Pass backcountry skier access at Summit East.

Developed Summer Recreation

Hiking

Under Alternative 1, hikers would continue to be able to utilize parking facilities at Alpental, The Summit and along SR-906 to access hiking trails throughout the Snoqualmie Pass area.

Mountain Biking

Under Alternative 1, dispersed mountain biking would continue to not be offered at The Summit-at-Snoqualmie, as described under existing conditions.

Summer Concert Series

Under Alternative 1, summer concert series would continue to be offered at Alpental.

Scenic Rides

Under Alternative 1, Ski Lifts, Inc. would not operate the *Central Express* chairlift in the summer months, as described under existing conditions.

Dispersed Summer Recreation

Alpine Lakes Wilderness

Under Alternative 1, access to the Alpine Lakes Wilderness would continue to be provided from Parking Lot 2 at Alpental. No impacts to users of Alpine Lakes Wilderness would occur under Alternative 1.

Pacific Crest National Scenic Trail

Under Alternative 1, access to the PCNST would continue to be provided at the trailhead east of Alpental Road and through Summit West as it works its way past Beaver Lake. No new impacts to users of the PCNST would occur under Alternative 1.

Parking

Under the No Action Alternative, no changes would occur to parking capacities at either The Summit or Alpental. Long walks that are currently experienced between the uppermost parking lots and the visitor service buildings would therefore continue. Due to the linear, confined nature of Alpental Valley, parking shortages would likely continue to be an issue on peak capacity days. Overall, parking capacity for the four ski areas would continue to be below the demand for parking, including skiers, tubing guests, Nordic skiers and other users. Alpental skiers would be required to park at more remote lots and ride the shuttle to Alpental, thereby reducing the quality of their recreational experience on busy days at Alpental. Due to the projected increase in visitation under Alternative 1 (see Illustration 4.11-1), the recreation experience would be diminished more than under the existing condition because of increased crowding and lack of parking, especially at Alpental.

4.11.2 Impacts – Alternative 2 (Proposed Action)

Under Alternative 2, The Summit-at-Snoqualmie would implement all projects documented in Chapter 2 - Alternatives, Section 2.3.3 - Alternative 2: The Summit-at-Snoqualmie's Proposed Action (see Figures 1.1.2-1, Alternative 2 Proposed Conditions – The Summit and 1.1.2-2, Alternative 2 Proposed Conditions – Alpental).

Recreation Opportunity Spectrum

Alternative 2 would introduce new development and upgrading of existing facilities at the ski area. This development would continue to meet the designated ROS criteria for *Roaded Natural*.

Developed Winter Recreation

The Summit

Under Alternative 2, The Summit would realign and/or upgrade a majority of the lifts at The Summit, provide additional guest service facilities and create new chairlifts and terrain in previously underutilized portions of the Study Area. In total, The Summit would operate 24 lifts (18 chairlifts, 3 surface lifts and 3 Magic Carpets). The trail network at The Summit would increase by approximately 54 acres, from the existing 70 named trails on approximately 545 acres, to 80 trails on approximately 599 acres. The Summit's CCC would increase from 8,140 (as in the existing condition, and the No Action Alternative) to 10,710.

Chairlifts at The Summit would be realigned in order to better distribute and circulate skiers on the mountain. New chairlifts would result in fewer breakdowns and better circulation than the existing condition or the No Action Alternative, which include old lifts that frequently experience mechanical problems and breakdowns. Tree islands would be created at Summit Central and Summit West in order to improve skier circulation by creating more defined trails boundaries and routes to chairlifts/facilities. The proposed tree islands would also provide separation between beginner areas/trails and more advanced terrain. As a result, skiers would not be forced to traverse across active ski trails to reach their destination, as is the case under existing conditions, creating safer conditions for all ability levels. The upgrades and additions to The Summit's lift and trail network would improve circulation, skier dispersal and have a positive impact on the recreational experience for guests of all levels.

As described for Alternative 1, Trail 61 (Summit West-Summit Central Crossover) would continue to be utilized by skiers traversing from Summit West to Summit Central. Trail 61 would continue to end on Trail 42 (Parachute) at Summit Central, an expert run. As a result, advanced intermediate and lower level skiers would continue to be required to negotiate terrain that is above their ability/comfort level to access Summit Central from Summit West.

Beginner facilities would continue to be provided at Summit West and Summit Central. Chairlifts and tows would either be realigned or replaced. Terminals would be located closer to base area facilities in order to minimize walking distances for beginners, creating more desirable learning conditions, as compared to existing conditions. Under Alternative 2, the beginner experience would be greatly enhanced by these terrain improvements as compared to Alternative 1.

Guest service facilities would be constructed at the base areas at Summit West, Summit Central and Silver Fir. Facilities would expand upon existing services and provide a new core area at the base of the *Silver Fir* chairlift. In addition, the existing Thunderbird Restaurant located near the upper terminal of the *Wildside* chairlift would be renovated and opened to serve cafeteria-style food and beverages. A new facility would be constructed near the upper terminal of the *Mt. Hyak* chairlift at Summit East to serve guests utilizing existing and new terrain at Summit East. Guest service facilities would help distribute

guests throughout The Summit in order to ease congestion at Summit Central and Summit West base area facilities.

Under Alternative 2, two new chairlifts and associated trails would be constructed at Summit East (*Creek Run* and *Rampart*) providing for most of the increase in available ski terrain, as compared to Alternative 1. The *Creek Run* and *Rampart* pods would introduce a ski experience at The Summit that is unlike existing conditions. The *Creek Run* chairlift would provide access to gladed trails that are created by selectively removing trees within the ski trail boundary to connect natural openings. Trails would capitalize on existing clearings for trails at Summit East. Existing Trails 55, 63 and 66, which currently traverse from the top of Mt. Hyak and follow the fall-line for approximately 300 vertical feet until returning back to Summit East's base area, would be extended along their natural fall line up to 600 vertical feet, creating round-trip skiing within the *Creek Run* and *Rampart* pods. The construction of the *Creek Run* and *Rampart* pods would increase the available intermediate and advanced intermediate terrain, which are currently lacking, as compared to the Alternative 1. In addition, the two pods would provide for the most consistent fall-line intermediate and advanced intermediate terrain throughout The Summit-at-Snoqualmie.

Under Alternative 2, the proposed *Ski School* chairlift would be constructed to provide out-of-base access to appropriate beginner terrain at Summit Central. The lower terminal would be approximately 250 feet from the new base lodge in order to minimize walking distances for beginners.

Trail 55A would be gladed and provide access to Trail 71 (Summit East to Summit Central crossover). Because Trail 55A would provide access to the crossover trail from Summit East to Central, the approximate 125-foot wide gladed trail would include a 25-foot, fully cleared path down the middle of the trail to provide safe access to skiers of lower abilities. Trail 49 would also be constructed to provide access from Summit Central to Summit East. The lower portion of Trail 49 would be retained to provide skier access to the Mt. Hyak chairlift for those skiers not wishing to ride Rampart or Creek Run. Trails 49 and 71 would provide more appropriate slope gradients than the existing crossover trails. As a result, skiers would not have to pole along the trail or remove their equipment in order to traverse between Summit Central and Summit East. The crossover trails would dramatically increase skier circulation between Summit Central and Summit East providing better utilization of the facilities at Summit East.

Trails would be cleared on private land on the backside of Mt. Hyak in order to utilize and expand upon existing terrain served by the *Mill Creek* chairlift. As a result, the ability of skiers to access the *Mill Creek* pod would allow for a unique skiing experience at The Summit – skiing out of the view of I-90 or the SR-906 corridor. Coupled with enhanced access from Summit Central and the development of *Rampart* and *Creek Run*, the remote skiing experience would enhance utilization of Summit East.

Expanded services at Summit East and improved crossover trails between Summit East and Summit Central would help better utilize existing infrastructure and facilities at Summit East. Trails within the

Rampart pod would be equipped with lights for night skiing. Coupled with additional night skiing in the *Silver Fir* pod, Alternative 2 would include approximately 120 additional acres of night skiing, as compared to existing conditions. The *Creek Run* pod would not be used for night skiing. The renovated and newly constructed facilities at Summit East, including the *Mill Creek* chairlift, would augment night skiing opportunities at Summit East.

Alpental

Under Alternative 2, Alpental would operate seven lifts (five chairlifts, one gondola, and one magic carpet). The trail network at Alpental would increase by approximately 11 acres, from the existing 25 named trails on approximately 206 acres to 27 trails on approximately 217 acres. Alpental's CCC would increase from 1,880 (the existing condition and as in the No Action Alternative) to 2,920.

The increase in CCC would result from the construction of the *Pulse Gondola* (from the base area to the top of the *Edelweiss* chairlift) and the installation of the *Internationale* chairlift. The *Internationale* chairlift would provide more direct access to backcountry terrain in the northern SUP boundary. *Trail 20* would be accessed via the *Internationale* chairlift and would include night lighting, increasing Alpental's night lighting terrain from 95 to 112 acres.

The gondola would provide year-round, direct access to the mountain-top restaurant at Alpental. Currently, ticketing is provided in one building in the base area. A new visitor service building would be constructed in the base area, near the lower terminal of the *Pulse Gondola*. Together, the gondola and new lodge would greatly enhance out of base access and reduce congestion at base area facilities. The direct base to mountain-top access would also enhance ski patrol access to the higher elevation terrain at Alpental. Furthermore, the *Pulse Gondola* would provide round trip skiing from the base area to the summit at Alpental via one lift ride, while the existing condition requires two lift rides (*Armstrong Express* and *Edelweiss*). The addition of skiers and restaurant visitors at the summit of Denny Mountain would exacerbate the current crowding that takes place at the top of the *Edelweiss* chairlift.

With the installation of the *Internationale* chairlift, lift-served backcountry skiing (via *Edelweiss*) would be replaced with lift-served alpine skiing in the Internationale basin. As a result, increased skier densities would be expected in this portion of the Study Area, and snow conditions would become skied out more quickly than under Alternative 1. Conversely, advanced level skiers would be afforded the opportunity to round-trip ski the Internationale basin without being required to access the base area and the *Armstrong Express*. This benefit would enhance the advanced alpine skier experience, compared to Alternative 1. The bottom terminal of the *Internationale* chairlift would be located to avoid trails used to round-trip ski on *Sessel*, as well as located uphill of the convergence of several trails used to reach to bottom terminal of the *Armstrong Express*, a location that is frequently congested under existing conditions. The location of the *Internationale* lift would reduce skier densities at the bottom of Alpental, as skiers would be able to round-trip ski the Internationale basin without returning to the base area or converging into the trails that lead to the bottom terminal of *Armstrong Express.*

The *Sessel* chairlift would be realigned and extended up-mountain in conjunction with the installation of the *Internationale* chairlift, providing direct access to the *Internationale* chairlift from the base, further reducing pressure on *Armstrong Express*. In addition, *St Bernard* would be realigned to provide better access to beginner terrain near the base area at Alpental and to reduce the slope gradient of the beginner area compared to the existing condition. Although beginner facilities would continue to be concentrated at The Summit, providing better access to beginner terrain at Alpental would help balance terrain capacities at Alpental.

The new restaurant at the top of the *Pulse Gondola* would provide an alternative warming and eating facility to the base area lodges. In addition, the possibility of eating in a facility at the top of the ski area would provide a new recreational experience at Alpental, similar to the experience at the summit of Crystal Mountain, with spectacular views of Mt. Rainier and the surrounding wilderness. The presence of additional restaurant seating outside of the base lodges would serve to reduce congestion in the base area, and to enhance circulation at Alpental.

Visitation

Under Alternative 2, it is expected that growth in visitation would be the result of excitement generated by ongoing improvement and expansion, particularly when considering that very little new development has occurred at The Summit-at-Snoqualmie over the past 15 years (see Table 4.11-2, Illustration 4.11-1 and Appendix J – Assumptions used in the Recreation, Social and Economic Analysis). The initial excitement would eventually wear off and maintenance of the increased visitation levels would be based on the improved circulation, enhanced facilities, and increased diversity of terrain at The Summit-at-Snoqualmie, including the tree-lined and tree skiing in Section 16, improved access to the terrain at Summit East, and the availability of round-trip, advanced level skiing in the Internationale basin. Over the projection period, annual average visitation is projected to increase from 486,000 to 633,803 (see Table 4.11-2).

In Phase 1, the *Rampart* and *Creek Run* development would stimulate increased visitation due to the offering of new lifts and ski trails, in combination with lift replacements, improved crossover trails (Trails 49 and 71) and additional parking facilities. As the first new terrain offering in many years, it is anticipated that overall visitation would increase by approximately 10 percent at the end of Phase 1, representing an annual increase of approximately 3.3 percent.

During Phase 2, installation of the *Internationale* chairlift at Alpental and lift realignments and/or upgrades throughout The Summit, as well as additional skier support facilities located throughout The Summit, visitation growth would continue, at a rate of approximately 2 percent annually during Phase 2.

In combination with upgrades from Phase 1 and 2, Phase 3 improvements (including lift replacements, base area and mountain-top skier support facilities, increased parking and the *Pulse Gondola* at Alpental), would continue to generate increased visitation growth of approximately 2.5 percent annually.

The *Pulse Gondola* and mountain-top restaurant at Alpental would become a year-round attraction and foster non-skier visits on a year-round basis. Proximity to the Puget Sound market area, the convenient location off of I-90, and views of the surrounding Cascade Range are all positive attributes that are expected to generate non-skier visitation. The gondola is projected to generate 70,000 non-skiing visits in its first year of operation and grow at a rate of approximately 6 percent during the final three years of Phase 3. Growth would be supported by the fact that similar development (e.g., gondola at Silver Mountain, Idaho) has generated approximately 74,000 annual non-skier visits.

Dispersed Winter Recreation

From Alpental

Under Alternative 2, the *Internationale* chairlift would provide more direct access to the *Great Scott Traverse* and The Bluffs within Alpental's backcountry. It is anticipated that combined with the increased popularity of backcountry skiing (see Section 3.11.3 – Developed Winter Recreation) and growing population of the Puget Sound region, the *Internationale* chairlift would increase use and pressure on backcountry resources in and around Alpental during the winter (including the Alpental Valley and Alpine Lakes Wilderness).

Under Alternative 2 skiers and snowboarders would continue to utilize facilities at Alpental to access the Great Scott Traverse and The Bluffs, as described in Section 3.11.3 – Developed Winter Recreation. The groomed traverse leading from Alpental Lot 6 would continue to be closed to uphill traffic, including backcountry skiers and snowshoers.

Under Alternative 2, Alpental would remove fill dirt on the west side of Parking Lot 6. The fill was originally placed to divert a stream around the north end of the parking lot. Under Alternative 2, the fill would be removed and the stream would be rerouted along its original alignment (see Section 4.3 - Watershed Resources). This fill area is currently used as part of the groomed traverse that backcountry skiers utilize to return from the Alpental Valley backcountry. The area would continue to be closed to uphill traffic, as in Alternative 1. Under Alternative 2, this area would be used for snow storage and a level surface would be created and maintained by Alpental in order to maintain access for all users (see Appendix G – Conceptual Stormwater Management Plan).

Sledding, ice-climbing and snowshoeing would continue to be accessed along Alpental Road under Alternative 2.

From The Summit

Under Alternative 2, Nordic facilities, including rentals and equipment, would continue to be located within Summit East's base area and provide access to areas adjacent to Summit Central and Summit East, including Nordic Pass (see Figure 2.3.2-5, Nordic Trail Network). Nordic skiers and snowshoers would continue to utilize the *Mt. Hyak* and *Silver Fir* chairlifts to access Nordic Pass.

The MDP proposes no substantial improvements to Nordic facilities. As a result, Nordic users would continue to provide approximately 1 – 2 percent or less of ski area revenue as revenues from alpine facilities increase. It is anticipated that given population growth and growth in the Nordic market the current proportion of Nordic Skiers would remain relatively constant (i.e., growth no higher that the projected growth in alpine visits). Trails constructed in the *Creek Run* pod would not cross the existing Nordic Pass Route (see Figure 2.3.2-5, Nordic Trail Network). Trail 49 and 71 would cross the Nordic Pass Route, as does the existing crossover trail from Summit East to Summit Central. However, due to increased use of Summit East and Summit Central as a result of project implementation, more traffic between Summit East and Summit Central is anticipated. As such, an increase in conflicts between Nordic users and skier traversing between Summit Central and Summit East would result under Alternative 2. In addition, due to the development of the *Backside* chairlift and trails as well as the projected increase in skier visitation under Alternative 2, an increase in conflicts between Nordic, backcountry and alpine skiers at The Summit-at-Snoqualmie is expected.

Development of Trail 71 at Summit East would alleviate pressure on existing Trail 71 from alpine skiers, snowshoers and Nordic skiers. The new trail would be utilized primarily by alpine skiers, therefore relieving multi-use pressure from dispersed users. Nordic trail users would continue to enjoy a high quality recreational experience due to the amount of solitude, lack of motorized vehicles, amount of available backcountry, low avalanche danger, mature forest, lakes, moderately gentle terrain, good snow, available winter parking, Nordic facilities, and proximity to the Seattle metropolitan area. However, the likelihood of encounters with alpine skiers would increase as a result of the increased development in the area. As a result, development at Summit East would detract from the backcountry experience for Nordic Pass skiers.

Developed Summer Recreation

The nature of The Summit-at-Snoqualmie's MDP would enhance developed winter recreation opportunities while providing dispersed summer recreation opportunities with the construction of a gondola and mountain-top restaurant at Alpental.

Hiking

Under Alternative 2, hikers would continue to be able to utilize parking facilities at Alpental, The Summit and along SR 906 to access hiking trails throughout the Snoqualmie Pass area. No direct or indirect impacts to hikers would occur at The Summit.

Under Alternative 2, the gondola would provide access to a mountain-top restaurant near the upper terminal of the *Edelweiss* chairlift. It is anticipated that the gondola would become a year-round attraction and foster non-skier visits on a year-round basis. As a result of the increased use of facilities at Alpental during the summer, indirect impacts to hikers within the Alpental Valley may occur as a result of increased use of parking areas at Alpental. It is not anticipated that the gondola would provide increased

access for hiking due to the rugged nature of the terrain at the summit of Alpental. The interpretive trail, however, would expand the hiking opportunities at the Alpental summit, particularly for gondola riders who may otherwise not participate in hiking in the alpine environment.

Mountain Biking

Under Alternative 2, dispersed mountain biking would continue to not be provided at The Summit-at-Snoqualmie, as described in the existing condition and Alternative 1.

Summer Concert Series

Under Alternative 2, summer concert series would continue to be offered at Alpental. Facilities and improvements would not present any direct or indirect impacts to the summer concert series.

Scenic Rides

Under Alternative 2, the *Central Express* chairlift would not be utilized in the summer months to provide scenic chairlift rides and access to summer recreation activities, as described in the existing condition and Alternative 1.

However, the *Pulse Gondola* would provide access from Alpental's base area to the summit at Alpental where a mountain-top restaurant would be located. It is anticipated that the gondola would generate approximately 70,000 visits by non-skiers. The facilities would provide an excellent opportunity for elderly and physically challenged guests and families with small children, to access Alpental's upper elevation environment. An ADA-accessible trail near the proposed mountain-top restaurant would provide the opportunity for educational and interpretive signage including information regarding the importance/delicacy of high elevation ecosystems, avalanche science and the behavior of snowpack, volcanology, human's historical use of the Snoqualmie Pass area, etc.[70]

Dispersed Summer Recreation

Alpine Lakes Wilderness

Under Alternative 2, access to the Alpine Lakes Wilderness would continue to be provided from Parking Lot 2 at Alpental. Although the *Pulse Gondola* and mountain-top restaurant would be located near the Alpine Lakes Wilderness, the facilities would not be visible from the Wilderness (see Section 4.5 - Visual Resources). Ambient light may be discernable to users of the Wilderness during the night. Other Management Provision OMP42 (see Table 2.4-2) would be implemented in order to mitigate impacts to Alpine Lakes Wilderness users.

Pacific Crest National Scenic Trail

Under Alternative 2, access to the PCNST would continue to be provided at the trailhead east of Alpental Road and through Summit West as it works its way past Beaver Lake. Two new chairlifts would be

[70] The trail would comply with the standards and guidelines established by the Americans with Disabilities Act.

constructed over the PCNST, resulting in temporary impacts to users of the PCNST during lift and facility construction, as well as an addition to the developed character along the PCNST at Summit West. Other Management Provision OMP53 would be implemented in order to mitigate impacts to users of the PCNST (see Table 2.4-2).

Parking

Alpental

A guest drop-off area at Alpental is proposed in front of the proposed visitor service building. The drop-off area would be used by shuttles conveying guests from the upper parking lots at Alpental to the base area, as well as by shuttles transporting guests between Alpental and The Summit. The drop-off area would alleviate the long walks currently experienced between the uppermost parking lots and the visitor service buildings. Due to the linear, confined nature of Alpental Valley, parking shortages would continue to be an issue on peak capacity days more often than under Alternative 1 due to the increased capacity at Alpental and projected increases in skier visitation. As a result, insufficient parking conditions at Alpental would be exacerbated, and would diminish the recreation experience to a greater degree than Alternative 1. The proposed lift and trail connection between Summit West, Summit Central, and Summit East would reduce the demand for shuttle service between the core base areas at The Summit, providing additional service between Alpental and The Summit's core area. Over time, with increased facilities and capacity, Alpental would grow to serve proportionately more skiers who are not able to park in the lots at Alpental. Under Alternative 2, the increased visitation at Alpental would continue to create crowded parking conditions, which may worsen as parking at Alpental would be less than the capacity of the lift and trail network. As a result, Alpental skiers would increasingly have to rely on shuttle services to provide access to the lifts and other facilities at Alpental.

The Summit

Approximately 9.8 additional acres of parking would be created at Summit West, the proposed Silver Fir base area, and Summit Central adjacent to the *Summit Tubing Center*. Due to the lack of guest services at Summit East, shuttle service would be available to transport guests from Summit East to other portals. Proposed crossover trails between Summit East and Summit Central are intended to reduce reliance on shuttle services between base areas.

The demand for shuttle service at The Summit is expected to decrease as a result of the proposed lift and trail connections between Summit East and Summit Central. As a result, The Summit-at-Snoqualmie would offer more frequent and consistent service between Alpental and The Summit, as needed.

4.11.3 Impacts – Alternative 3

Under Alternative 3, The Summit-at-Snoqualmie would implement all projects documented in Chapter 2 - Alternatives, Section 2.3.4 - Alternative 3 – Reduced Section 16 Development (see Figures 2.3.4-1,

Alternative 3 Proposed Conditions - The Summit, and 2.3.4-2, Alternative 3 Proposed Conditions – Alpental).

Recreation Opportunity Spectrum

Alternative 3 would introduce new development and upgrading of existing facilities a The Summit-at-Snoqualmie ski area. This development would continue to meet the designated ROS criteria for *Roaded Natural*.

Developed Winter Recreation

The Summit

Under Alternative 3, developed winter recreation at The Summit would be as described under Alternative 2, except the proposed *Creek Run* chairlift and associated trails would not be constructed. Accordingly, The Summit would operate 23 lifts (17 chairlifts, 3 surface lifts and 3 magic carpets). The trail network at The Summit would increase by approximately 6 acres, from the existing 70 named trails on approximately 545 acres, to 76 trails on approximately 551 acres, as compared to existing conditions. The Summit's CCC would increase from 8,140 to 9,990 skiers (720 less than proposed in Alternative 2).

Beginner facilities would continue to be provided at Summit West and Summit Central, similar to Alternative 2. Chairlifts and tows would either be realigned or replaced. Terminals would be located closer to base area facilities in order to minimize walking distances for beginners, creating more desirable learning conditions, as compared to existing conditions. Under Alternative 3, the beginner experience would be greatly enhanced by these terrain improvements as compared to Alternative 1.

All lift realignments and/or upgrades, facility construction, revegetation and resulting impacts that were discussed for Summit West and Summit Central under Alternative 2 would occur under Alternative 3, including the difficult access from Summit West to Summit Central via Trail 42 (Parachute). These upgrades and additions to The Summit-at-Snoqualmie's lift and trail network would improve circulation, skier dispersal and have a positive impact on the recreational experience for guests of all levels.

The reduction in trail acreage and CCC under Alternative 3, as compared to Alternative 2 (see Table 4.11-1), is a result of the *Creek Run* chairlift and associated trails not being implemented at Summit East under Alternative 3. With no development in the *Creek Run* area, gladed skiing would not be provided at The Summit, resulting in a somewhat less diverse ski terrain offering at The Summit, as compared to Alternative 2. Night skiing would be as discussed under Alternative 2.

Even without development of *Creek Run*, Summit East would be an improvement over existing conditions under Alternative 3. Ski terrain acreage would be increased and aligned to the fall-line as a result of the development of the *Rampart* pod. Facilities construction and development of additional terrain in the *Rampart* and *Mill Creek* pods would enhance the skier experience at Summit East and provide improved

skier connectivity between Summit Central and Summit East. Night skiing at Summit East under Alternative 3 would be as described for Alternative 2.

Under Alternative 3, a skier trestle would be constructed along the existing Trail 49 to reduce the uphill gradient as Trail 49 (Summit Central-Summit East crossover) crosses Hyak Creek within the existing powerline right-of-way. The trestle will be no greater than 50 feet wide and require no in-stream activities. No clearing outside of the existing powerline right-of-way will take place. Any structural supports required to construct the trestle will be located outside the top-of-bank. The skier trestle would improve access to Summit East from Summit Central, however, with no additional improvements to Trail 49, the skier experience would be less than desirable as skiers may still be required to pole, and snowboarders to dismount. This situation would provide less demand for skiing at Summit East as compared to Alternative 2 and Modified Alternative 5 (with both the *Rampart* and *Creek Run* lifts), but more than Alternatives 1 or 4, with no development in Section 16. As a result, facilities at Summit West and Summit Central would realize proportionately higher densities, as compared to Alternative 2 and Modified Alternative 5.

Alpental

Under Alternative 3, developed winter recreation at Alpental would be as described under Alternative 2 except that the proposed *Pulse Gondola* would not be constructed. Accordingly, Alpental's CCC would increase from 1,880 to 2,620 skiers (300 less than proposed in Alternative 2).

All lift realignments and/or upgrades, lift installations, facility construction and resulting impacts discussed for Alternative 2 would occur under Alternative 3 except that with no development of the *Pulse Gondola*, round-trip skiing from the base area to the summit at Alpental in one chairlift ride versus two would not be possible, resulting in a slightly less diverse lift network compared to alternatives that include development of a gondola. Current crowding at the summit of Denny mountain would continue as described under Alternative 1.

With omission of the *Pulse Gondola*, Alternative 3 would not provide for the direct base-to-mountain-top access and enhanced ski patrol response to the higher elevation terrain at Alpental that is associated with Alternatives 2, 4 and Modified Alternative 5.

Under Alternative 3, conditions in the Internationale basin would be as described for Alternative 2, with the area becoming skied out more quickly, and the opportunity for round-trip skiing without having to access the *Armstrong Express* lift.

Visitation

Overall, the skier visit response to improvements under Alternative 3 would be less than the response to Alternative 2 due to the absence of the *Creek Run* chairlift at Summit East and the *Pulse Gondola* at

Alpental (see Table 4.11-2, Illustration 4.11-1 and Appendix J – Assumptions used in the Recreation, Social and Economic Analysis).

In Phase 1, the *Internationale* and *Rampart* development at Alpental and Summit East, respectively, in combination with other lift replacements and other visitor improvements throughout the ski facility, would generate an overall increase in visitation of approximately 8 percent by the end of Phase 1 (year 3 of the projection period), representing an annual increase of approximately 2.7 percent.

During Phase 2, realignments and/or upgrades to chairlifts, additional skier support facilities and increased parking would further stimulate visitation growth, although at a slightly lower rate than under Phase 1. Skier visitation would increase at a rate of approximately 2 percent annually during Phase 2.

The Phase 3 improvements under Alternative 3 provide for continued lift replacements and the construction of additional skier support facilities. It is expected that these improvements would continue to stimulate visitation growth at a rate of approximately 2.5 percent annually through the life of the MDP.

Dispersed Winter Recreation

From Alpental

Impacts to dispersed winter recreation from Alpental under Alternative 3 would be as discussed under Alternative 2 except that any anticipated impacts to dispersed winter recreation resulting from the *Pulse Gondola* would be eliminated under Alternative 3. Those wishing to access the backcountry would have to ride the *Armstrong Express* and *Edelweiss* or the *Internationale* chairlift to access the backcountry.

Under Alternative 3, skiers would continue to utilize facilities at Alpental to access the Great Scott Traverse and The Bluffs, as described in Section 3.11.3 – Developed Winter Recreation. The groomed traverse leading from Alpental Lot 6 would continue to be closed to uphill traffic, including backcountry skiers and snowshoers.

From The Summit

Impacts to dispersed winter recreation from The Summit under Alternative 3 would be as discussed under Alternative 2, except that impacts to Nordic Pass route users would be reduced, considering the *Creek Run* chairlift would not be constructed under Alternative 3 and visitation would be less than anticipated under Alternative 2. Alternative 3 would detract from the current backcountry skiing access to Nordic Pass, nonetheless.

Developed Summer Recreation

Hiking

Under Alternative 3, impacts to existing hikers would be as described under Alternative 1. With no *Pulse Gondola*, Alternative 3 would not provide access to the summit of Alpental for interpretive hiking. As a

result, the Alpental summit would provide a dispersed recreation opportunity during the summer, providing more solitude than under Alternatives 2, 4 and Modified Alternative 5.

Mountain Biking

Under Alternative 3, impacts to mountain biking would be as described under Alternative 2.

Summer Concert Series

Under Alternative 3, impacts to the summer concert series at Alpental would be as described under Alternative 2.

Scenic Rides

Under Alternative 3, scenic rides would be as discussed under Alternative 1.

Dispersed Summer Recreation

Alpine Lakes Wilderness

Under Alternative 3, dispersed summer recreation impacts to Alpine Lakes Wilderness would be as described under Alternative 1.

Pacific Crest National Scenic Trail

Under Alternative 3, dispersed summer recreation impacts to users of the PCNST would be as described under Alternative 2.

Parking

Parking under Alternative 3 would be as described under Alternative 2. The reduced development in Section 16 (no *Creek Run* development) would reduce the circulation between Summit Central and Summit East, thereby increasing reliance on the shuttle to provide access to Summit East. As a result, shuttle service to Alpental would be proportionately less than under Alternative 2. The lift and trail capacity would exceed the parking capacity, as described for Alternative 2.

Although Alternative 3 does not include the *Pulse Gondola* and mountain-top restaurant at Alpental, parked-out conditions would continue to occur during peak visitation due to the projected increase in visitation and increased capacity of the lift and trail system at Alpental. Insufficient parking conditions at Alpental would be less than Alternative 2, but more than Alternative 1, and would continue to reduce the quality of the recreation experience at The Summit-at-Snoqualmie.

4.11.4 Impacts – Alternative 4

Under Alternative 4, The Summit-at-Snoqualmie would implement all projects documented in Chapter 2, Section 2.3.5 - Alternative 4 (see Figures 2.3.5-1, Alternative 4 Proposed Conditions - The Summit, and 2.3.5-2, Alternative 4 Proposed Conditions – Alpental).

Recreation Opportunity Spectrum

Alternative 4 would introduce new development and upgrading of existing facilities at the ski area. This development would continue to meet the designated ROS criteria for *Roaded Natural*.

Developed Winter Recreation

The Summit

Under Alternative 4, developed winter recreation at The Summit would be as described under Alternative 2 except that the *Creek Run* and *Rampart* chairlifts and associated trails would not be constructed. Accordingly, The Summit would operate 22 lifts (16 chairlifts, 3 surface lifts and 3 magic carpets). The trail network at The Summit would increase by approximately 9 acres, from the existing 70 named trails on approximately 545 acres, to 75 trails on approximately 554 acres, as compared to existing conditions. The Summit's CCC would increase from 8,140 to 9,360 skiers (1,350 less than proposed in Alternative 2).

Beginner facilities would continue to be provided at Summit West and Summit Central, as described for Alternative 2. Chairlifts and tows would either be realigned or replaced. Terminals would be located closer to base area facilities in order to minimize walking distances for beginners, creating more desirable learning conditions, as compared to existing conditions. Under Alternative 4, the beginner experience would be enhanced by these terrain improvements as compared to Alternative 1.

All lift realignments and/or upgrades, facility construction, revegetation and resulting impacts that were discussed for Summit West and Summit Central under Alternative 2 would occur under Alternative 3, including the difficult access from Summit West to Summit Central and from Summit Central to Summit East. These upgrades and additions to The Summit's lift and trail network would improve circulation, skier dispersal and have a positive impact on the recreational experience for guests of all levels.

Facility and trail improvements at Summit East would be as discussed under Alternative 2 except that the *Creek Run* and *Rampart* chairlifts would not be constructed. Existing trails in the vicinity of the *Creek Run* and *Rampart* pods would remain as described for Alternative 1. Additional night skiing at Summit East would include new trails constructed within the *Mill Creek* pod; however the *Silver Fir* pod would not be night lit.

Alternative 4 would not develop the *Rampart* and *Creek Run* chairlifts or the improved crossover trails between Summit East and Summit Central. Considering the lack of access to Summit East and the lack of night lighting on the *Silver Fir* pod, night skiers at Summit Central would be less likely to access Summit East under Alternative 4 as compared to Alternatives 2, 3 and Modified Alternative 5. Therefore, night skiing at Summit East would rely solely on visitors to Summit East (i.e., parked at Summit East for night skiing).

Overall, with the inability of skiers to circulate between Summit East and Summit Central, the lack of skier facilities at Summit East, and the lack of night skiing at Summit East, the incorporation of the

Summit East facility in the overall operation at The Summit would continue to present a problem for Ski Lifts, Inc. As a result, the viability of the operation at Summit East would continue to be uncertain.

Alpental

Under Alternative 4, developed winter recreation at Alpental would be as described under Alternative 2, including the effect of the mountain-top restaurant on winter circulation patterns and density. The direct base to mountain-top access via the *Pulse Gondola* would enhance ski patrol access to the higher elevation terrain at Alpental.

Under Alternative 4, conditions in the Internationale basin would be as described for Alternative 2, with the area becoming skied out more quickly, and the opportunity for round-trip skiing from the summit without having to access the *Armstrong Express* lift.

Visitation

Overall, skier visit response to improvements under Alternative 4 would be less than Alternatives 2 and 3, as neither the *Creek Run* nor the *Rampart* chairlifts and associated trails would be developed (see Table 4.11-2, Illustration 4.11-1 and Appendix J – Assumptions used in the Recreation, Social and Economic Analysis).

In Phase 1, the *Internationale* development at Alpental, chairlift realignments and/or upgrades, and new chairlift installations throughout The Summit-at-Snoqualmie would stimulate visitation growth by approximately 4 percent at the end of Phase 1 (year 3 of the projection period), representing an annual increase of approximately 1.3 percent.

Phase 2 developments, including lift realignments and/or upgrades at Alpental and Summit West, as well as the construction of additional skier support facilities, would continue to increase visitation at The Summit-at-Snoqualmie at a rate of approximately 2 percent annually.

Phase 3 new facilities and improvements would be similar to those proposed under Alternative 2, providing for increased visitation growth of approximately 2.5 percent annually.

Similar to Alternative 2, the *Pulse Gondola* and mountain-top restaurant at Alpental would become a year-round attraction during Phase 3, and would generate approximately 70,000 non-skiing visits in its first year of operation and grow at a rate of approximately 6 percent during the final three years of Phase 3.

Dispersed Winter Recreation

From Alpental

Impacts to dispersed winter recreation from Alpental under Alternative 4 would be as discussed under Alternative 2.

Under Alternative 4, skiers would continue to utilize facilities at Alpental to access the Great Scott Traverse and The Bluffs, as described in Section 3.11.3 – Developed Winter Recreation. The groomed traverse leading from Alpental Lot 6 would continue to be closed to uphill traffic, including backcountry skiers and snowshoers.

From The Summit

Impacts to dispersed winter recreation from The Summit under Alternative 4 would be less than Alternative 3. With no development of alpine ski lifts or trails in Section 16, the possibility of encounters between downhill and backcountry skiers would be greatly reduced, as compared to Alternative 2. In addition, no improvement of the existing crossover trail from Summit Central to Summit East would reduce the likelihood of similar encounters. Overall, Alternative 4 would affect Nordic Pass backcountry skiing in a manner similar to Alternative 1.

Developed Summer Recreation

Hiking

Under Alternative 4, impacts to hiking would be as described under Alternative 2.

Mountain Biking

Under Alternative 4, impacts to mountain biking would be as described under Alternative 2.

Summer Concert Series

Under Alternative 4, impacts to the summer concert series at Alpental would be as described under Alternative 2.

Scenic Rides

Under Alternative 4, impacts to scenic rides would be as described under Alternative 2.

Dispersed Summer Recreation

Alpine Lakes Wilderness

Under Alternative 4, dispersed summer recreation impacts to Alpine Lakes Wilderness would be as described under Alternative 2.

Pacific Crest National Scenic Trail

Under Alternative 4, dispersed summer recreation impacts to users of the PCNST would be as described under Alternative 2.

Parking

The effects of parking under Alternative 4 would be similar to Alternative 2 at The Summit. However, Alternative 4 would enhance the effect of insufficient parking at Alpental by reducing the acreage of parking by 0.9 acre in Parking Lots 4, 5, 6 and 7, in order to accommodate the realignment of Alpental

Road to allow for riparian restoration (see Section 4.3 - Watershed Resources). As a result, Alternative 4 represents the greatest impact to skiers wishing to park at Alpental for skiing at the area, with the lift and trail CCC exceeding parking capacity to a greater extent than the other Action Alternatives, due to the loss of 0.9 acre of parking. The insufficient supply of parking at Alpental would continue to detract from the recreation experience of visitors at The Summit-at-Snoqualmie.

4.11.5 Impacts – Modified Alternative 5

Under Modified Alternative 5, The Summit-at-Snoqualmie would implement all projects documented in Chapter 2 - Alternatives, Section 2.3.6 - Modified Alternative 5 (see Figures 2.3.6-1, Modified Alternative 5 Proposed Conditions - The Summit, and 2.3.6-2, Modified Alternative 5 Proposed Conditions – Alpental).

Recreation Opportunity Spectrum

Modified Alternative 5 would introduce new development and upgrading of existing facilities at the ski area. This development would continue to meet the designated ROS criteria for *Roaded Natural*.

Developed Winter Recreation

<u>The Summit</u>

Under Modified Alternative 5, developed winter recreation would be as described under Alternative 2 except that Trail 55A would be completely gladed (as compared to gladed with a 25-foot wide, fully cleared path down the middle of the trail, as discussed under Alternative 2). In addition, proposed Trails 60 and 61 would have reduced trail widths (as compared to Alternative 2) and Trail 49 (Summit Central–Summit East crossover) would follow a different alignment than in Alternative 2, resulting in less clearing. Accordingly, the trail network at The Summit would increase by approximately 48 acres (6 acres less than proposed under Alternative 2), from the existing 70 named trails on approximately 545 acres to 80 trails on approximately 593 acres. Development in Section 16 would enhance the intermediate and advanced intermediate level skiing as compared to Alternative 1 by providing tree-lined and tree skiing in Section 16. Modified Alternative 5 would provide higher ability level terrain that Alternative 2 due to the comparatively decreased trail clearing and increased gladed terrain.

Beginner facilities would continue to be provided at Summit West and Summit Central, as described for Alternative 2. Chairlifts and tows would either be realigned or replaced. Terminals would be located closer to base area facilities in order to minimize walking distances for beginners, creating more desirable learning conditions, as compared to existing conditions. Under Modified Alternative 5, the beginner experience would be enhanced by these terrain improvements as compared to Alternative 1.

All lift realignments and/or upgrades, lift installations, facility construction, revegetation and resulting impacts that were discussed for Summit West, Summit Central and Summit East under Alternative 2 would occur under Modified Alternative 5 except that Trail 55A would not include any full clearing. As

such, the trail would not be utilized by skiers of lower abilities because of the additional challenge of navigating though trees as opposed to utilizing a fully-cleared trail. Regardless, development in Section 16 would enhance the skier experience at Summit East and provide improved skier connectivity between Summit Central and Summit East under Modified Alternative 5, as compared to Alternatives 1 and 4, similar to Alternative 2, and more than Alternative 3. Difficult access between Summit West and Summit Central would remain for beginner to intermediate level skiers due to the necessity to negotiate Trail 42 (Parachute) in order to access Summit Central from Summit West. In addition, Summit East would be fully integrated into The Summit operations, as described for Alternative 2, despite the comparatively less development in Section 16.

Alpental

Under Modified Alternative 5, developed winter recreation at Alpental would be as described under Alternative 2 with the exception of an upgrade to the *Edelweiss* chairlift to provide increased capacity within the existing alignment. The upgrade of the *Edelweiss* chairlift would improve the skier experience by alleviating lift lines for skiers wishing to round-trip ski the Edelweiss bowl. The increase in capacity would also include improvements to the top terminal to provide additional area for skiers getting off of the lift. However, due to the limited space available at the top of the lift, it is expected that crowing at the top terminal will continue to be an issue due to the increased capacity of the lift.

The development of a restaurant at the summit of Alpental would affect the skier experience and circulation as described for Alternative 2. The direct base to mountain-top access would enhance ski patrol access to the higher elevation terrain at Alpental, as described for Alternative 2. Under Modified Alternative 5, conditions in the Internationale basin would be as described for Alternative 2, with the area becoming skied out more quickly, and the opportunity for round-trip skiing from the summit without having to access the *Armstrong Express* lift.

The combination of the *Pulse Gondola* and upgrade to the *Edelweiss* chairlift would result in an exacerbation of the crowding conditions that currently occur at the summit of Denny mountain at the top terminal of *Edelweiss* more than the other Action Alternatives.

Visitation

Skier and non-skier visitation projections under Modified Alternative 5 would be identical to Alternative 2, based upon the capacity and phasing of improvements. The slight reduction in development in Section 16 under Modified Alternative 5, compared to Alternative 2, would not affect visitation because the capacities of the *Rampart* and *Creek Run* pods would be the same as Alternative 2.

Dispersed Winter Recreation

From Alpental

Impacts to dispersed winter recreation from Alpental under Modified Alternative 5 would be as discussed under Alternative 2.

From The Summit

Impacts to dispersed winter recreation from The Summit under Modified Alternative 5 would be as discussed under Alternative 2.

Developed Summer Recreation

Hiking

Under Modified Alternative 5, impacts to hiking would be as described under Alternative 2.

Mountain Biking

Under Modified Alternative 5, impacts to mountain biking would be as described under Alternative 2.

Summer Concert Series

Under Modified Alternative 5, impacts to the summer concert series at Alpental would be as described under Alternative 2.

Scenic Rides

Under Modified Alternative 5, impacts to scenic rides would be as described under Alternative 2.

Dispersed Summer Recreation

Alpine Lakes Wilderness

Under Modified Alternative 5, dispersed summer recreation impacts to Alpine Lakes Wilderness would be as described under Alternative 2.

Pacific Crest National Scenic Trail

Under Modified Alternative 5, dispersed summer recreation impacts to users of the PCNST would be as described under Alternative 2, with the exception of an upgrade of the PCNST where it traverses the Summit West parking lot. The modified location would reroute the PCNST through an adjacent vegetated area. The upgrade would improve the quality of the PCNST experience as hikers traverse through the ski area.

Parking

Parking under Modified Alternative 5 would be as described under Alternative 2.

4.11.6 CUMULATIVE EFFECTS

Population and economic growth in the communities near Snoqualmie Pass is inevitable. Growth in King and Kittitas counties, as well as at a regional level, will affect recreational demand in the Snoqualmie Pass area. This can be expected to occur in two ways: population growth will spread to new areas (primarily east of Seattle); and residents of the region will demand sources of recreation.

As stated in Chapter 3, development pressures on Kittitas County are expected to increase as the capacities of east King County communities (e.g., Issaquah and North Bend) are further taxed. The Snoqualmie Pass area and communities to the east represent a next logical tier along the I-90 corridor to accept development pressures emanating from the greater Seattle-Tacoma area.

Suncadia is a new master planned resort community presently under development on a 6,300-acre site in the foothills of the Cascade Mountains, adjacent to the town of Roslyn. Suncadia is fully permitted and is planned to be developed in three phases. As envisioned, the resort will be developed as an upscale destination resort community primarily serving residents of the central Puget Sound region, but also residents of central and eastern Washington and elsewhere. Plans include a mountain-style lodge and resort village, at least three 18-hole golf courses, a large recreation center, 40 miles of multiple use trails, approximately 2,300 second-home units and homesites, about 170 fractional units, and about 150 timeshare units. Suncadia has the potential to alter the character of the communities east of Snoqualmie Pass by increasing the population and property values, but will also create additional employment and recreational opportunities.

Located approximately 31.5 miles east of The Summit-at-Snoqualmie, Suncadia represents a reasonably foreseeable future source of additional development and population growth in Kittitas County. With Suncadia providing primarily second homes, it is foreseeable that an increasing number of metropolitan Seattle residents will travel past The Summit-at-Snoqualmie to visit homes at Suncadia. This additional traffic represents a potential new source of visitation and recreation at The Summit-at-Snoqualmie during both the summer and winter seasons. As a golf community, the potential for Suncadia to enhance summer visitation at The Summit-at-Snoqualmie, particularly for the Action Alternatives that include the *Pulse Gondola* at Alpental would be a significant cumulative effect on recreation in the Study Area.

Tables 4.11-6 and 4.11-7 present a description of this and other projects that have the potential to cumulatively effect recreation in the vicinity of the Study Area, in both the U. Yakima and S.F. Snoqualmie Watersheds, respectively.

Table 4.11-6:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Recreation

Project Name	Project Summary	Cumulative Effects on Recreation
Projects Not Associated with The Summit-at-Snoqualmie		
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	The modification and potential widening of I-90 would overlap spatially and temporally with the proposed MDP. The I-90 project is expected to increase daily traffic in the area, and would result in an alteration of access to recreation areas. The project could also result in an increase in recreation visitation in the vicinity of Snoqualmie Pass, and an increase in demand for recreation.
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	The management of newly acquired lands will be beneficial to the forest ecosystem and will provide additional recreational opportunities. Implementation of the I-90 Land Exchange will overlap both spatially and temporally with the Action Alternatives and other land management type projects (described below). Alternative 3 and Modified Alternative 5, with a 390-acre land donation, would cumulatively improve the social and recreational opportunities in the Snoqualmie Pass area.
Gold Creek Pond Trail Development	A native surface foot trail was constructed approximately 100 feet long. This project was completed in 2001.	Construction of a native surface foot trail provides additional recreational opportunities in the Snoqualmie Pass area. When coupled with the Pulse Gondola at Alpental, this trail provides additional capacity for the increasing summer recreation in the Snoqualmie Pass area. The impacts of this project overlap temporally and spatially (in the 5th field scale) with the MDP.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	The purchase of private lands and donation to NFSL overlaps spatially (at the 5th field scale) and temporally with the MDP. Coupled with the 390-acre donation in Alternative 3 and Modified Alternative 5, this project could alter the access and use of NFSL, increasing the recreation opportunities available in the Snoqualmie Pass area.
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of The Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in space and time with the MDP at the site and 5th field scales. This will cumulatively increase the year-round and seasonal population of The Summit-at-Snoqualmie CDP. Demand for recreation would be expected to increase, accordingly.

Table 4.11-6:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Recreation

Project Name	Project Summary	Cumulative Effects on Recreation
Cle Elum RD roads analysis	Analysis of road system to determine long-term need. Implementation is expected in 2010.	The analysis of road systems to determine long-term needs and implementation of this project overlaps spatially (in the 5th field scale) and temporally with the MDP. This project has the potential to alter access and use of NFSL, affecting the variety of recreation opportunities available in the Snoqualmie Pass area.
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the OWNF Land and Resource Management Plan.	The study of lands to determine suitability for preservation as wilderness overlaps spatially and temporally with the MDP. This project has the potential to change land allocations of the OWNF, and could alter the access to and use of NFSL if lands are reallocated to wilderness.
Pro Guiding Service Area Expansion	Pro Guiding has requested expansion of their area of operation to include the Cascade crest area from Kendall Lakes to Mt. Daniel, plus the Alta Mountain area. They are not requesting an increase in number of service days.	The expansion of Pro Guiding's area of operation overlaps temporally, but not spatially with the MDP. This project, coupled with the Action Alternatives, would increase the available recreation opportunities in the Snoqualmie Pass area.
Development of Suncadia Resort Community near Roslyn	Suncadia is fully permitted and is planned to be developed in three phases. Plans include a mountain-style lodge and resort village, three 18-hole golf courses, a recreation center, 40 miles of multiple use trails, approximately 2,300 second-homes, 170 fractional units, and 150 timeshares.	Ongoing development of Suncadia will continue, overlapping with MDP implementation over time. Because Suncadia is located along the I-90 corridor, it's development occupies the same recreation corridor as the MDP alternatives. In conjunction with Suncadia, the Action Alternatives have the potential to cumulatively alter the character of the developed and dispersed recreation offerings east of the Pass. Together, Suncadia and the MDP alternatives would cumulatively additional pressures for developed recreation, as well as dispersed recreation in the Snoqualmie Pass area. Suncadia will also provide a potential source of additional visitation at The Summit-at-Snoqualmie
Snoqualmie Pass Summer Home Tract Permit Reissuance	This project proposes to authorize continued recreation residence use of the 14 cabins located in the Snoqualmie Pass Tract for a 20-year period beginning January 1, 2009 with no change to the current authorized use.	The reauthorization of and continued use of recreation residences in the Snoqualmie Pass Tract would overlap spatially (at the 5th field scale) and temporally with the MDP. Although this project would not create additional recreation residence use, it would maintain recreation residence use which, when combined with the Action Alternatives and other cumulative effects projects, would contribute to the cumulative increase in demand for recreation at The Summit-at-Snoqualmie.

Table 4.11-7:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed on Recreation

Project Name	Project Summary	Cumulative Effects on Recreation
Projects Associated with The Summit-at-Snoqualmie		
Cave Ridge Land Donation	The Summit-at-Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	The donation of 138 acres of private land to the National Forest would overlap spatially and temporally with the MDP at the site scale. Coupled with the 390-acre land donation under Alternative 3 and Modified Alternative 5, this project would alter access to and use of NFSL and recreational opportunities in the Snoqualmie Pass area.
Projects Not Associated with The Summit-at-Snoqualmie		
Huckleberry Land Exchange	Exchange of NFSL for 6,798 acres of Weyerheauser lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	The management of private lands exchanged forof NFSL the I-90 corridor would overlap spatially (in the 5th field scale) and temporally with the MDP. Coupled with the other land exchanges and donations, as well as the Alternative 3 and Modified Alternative 5 (which include a 390-acre land donation), this project would alter access and use of NFSL and recreational opportunities in the Snoqualmie Pass area.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The purchase of private lands and probable donation to the NFSL would overlap spatially (in the 5th field scale) and management of the acquired land would temporally overlap with the MDP. Coupled with other land donations and Alternative 3 or Modified Alternative 5 (which include a 390-acre land donation), this project would alter access and use of NFSL and increase recreational opportunities in the Snoqualmie Pass area.
McClellan Butte Trail Reconstruction Project	The project will relocate approximately 1.5 miles of trail to newly constructed trail or old road bed, abandon 1.5 miles of trail, and rehabilitate tread, drainage and switchbacks as required along the remainder of the 4.4-mile trail.	The relocation and rehabilitation of approximately 5.9 miles of trail did not overlap temporally with the MDP, but does overlap spatially at the 5th field scale. Impacts due to the improvement of the trail, however, coupled with the *Pulse Gondola* at Alpental, would increase the availability and quality of summer recreation in the Snoqualmie Pass area.
Bandera Mountain/Mason Lake Trail Relocation Project	This project reorganized trail access to Mason Lake and Bandera Mountain in order to minimize social and resource impacts associated with the existing trails. The project involved construction of 1.5 miles of new trail, reconstructing 2.0 miles of existing trail and decommissioning 2.3 miles of existing trail.	The construction and reconstruction of approximately 3.5 miles of trail did not overlap temporally with the MDP, but does overlap spatially at the 5th field scale. Recreation effects due to the trail improvements, coupled with the *Pulse Gondola* at Alpental, would increase the availability and quality of summer recreation in the Snoqualmie Pass area.

Table 4.11-7:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed on Recreation

Project Name	Project Summary	Cumulative Effects on Recreation
High Lakes Trail #1012 and Snow Lake Trail #1013 Reconstruction	This project repaired seven switchbacks on the Snow Lake Trail and reconstructed 2 miles on the High Lakes Trail from Snow to Gem Lake.	The reconstruction and rehabilitation of approximately 2 miles of trail did not overlap temporally with the MDP, but does overlap spatially at the 5th field scale. Recreation effects due to trail improvements, coupled with the *Pulse Gondola* at Alpental, this project would increase the availability and quality of summer recreation in the Snoqualmie Pass area.
South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project	This project involves the redcution in maintenance level (ML) on 11 roads (26.3 miles). 19.4 miles would be reduced to ML 1 (closed to motorized access) and utilized as loop and destination trail routes; 2.7 miles would be closed - placed in storage for future forest management; 1.1 mile would be removed from the transportation system and converted to trail; approximately 22.2 miles of spur roads mostly associated with roads proposed for reduction to ML 1 would be closed and removed from the Forest Road Transportation System.	The closure to motorized vehicles and decommissioning or roads would overlap spatially (at the 5th field scale) and temporally with the MDP. The closure of roads would affect access to and use of NFSL, while the closure of roads to motorized vehicles would create non-motorized trails, increasing the recreational opportunities available within the Snoqualmie Pass area.
Road 9020 ERFO Repair	This project proposes to either replace the culvert at Alice Creek or reduce the ML of Road 9020 past Alice Creek to 1.	The replacement of a culvert or closure of the road to motorized access would overlap spatially (in the 5th field scale) and temporally with the MDP. Closure of the road to motorized access would affect access to and use of NFSL, and increase the availability of summer hiking trails within the Snoqualmie Pass area.
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	The construction of a trail and parking facilities would overlap spatially (at the 5th field scale) and temporally with the MDP. Coupled with the Pulse Gondola at Alpental, this project would provide additional capacity for the increasing summer recreation in the Snoqualmie Pass area.
Denny Creek Recreation Residence Permit Reissuance	Authorize continued recreation residence use of the 21 recreation residences located in the Denny Creek Track for a 20-year period beginning January 1, 2009 with no change in the current authorized use.	The reauthorization of and continued use of recreation residences in the Denny Creek Tract would overlap spatially (at the 5th field scale) and temporally with the MDP. Although this project would not create additional recreation residence use, it would maintain recreation residence use which, when combined with the Action Alternatives and other cumulative effects projects, would contribute to the cumulative increase in demand for recreation at The Summit-at-Snoqualmie.

4.11.7 IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

The Action Alternatives that include development of ski area facilities in areas that are currently used for dispersed winter recreation would represent an irretrievable commitment of backcountry skiing resources. Specifically, development in Section 16 (Summit East) would result in the irretrievable loss of solitude for Nordic Pass skiers on their way up to the pass. Similarly, the *Internationale* lift at Alpental would irretrievably commit the Internationale bowl to developed alpine recreation, thereby removing the backcountry potential of the area for the life of the MDP. These effects are reversible, in that the developed facilities could be removed at some time, allowing for continuation of the dispersed uses.

During the summer, the operation of the *Pulse Gondola* at Alpental would irretrievably replace the dispersed nature of the Alpental summit during the summer, for the life of the MDP. Removal of the gondola in the future would restore this commitment of solitude. Therefore, this effect would be reversible.

4.12 TRANSPORTATION

The following section analyzes the effects of The Summit-at-Snoqualmie's FEIS alternatives on traffic, parking and transit conditions at and around The Summit-at-Snoqualmie Study Area.

4.12.1 Impacts – Alternative 1 (No Action Alternative)

Access and Street System

Interstate 90, State Route 906, Alpental Road, and Interchanges 52, 53, and 54

Under Alternative 1, parking and traffic operations along I-90 and SR 906 (including on/off-ramps) would remain unchanged. Any anticipated increase in use along I-90 and/or SR 906 would follow existing trends and are discussed in Section 4.12.8 - Cumulative Effects. Any future road developments proposed by The Summit-at-Snoqualmie would require project-specific approval from the USFS or appropriate regulatory agency(s).

Winter/Summer Peak Volumes

Peak hour volumes under Alternative 1 would be as described for the background condition (see Section 3.12.2.2 - Transportation). Peak volumes would continue to be greatest during the summer months when visitation at The Summit-at-Snoqualmie is at its lowest. Any increase in peak volumes during summer/winter would follow existing trends.

Accidents

Under Alternative 1, no additional development would occur at The Summit-at-Snoqualmie. Any increase in the annual accident rate would correspond to the increase in ADT. The number of accidents that are a result of ski area operations is unknown. As such, anticipating future accidents associated with ski area operations is not possible.

Pedestrian Access

Currently, there are no pedestrian or bicycle pathways along State Route 906 or Alpental Road that provide access to The Summit or Alpental. Consequently, there is limited pedestrian and bicycle activity occurring along State Route 906 and Alpental Road. Under Alternative 1, pedestrian/vehicular incidents would continue to be infrequent as described for the background condition (see Section 3.12.2 - Transportation).

Parking and Shuttle System

No additional parking areas would be constructed at The Summit-at-Snoqualmie under Alternative 1. Any future parking developments would require project-specific approval from the USFS or appropriate regulatory agency(s). The Summit would continue to provide approximately 39.6 acres of parking on 12 surface lots, and Alpental would provide approximately 7.8 acres of parking in 7 surface lots. Parking would continue to be first-come first-serve.

Assuming 2.2 visitors/car, 118 cars/acre and 47.4 acres of parking, the existing parking situation at The Summit-at-Snoqualmie could accommodate a CCC of approximately 12,000 skiers. It appears that an abundance of parking is available, considering The Summit-at-Snoqualmie currently operates at a CCC of 10,020. However, unlike other ski areas, guests other than downhill skiers/snowboarders utilize parking lots at The Summit-at-Snoqualmie. At Summit East, Nordic skiers utilize parking to access over 43 kilometers of groomed Nordic trails in and around Snoqualmie Pass. Furthermore, guests use the parking lots to access public lands at and around both Alpental and The Summit during winter and summer months, for backcountry use, snowshoeing, and hiking. In addition, parking lots at Summit Central and Silver Fir are utilized by guests for tubing. During peak times (which includes most winter weekend days), parking would continue to be overcrowded at The Summit-at-Snoqualmie, particularly at Alpental.

The Summit-at-Snoqualmie would continue to operate its intra-resort shuttle system in order to alleviate deficits in parking. The shuttle system would continue to serve the existing shuttle stop locations and maintain the current operating schedule.

4.12.2 Impacts – Alternative 2 (Proposed Action)

Access and Street System

Interstate 90, State Route 906, Alpental Road, and Interchanges 52, 53, and 54

Under Alternative 2, traffic operations along I-90 and SR 906 (including on/off-ramps) would remain unchanged. Magnesium chloride would be utilized along Alpental Road instead of sand in order to improve traction. The northern segment of the existing Alpental Road (adjacent to Parking Lots 4, 5, 6, and 7) would be paved and include stormwater management.

No changes in road access in the Snoqualmie Pass vicinity are expected due to implementation of Alternative 2, including commercial access through Hyak Estates.[71]

Changes to mountain access roads under Alternative 2 are analyzed in Table 4.2.3-1 - Summary of Sediment Risks from Roads.

Winter/Summer Peak Volumes

Table 4.12-1 summarizes projected peak hour volumes for the 2015 winter operating season for I-90, State Route 906, and Interchanges 52, 53 and 54 in the vicinity of The Summit-at-Snoqualmie. Peak hour volumes represent the morning and evening hours that coincide with the highest traffic volumes for a particular road segment. The table below displays peak traffic volumes projected for 2015 from the 1999 transportation study for the Snoqualmie Pass Community Advisory Council (SNOPAC 1999). The projections were derived from 1998 traffic data and were intended to model traffic at Snoqualmie Pass on

[71] The USFS has an easement through the private section of the 9070 road and 120 and 110 spurs in Section 15. This easement allows access to Section 16 for construction and maintenance of chairlifts and other infrastructure.

a winter Saturday. The SNOPAC study considered full build-out of The Summit-at-Snoqualmie MDP (Alternative 2) when projecting traffic volumes.

Table 4.12-1:
Projected Winter Peak Hour Volumes for 2015

Location	Peak Volume (vehicles/hour)
State Route 906	
Eastbound	293
Westbound	388
Interstate 90	
Eastbound	2,654
Westbound	3,494
Interchange 52	
Eastbound Off	268
Westbound On	764
Interchange 53	
Eastbound On	166
Eastbound Off	106
Westbound On	509
Westbound Off	162
Interchange 54	
Eastbound On	58
Eastbound Off	329
Westbound On	679
Westbound Off	241

Source: SNOPAC 1999

A peak hour volume was recorded in 2006 on Interstate 90 was 3,826 vehicles, as stated in Section 3.12.2.2. The projected 2015 Peak Hour Volume for eastbound and westbound traffic flow on Interstate 90 is 6,148 vehicles, representing a 60 percent increase in peak hour volumes.

Occurrences of peak hour volumes would continue to follow existing trends, and would continue to be less during the winter operating season as compared to the summer months. It is not expected that the occurrences of peak hours would increase during the winter operating season. Peak use of I-90 and SR 906 near The Summit-at-Snoqualmie would continue to occur during the summer months under Alternative 2.

As described in Mitigation Measure MM3, The Summit-at-Snoqualmie would develop a Traffic Management Plan (TMP) that would address traffic congestion created at peak times at the I-90 interchange, as well as other traffic, parking, pedestrian access, and safety issues (see Table 2.4-2). Implementation of this Mitigation Measure would reduce winter-time peak traffic congestion as compared to Alternative 1.

Accidents

Under Alternative 2, the increased facilities at The Summit-at-Snoqualmie would result in a 36 percent increase in the CCC. Using this approach as a conservative estimate, the increase to the annual accident rate under Alternative 2 would be comparable to the 36 percent increase in CCC. Table 4.12-2 summarizes the projected accident rates for Interstate 90 and State Route 906 under Alternative 2.

Table 4.12-2:
Projected Accident Data
for the Vicinity of The Summit-at-Snoqualmie

Road Segment	Total Collisions	Total Injuries	Total Fatalities
Interstate 90[a]	79	29	0
SR 906[b]	12	4	0

[a] 2.09-mile segment between Kittitas County Line and SR 906 at Exit 54
[b] 3.08-mile segment from Exit 52 to the DOT access road beyond Exit 54

Pedestrian Access

Under Alternative 2, the expansion of the existing Summit West Lot 1 and Silver Fir Lots 2 and 3, combined with the proposed construction of Silver Fir Lot 4, will provide additional parking at The Summit-at-Snoqualmie on peak skier days. The increased parking capacity in the proposed and expanded parking lots would reduce the need for ski area visitors to park along the shoulders of SR 906 and therefore reduce the likelihood of vehicle/pedestrian conflicts in the general vicinity of SR 906 parking area. However, proposed parking construction and expansion would not alleviate pedestrians crossing SR 906 from Silver Fir Lot 2 and Summit Central Lot 1 to access facilities at Summit Central and Silver Fir.

Mitigation Measure MM3 would require The Summit-at-Snoqualmie to develop a TMP to address pedestrian safety at crossings (see Table 2.4-2). This Mitigation Measure would improve pedestrian safety in and around the parking lots, as compared to Alternative 1.

Parking and Shuttle System

Alternative 2 would provide approximately 9.7 additional acres of parking, resulting in approximately 57.1 acres of parking on 19 parking lots and along State Route 906 at Summit West (see Table 2.3.5-3).

The Summit would expand the existing Summit West Lot 1, Silver Fir Lots 2 and 3, and construct the proposed Silver Fir Lot 4. Alpental Lots 3, 4, 5, 6, and 7, Summit West Lots 1 and 2, the maintenance shop lot area, and Silver Fir Lot 1 would be paved under Alternative 2. Stormwater management for these parking lots would include oil/water separators, the use of a magnesium chloride deicer instead of sand, and sediment detention areas.

- Parking Lot 1 at Summit West would be regraded and paved to provide an additional 2.8 acres of parking space. Stormwater retention would be installed subsurface.

- Parking Lot 2 at Summit West would be paved and would include stormwater management.
- Parking Lot 1 at Silver Fir would be paved and would include stormwater management.
- Parking Lot 2 at Silver Fir would be expanded from 1.4 acres to approximately 3.6 acres.
- Parking Lot 3 at Silver Fir would be expanded from 0.6 acre to approximately 1.3 acres.
- Parking Lot 4 at Silver Fir would be constructed approximately 100 feet north of the existing Parking Lot 3 and would provide approximately 4.7 acres of additional parking, particularly for tubing.
- Parking Lots 3, 4, 5, 6, and 7 at Alpental would be paved and would include stormwater management.

Table 2.12-3:
The Summit-at-Snoqualmie Parking Lots Under Alternative 2

Parking Lot	Area (acres)	Status	Total Car Capacity	Cars per Acre
Alpental				
Lot 1	0.8	Existing	83	104
Lot 2	1.9	Existing	295	155
Lot 3a	0.9	Proposed	65	72
Lot 4a	0.6	Proposed	80	133
Lot 5a	0.9	Proposed	81	90
Lot 6a	2.5	Proposed	303	121
Lot 7a	0.2	Proposed	25	125
Subtotal	**7.8**		**932**	**119**
The Summit				
Summit West Lot 1b	8.0	Proposed	944	118
Summit West Lot 2a	4.3	Proposed	426	99
First Western	1.8	Existing	190	105
SR 906	2.3	Existing	300	130
Summit Central Lot 1	10.9	Existing	1,606	147
Summit Central Lot 2	4.2	Existing	405	96
Silver Fir Lot 1a	2.7	Proposed	295	109
Silver Fir Lot 2c	3.6	Proposed	425	118
Silver Fir Lot 3c	1.3	Proposed	172	132
Silver Fir Lot 4d	4.8	Proposed	566	118
Summit East Lot 1	1.8	Existing	150	83
Summit East Lot 2	2.6	Existing	195	75
Summit East Lot 3	1.1	Existing	115	105
Subtotal	**49.4**		**5,789**	**118**
Total	**57.2**		**6,721**	**118**

[a] Proposed paving of the existing parking lot and installation of stormwater facilities.
[b] Proposed expansion of existing parking lot, paving and installation of stormwater facilities.
[c] Proposed expansion of existing parking.
[d] Proposed new parking lot.

Total car capacity would increase by 1,109 spaces to a total of 6,721 parking spaces, representing a 20 percent increase over the existing 5,612 parking spaces. The approximate 20 percent increase in parking does not correlate with the approximate 36 percent increase in CCC of Alternative 2, as compared with Alternative 1. As previously noted, parking at The Summit-at-Snoqualmie is overcrowded during peak times during the summer and winter as a result of visitors utilizing public land in and around The Summit-at-Snoqualmie.

Proposed Silver Fir Lot 4 would create additional parking near the tubing facilities at Summit Central which would help to alleviate the current demand of Summit Central Lot 1 by tubing guests. The proposed expansion of Summit West Lot 1 would help to maximize parking at Summit West. In addition, stormwater management proposals (paving of lots, snow storage options and use of MgCl as a deicer, as discussed in Appendix G – Stormwater Management Plan) would help to maximize existing parking opportunities at The Summit and Alpental without expanding existing lots.

Due to the high volume of visitation on peak days at The Summit-at-Snoqualmie, parked-out and crowded conditions would continue at both Alpental and The Summit. However, increased parking capacity at Summit West, combined with the improvement of the Summit East-Summit Central crossover trails, would allow visitors to park at Summit West and ski at Summit East, improving dispersal of skiers in parking lots and alleviating some of the congestion problems currently experienced.

Parking at Alpental would continue to be less than the capacity of the lift and trail network, requiring some Alpental guests to use the intra-resort shuttle to access the facilities at Alpental.

Implementation of Mitigation Measure MM3, the development of a TMP, would address parking congestion and encouragement of carpooling and transit use (see Table 2.4-2). In addition, Other Management Provision OMP59 would require The Summit-at-Snoqualmie to make an effort to increase the use of buses and carpools in order to decrease parking area crowding and parked-out conditions.

4.12.3 Impacts – Alternative 3

Access and Street System

Interstate 90, State Route 906, Alpental Road, and Interchanges 52, 53, and 54

Under Alternative 3, traffic operations along I-90, SR 906 and Alpental Road (including on/off-ramps) would be as described under Alternative 2.

Winter/Summer Peak Volumes

Under Alternative 3, Winter/Summer Peak Volumes along I-90 and SR 906 would be as described under Alternative 2. However, due to the reduced CCC, Peak Hour Volumes would be reduced, as compared to Alternative 2. In addition, the proposed *Pulse Gondola* at Alpental would not be constructed, further reducing anticipated volumes presented under Alternative 2. Occurrences of peak hour volumes would continue to follow existing trends, and would continue to be less during the winter operating season as

compared to the summer months. It is not expected that the occurrences of peak hours would increase during the winter operating season under implementation of Alternative 3. Peak use of I-90 and SR 906 near The Summit-at-Snoqualmie would continue to occur during the summer months under Alternative 3.

As described in Mitigation Measure MM3, The Summit-at-Snoqualmie would develop a TMP that would address traffic congestion created at peak times at the I-90 interchange, as well as other traffic, parking, pedestrian access, and safety issues (see Table 2.4-2). Implementation of this Mitigation Measure would reduce winter-time peak traffic congestion as compared to Alternative 1.

Accidents

Under Alternative 3, the CCC at The Summit of Snoqualmie would be approximately 93 percent of capacity as compared to Alternative 2. Therefore, the annual accident rate under Alternative 3 along SR-906 and Interstate 90 would generally be as described under Alternative 2, with a 7 percent decrease comparable to the decrease in CCC.

Pedestrian Access

Pedestrian access for Alternative 3 would be as described for Alternative 2.

Parking and Shuttle System

The parking scenario under Alternative 3 would be as described for Alternative 2. The reduced CCC, as compared to Alternative 2, would result in slightly less congested parking under Alternative 3.

4.12.4 Impacts – Alternative 4

Access and Street System

Interstate 90, State Route 906, Alpental Road, and Interchanges 52, 53, and 54

Under Alternative 4, traffic operations along I-90 and SR 906 (including on/off-ramps) would be as described under Alternative 2.

Under Alternative 4, the northern segment of the existing Alpental Road (adjacent to Parking Lots 4, 5, 6, and 7) would be realigned approximately 100 feet west of the South Fork of the Snoqualmie River. The road segment would be paved and include stormwater management.

Changes to mountain access roads under Alternative 4 are analyzed in Table 4.2.3-1 - Summary of Sediment Risks from Roads.

Winter/Summer Peak Volumes

Under Alternative 4, winter/summer peak volumes along I-90 and SR 906 would be as described under Alternative 2. However, due to the reduced CCC, peak hour volumes would be reduced, as compared to all other Action Alternatives (Alternatives 2, 3 and Modified Alternative 5). Occurrences of peak hour volumes would continue to follow existing trends, and would continue to be less during the winter

operating season as compared to the summer months. It is not expected that the occurrences of peak hours would increase during the winter operating season under implementation of Alternative 4. Peak use of I-90 and SR 906 near The Summit-at-Snoqualmie would continue to occur during the summer months under Alternative 4.

As described in Mitigation Measure MM3, The Summit-at-Snoqualmie would develop a TMP that would address traffic congestion created at peak times at the I-90 interchange, as well as other traffic, parking, pedestrian access, and safety issues (see Table 2.4-2). Implementation of this Mitigation Measure would reduce winter-time peak traffic congestion as compared to Alternative 1.

Accidents

Under Alternative 4, the CCC at The Summit of Snoqualmie would be approximately 90 percent of capacity as compared to Alternative 2. Therefore, the annual accident rate under Alternative 4 along SR-906 and Interstate 90 would generally be as described under Alternatives 2 and 3, with a 10 percent decrease comparable to the decrease in CCC.

Pedestrian Access

Pedestrian access for Alternative 4 would be as described for Alternative 2.

Parking and Shuttle System

Proposed parking lots and expansion would be as described for Alternative 2 except Parking Lots 4, 5 and 6 at Alpental would be reduced in size and Parking Lot 7 at Alpental would be completed eliminated. The reduction would occur to accommodate the proposed realignment of the Alpental Road. The reduction of Parking Lots 4, 5 and 6 combined with the loss of Parking Lot 7 would result in a decrease of 12 percent of available parking at Alpental. Reduction in parking at Alpental under Alternative 4 would further exacerbate the parking situation during the summer and winter, requiring more people to ride the shuttle bus to Alpental than any of the other Action Alternatives.

Implementation of Mitigation Measure MM3, the development of a TMP, would address parking congestion and encouragement of carpooling and transit use (see Table 2.4-2). In addition, Other Management Provision OMP59 would require The Summit-at-Snoqualmie to make an effort to increase the use of buses and carpools in order to decrease parking area crowding and parked-out conditions.

4.12.5 Impacts – Modified Alternative 5

Access and Street System

Interstate 90, State Route 906, Alpental Road, and Interchanges 52, 53, and 54

Under Modified Alternative 5, traffic operations along I-90, SR 906 and Alpental Road (including on/off-ramps) would be as described under Alternative 2.

Winter/Summer Peak Volumes

Modified Alternative 5 represents a 2 percent increase in CCC at The Summit-at-Snoqualmie when compared to Alternative 2. Winter/summer peak volumes along I-90 and SR 906 would be as described under Alternative 2, with a 2 percent increase comparable to the increase in CCC. Occurrences of peak hour volumes would continue to follow existing trends, and would continue to be less during the winter operating season as compared to the summer months. It is not expected that the occurrences of peak hours would increase during the winter operating season under implementation of Modified Alternative 5. Peak use of I-90 and SR 906 near The Summit-at-Snoqualmie would continue to occur during the summer months under Modified Alternative 5.

As described in Mitigation Measure MM3, The Summit-at-Snoqualmie would develop a TMP that would address traffic congestion created at peak times at the I-90 interchange, as well as other traffic, parking, pedestrian access, and safety issues (see Table 2.4-2). Implementation of this Mitigation Measure would reduce winter-time peak traffic congestion as compared to Alternative 1.

Accidents

Modified Alternative 5 represents a 2 percent increase in CCC at The Summit-at-Snoqualmie when compared to Alternative 2. Therefore, the annual accident rate along SR-906 and Interstate 90 would be as described under Alternative 2, with a 2 percent increase comparable to the increase in CCC.

Pedestrian Access

Pedestrian access for Modified Alternative 5 would be as described for Alternative 2.

Parking and Shuttle System

Under Modified Alternative 5, total car capacity would increase by 1,109 spaces to a total of 6,721 parking spaces, representing a 20 percent increase over the existing 5,612 parking spaces and would be as described for Alternative 2. The approximate 20 percent increase in parking does not correlate with the approximate 39 percent increase in CCC of Modified Alternative 5, as compared with Alternative 1. As previously noted, parking at The Summit-at-Snoqualmie is overcrowded during peak times during the summer and winter as a result of visitors utilizing public land in and around The Summit-at-Snoqualmie.

Implementation of Mitigation Measure MM3, the development of a TMP, would address parking congestion and encouragement of carpooling and transit use (see Table 2.4-2). In addition, Other Management Provision OMP59 would require The Summit-at-Snoqualmie to make an effort to increase the use of buses and carpools in order to decrease parking area crowding and parked-out conditions.

4.12.6 Cumulative Effects

Traffic

Currently, WSDOT is analyzing the effects of widening I-90 in the vicinity of Snoqualmie Pass to accommodate increased traffic congestion and improve roadway conditions. The expansion would benefit automobiles traveling across Snoqualmie Pass in either eastbound or westbound directions. The proposed expansion would be constructed to accommodate future demand and increased use of I-90, as documented earlier in this section.

Private land developments (including four zoned PUDs) would increase the population of the Snoqualmie Pass area, and may increase traffic congestion and demand for additional roads.

The traffic effects under any of The Summit-at-Snoqualmie Action Alternatives combined with the potential effects of the I-90 widening project and private land developments would have no cumulative effects on traffic within the Study Area.

Excluding The Summit-at-Snoqualmie MDP, the I-90 EIS, and the private land developments, there are no other reasonably foreseeable projects that would have the potential to affect traffic in the Study Area, resulting in cumulative effects.

Parking

There are no past, present or reasonably foreseeable actions identified that would cumulatively affect parking at The Summit-at-Snoqualmie.

4.12.7 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitments of transportation resources in the Study Area. Should the purpose and need for The Summit-at-Snoqualmie be eliminated, the management direction for the SUP area could be revised and the existing and proposed facilities could be removed within the Study Area. Accordingly, traffic, parking and transit facilities associated with The Summit-at-Snoqualmie operations could be eliminated altogether, although other transportation facilities may remain.

4.13 UTILITIES

The utilities analysis is presented under each alternative for the following categories: domestic water; wastewater treatment; power; communications; electronic sites; fuel storage and solid waste.

4.13.1 Impacts - Alternative 1 (No Action Alternative)

Domestic Water

Under Alternative 1, The Summit would continue to obtain domestic water supply from SPUD. No additional facilities would be implemented and therefore The Summit's total water consumption would increase with increased visitation (see Section 4.11 – Recreation) from the current rate of approximately 85,000 gallons per day to approximately 93,500 gallons per day after 10 years. As such, the existing water supply and storage would remain adequate and continue to meet peak domestic water demand.

Alpental would continue to obtain domestic water from the two existing wells. Peak daily consumption at the resort would remain at approximately 28,000 gallons as no additional facilities are proposed under Alternative 1. Consequently, Alpental's existing domestic water supply and storage would remain adequate and meet the resort's peak domestic water demand.

The Oly tank at Summit East would remain abandoned from the water infrastructure at Summit East, but the tank would be maintained as an icon and snowboard terrain feature.

Table 4.13.1-1 displays the projected water consumption for The Summit and Alpental under the range of alternatives analyzed.

Table 4.13.1-1:
Water Demand at The Summit-at-Snoqualmie

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
The Summit CCC	8,140	10,710	9,990	9,360	10,710
The Summit gpd (capacity = 465,000)	93,500	149,126	117,882	110,448	149,126
Alpental CCC	1,880	2,920	2,620	2,920	3,220
Alpental gpd (capacity – 620,640)	28,000	34,500	30,916	34,500	37,950

Wastewater Treatment

The Summit-at-Snoqualmie would continue to utilize the wastewater treatment system serviced by SPUD under Alternative 1. SPUD has proposed additional spray fields/reservoirs in order to accommodate a higher daily flow, but has indicated the existing treatment plant has adequate capacity to accommodate The Summit-at-Snoqualmie (SPUD 2002, 2007).

Power

Under Alternative 1, The Summit-at-Snoqualmie would continue to draw power from Puget Sound Energy. Puget Sound Energy has indicated that the power supply infrastructure has ample capacity to fully accommodate The Summit-at-Snoqualmie (Sno.engineering 1998).

Communications

PTI Communications would continue to furnish telecommunications services to The Summit-at-Snoqualmie under Alternative 1.

Electronic Sites

Under Alternative 1, no additional private land would be leased to accommodate cellular transmission service providers. The existing developed sites would continue to operate as stated in the current lease agreements.

Fuel Storage

No additional fuel storage facilities would be implemented at The Summit-at-Snoqualmie under Alternative 1. All existing fuel storage tanks would remain in compliance with applicable federal, state and local regulations.

Solid Waste

Under Alternative 1, no increase to on-mountain CCC would occur. Therefore, the solid waste generated by The Summit-at-Snoqualmie would continue to be generated at approximately 0.96 pound per skier visit (see Table 3.13.2-1). Anticipated increase in visitation is approximately one percent for each year (see Section 4.11 – Recreation). Existing solid waste production at 0.96 pound per skier visit generates approximately 470,000 pounds of solid waste per year. Considering visitation is expected to increase over the next ten years, solid waste generated at year ten of the visitation projections would be approximately 515,000 pounds under Alternative 1. Table 4.13.1-2 displays the projected solid waste generation under all of the alternatives.

Table 4.13.1-2:
Solid Waste Generation at The Summit-at-Snoqualmie

Existing	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Modified Alternative 5
470,000 lb.	515,000 lb.	608,000 lb.	598,000 lb.	574,000 lb.	608,000 lb.

4.13.2 Impacts - Alternative 2

Domestic Water

Under Alternative 2, SPUD would continue to supply domestic water to The Summit.

At Summit East approximately 2,400 feet of proposed water lines would be extended from a proposed potable water pump station, which would be located along an access part way up the mountain near the bottom terminals of the *Rampart* and *Creek Run* chairlifts. Utilities already exist to serve homes in this area. The utility extensions would be installed subsurface (trench dimensions – 1 foot by 2 feet 6 inches) and would terminate at a proposed water pump and tank, which would be constructed adjacent to the proposed mountain-top restaurant at the upper terminal of the *Mt. Hyak* chairlift.

At Summit West approximately 2,300 feet of water lines would be extended from an existing water pumping station adjacent to the existing maintenance building. The water line extensions would be installed subsurface (trench dimensions – 1 foot by 2 feet 6 inches) and would terminate at a proposed water pump and tank, which would be constructed adjacent to the proposed mountain-top restaurant at the upper terminal of the *Wildside* chairlift.

Under Alternative 2, water lines would be extended from the base area to the proposed mountain-top restaurant at Alpental. The first extension would extend from a potable water pump station in the base area to the upper terminal of the *Armstrong Express* chairlift. The first section of water line extensions would be installed subsurface (trench dimensions – 1 foot by 2 feet 6 inches) and run 4,966.25 feet in length. The second section of extension would be installed in an aboveground utilidor (including both sewer and potable water piping) and would terminate at a proposed water pump and tank, which would be constructed adjacent to the proposed mountain-top restaurant and run approximately 2,900 feet in length. Approximately 200 feet of utility extensions would be installed and supplied to the proposed ski patrol bump shack at the upper terminal of the *Armstrong Express* chairlift.

The Summit-at-Snoqualmie would install approximately 15,000 feet of waterlines under Alternative 2. (see Figures 2.3.3-3, Proposed Utilities Night Skiing and Roads Alternative 2 – The Summit and 2.3.3-4, Proposed Utilities Night Skiing and Roads Alternative 2 – Alpental and Appendix H – Mountaintop Restaurant Utility Corridors Memo).

The Oly tank at Summit East would remain abandoned from the water infrastructure at Summit East, but the tank would be maintained as an icon and snowboard terrain feature.

Under Alternative 2, it is anticipated that Alpental's domestic water demand at full build-out would be approximately 34,500 gpd, which is well below the capacity of over 600,000 gallons per day. Water demand at The Summit would increase to 149,126gpd, which is below the capacity of 465,000 gpd (see Table 4.13.1-1).

Wastewater Treatment

Under Alternative 2 SPUD would continue to treat wastewater generated by ski area operations. As described for Alternative 1, The Summit-at-Snoqualmie currently generates on average 0.122 million gallons of wastewater per day. Under Alternative 2 it is expected that wastewater generation at The

Summit-at-Snoqualmie would increase by approximately 0.062 million gallons per day to a total of 0.184 million gallons per day. SPUD has indicated that the wastewater treatment facility has ample capacity to accommodate The Summit-at-Snoqualmie under the Action Alternatives (SPUD 2002, 2007). Project level approval would be required for implementation of individual projects that would increase wastewater flows and would be subject to available treatment capacity at SPUD.

Under Alternative 2, approximately 2,400 feet of proposed sewer lines would be extended from a proposed sewer connection, which would be located along an access part way up the mountain near the bottom terminals of the *Rampart* and *Creek Run* chairlifts at Summit East. Utilities already exist to serve homes in this area. The utility extensions would be installed subsurface (trench dimensions – 1 foot by 2 feet 6 inches) and would end at a proposed water pump and tank, which would be constructed adjacent to the proposed mountain-top restaurant at the upper terminal of the *Mt. Hyak* chairlift.

At Summit West approximately 2,300 feet of sewer lines would be extended from an existing sewer connection adjacent to the existing maintenance building. The utility extensions would be installed subsurface (trench dimensions – 1 foot by 2 feet 6 inches) and would terminate at a proposed water pump and tank, which would be constructed adjacent to the proposed mountain-top restaurant at the upper terminal of the *Wildside* chairlift.

Sewer lines under Alternative 2 would be extended approximately 7,000 feet to the proposed mountain-top restaurant from the base area at Alpental. The first extension would extend from a sewer connection at an existing manhole in the base area to the upper terminal of the *Armstrong Express* chairlift. The first section of sewer extensions would be installed subsurface (trench dimensions – 1 foot by 2 feet 6 inches) and run approximately 5,000 feet in length. The second extension of approximately 2,800 feet would be installed in an aboveground utilidor (including both sewer and potable water piping) and would terminate at a proposed water pump and tank, which would be constructed adjacent to the proposed mountain-top restaurant.

In total, approximately 17,500 feet of sewer lines would be installed at The Summit-at-Snoqualmie under Alternative 2.

Puget Sound Energy supplies electrical power to The Summit and Alpental and furnishes most of the high voltage power lines, as well as the requisite transformers and distribution lines. Puget Sound Energy has indicated that the power supply infrastructure has ample capacity to fully accommodate The Summit-at-Snoqualmie (Sno.engineering 1998).

The proposed *Surface Lift I and II, Baby Double, Northside, Julie's Chair, Little Thunder, Dodge Ridge,* and *Wildside* chairlifts at Summit West would be equipped with bottom drive terminals. These lift installations would include approximately 750 feet of underground power line extensions from the existing network of power lines.

At Summit West, power would be supplied to the proposed maintenance facility by installing approximately 230 feet of subsurface power line along the existing road from the maintenance lot parking area. The power line would be grouped in the same trench as other proposed utilities where possible, or in parallel trenches where required (e.g., vertical/horizontal spacing is required for sewer/water lines).

At Summit Central, the proposed *Holiday, Triple 60, Ski School, and Easy Street* chairlifts would be equipped with bottom drive terminals. These lift installations would include approximately 600 feet of underground power line extensions from the existing network of power lines.

Power would be supplied to the *Silver Fir* base area at Summit Central from the existing network of power lines. The power lines would be installed subsurface and run approximately 15 feet.

The proposed *Mill Creek* chairlift would be equipped with a bottom drive terminal at Summit East. The lift installation would include an underground power line extension of approximately 200 feet from the existing network of power lines.

The proposed *Rampart* and *Creek Run* chairlifts would be equipped with bottom drive terminals. These lift installations would include approximately 1,250 feet of underground power line extensions from the existing network of power lines. These power lines would be installed within the proposed road leading to the bottom terminals of *Rampart* and *Creek Run* chairlifts.

Power would be supplied to the proposed mountain-top restaurant at Summit East. This would require the installation of approximately 100 feet of subsurface power line and would extend from the existing power line network. Utility lines would be installed subsurface and would be grouped in the same trench, where possible, or in parallel trenches where required (e.g., vertical/horizontal spacing is required for sewer/water lines).

The proposed *Internationale, St. Bernard*, and *Sessel* chairlifts at Alpental would be equipped with bottom drive terminals. These lift installations would include approximately 600 feet of underground power line extensions from the existing network of power lines.

At Alpental, the proposed *Pulse Gondola* would be equipped with a bottom drive terminal. This lift installation would include approximately 30 feet of underground power line extensions from the existing network of power lines.

Power would be supplied to the proposed mountain-top restaurant at Alpental as discussed for water and sewer utility lines with an additional approximately 130 feet of power line extensions. 68.12 feet of power and communication lines would be extended to the proposed bump shack at the upper terminal of the *Armstrong Express* chairlift. The proposed visitor services building would require approximately 60 feet of power line extensions from the existing network of power lines. Additionally, the proposed Fuel and Maintenance Facilities would require approximately 130 feet of power line extensions. Utility lines would

be installed subsurface and would be grouped in the same trench, where possible, or in parallel trenches where required (e.g., vertical/horizontal spacing is required for sewer/water lines).

In total, approximately 8,800 feet power line extensions would be installed at The Summit-at-Snoqualmie under Alternative 2. Of the 8,786.88 feet of proposed power line extensions, approximately 6,000 feet would be installed sub-surface with the remaining 2,800 feet installed above ground.

Communications

Under Alternative 2, communications would continue to be provided via telephone service connecting all base area and on-mountain facilities. The addition of communications lines along proposed or upgraded chairlifts would include aerial installation. All other proposed communication lines would be buried.

Electronic Sites

Alternative 2 does not allocate any new land for proposed electronic sites at Alpental or The Summit. Therefore, new leases will not be issued for electronic sites on Booth Creek Resorts land. The three currently developed sites will remain in place and continue to operate under the terms stated in their respective lease agreements.

Fuel Storage

Under Alternative 2, Alpental's existing aboveground fuel storage tank, comprised of two tanks (500 gallon gasoline and 1,500 gallon diesel), would be relocated alongside the existing maintenance road, across from the maintenance facility to be constructed under Alternative 2.

The existing fuel station at Summit West would be removed for the construction of the proposed maintenance facility. A new fueling station would be constructed adjacent to the proposed maintenance facility at Summit West. The existing fuel station at Summit Central would remain.

Solid Waste

Under Alternative 2, the on-mountain CCC would increase from 10,020 to 13,630 skiers. Anticipated increase in visitation is expected to reach 633,803 skiers during the final year of implementation in year 10 (see Section 4.11 – Recreation). Existing solid waste production at 0.96 pound per skier visit generates approximately 470,000 pounds of solid waste per year. Considering visitation is expected to increase over the next ten years, solid waste generated at year ten of the visitation projections would be approximately 608,000 pounds (see Table 4.13.1-2).

4.13.3 Impacts - Alternative 3

Domestic Water

Domestic water under Alternative 3 would be as described under Alternative 2, with the following exceptions: no waterline would be installed to the Alpental Summit, as no restaurant is proposed under Alternative 3. Furthermore, the proposed ski patrol bump shack at the upper terminal of the *Armstrong*

Express chairlift would not require the installation of a new water line as proposed in Alternative 2. As a result, Alternative 3 would include approximately 4,300 feet of proposed water lines.

The Oly tank at Summit East would remain abandoned from the water infrastructure at Summit East, but the tank would be maintained as an icon and snowboard terrain feature.

Under Alternative 3, it is anticipated that Alpental's domestic water demand at full build-out would be approximately 30,916 gpd, which is well below the capacity of over 600,000 gallons per day. Water demand at The Summit would increase to 117,882 gpd which is below the capacity of 465,000 gpd (see Table 4.13.1-1).

Wastewater Treatment

Under Alternative 3, wastewater treatment facilities would be as described under Alternative 2, with the following exceptions: no sewer line would be extended to the upper terminal of the existing *Edelweiss* chairlift at Alpental. In addition, the proposed ski patrol bump shack at the upper terminal of the *Armstrong Express* chairlift would not install a proposed sewer line as described in Alternative 2. Alternative 3 would propose installation of approximately 6,700 feet of subsurface sewer lines.

Power

Under Alternative 3, power supply and distribution would be as described under Alternative 2, with the following exceptions: no power lines would be extended to the *Edelweiss* chairlift at Alpental or the *Creek Run* chairlift at Summit East. As such, a total of approximately 4,000 feet of power line would be proposed under Alternative 3.

Communications

Communications under Alternative 3 would be as described under Alternative 2, with following exception: no communication line would be extended to the *Creek Run* chairlift at Summit East.

Electronic Sites

Electronic sites under Alternative 3 would be as described under Alternative 2.

Fuel Storage

Fuel Storage under Alternative 3 would be as described under Alternative 2.

Solid Waste

Under Alternative 3, the on-mountain CCC would increase from 10,020 to 12,610 skiers. Anticipated increase in visitation is expected to reach 622,823 skiers during the final year of implementation in year 10 (see Section 4.11 – Recreation). Existing solid waste production at 0.96 pound per skier visit generates approximately 470,000 pounds of solid waste per year. Considering visitation is expected to increase over

the next ten years, solid waste generated at year ten of the visitation projections would be approximately 598,000 pounds, approximately 10,000 pounds per year less than Alternative 2 (see Table 4.13.1-2).

4.13.4 Impacts - Alternative 4

Domestic Water

Domestic water infrastructure under Alternative 4 would be as described under Alternative 2. Under Alternative 4, it is anticipated that Alpental's domestic water demand at full build-out would be approximately 34,500 gpd, which is well below the capacity of over 600,000 gallons per day. Water demand at The Summit would increase to 110,448 gpd which is the lowest among the Action Alternatives, and well below the capacity of 465,000 gpd (see Table 4.13.1-1).

The Oly tank at Summit East would remain abandoned from the water infrastructure at Summit East, but the tank would be maintained as an icon and snowboard terrain feature.

Wastewater Treatment

Wastewater treatment facilities under Alternative 4 would be as described under Alternative 2.

Power

Under Alternative 4, power supply and distribution would be as described for Alternative 2 except that power lines would not be supplied to the *Creek Run* and *Rampart* pods, as proposed for Alternative 2. In total, approximately 7,400 feet of proposed powerlines are included under Alternative 4 at The Summit-at-Snoqualmie.

Communications

Communications under Alternative 4 would be as described for Alternative 2 except that communication lines would not be supplied to the *Creek Run* and *Rampart* pods, as discussed for Alternative 2.

Electronic Sites

Electronic sites under Alternative 4 would be as discussed under Alternative 2.

Fuel Storage

Fuel Storage under Alternative 4 would be as described under Alternative 2.

Solid Waste

Under Alternative 4, the on-mountain CCC would increase from 10,020 to 12,280 skiers. Anticipated increase in visitation is expected to reach 597,698 skiers during the final year of implementation in year 10 (see Section 4.11 – Recreation). Existing solid waste production at 0.96 pound per skier visit generates approximately 470,000 pounds of solid waste per year. Considering visitation is expected to increase over the next ten years, solid waste generated at year ten of the visitation projections would be approximately 574,000 pounds, less than Alternatives 2 and 3 (see Table 4.13.1-2).

4.13.5 Impacts - Modified Alternative 5

Domestic Water

Modified Alternative 5 represents a 2 percent increase in CCC at The Summit-at-Snoqualmie when compared to Alternative 2. Therefore, domestic water demand under Modified Alternative 5 would be as described for Alternative 2, with a 2 percent increase comparable to the increase in CCC (see Table 4.13.1-1). Domestic water infrastructure under Modified Alternative 5 would be as described under Alternative 2.

Wastewater Treatment

Modified Alternative 5 represents a 2 percent increase in CCC at The Summit-at-Snoqualmie when compared to Alternative 2. Therefore, wastewater treatment under Modified Alternative 5 would be as described for Alternative 2, with a 2 percent increase comparable to the increase in CCC. SPUD has indicated that the wastewater treatment facility has ample capacity to accommodate The Summit-at-Snoqualmie under the Action Alternatives (SPUD 2002, 2007). Project level approval would be required for implementation of individual projects that would increase wastewater flows and would be subject to available treatment capacity at SPUD.

Power

Power supply and distribution under Modified Alternative 5 would be as described for Alternative 2.

Communications

Under Modified Alternative 5, communications would be as described for Alternative 2.

Electronic Sites

Electronic sites under Modified Alternative 5 would be as discussed under Alternative 2.

Fuel Storage

Fuel storage under Modified Alternative 5 would be as described for Alternative 2.

Solid Waste

Solid waste under Modified Alternative 5 would be as described for Alternative 2.

4.13.6 Cumulative Effects

SPUD has proposed additional spray fields/reservoirs to accommodate higher daily flows as demand increases. New service hook-ups for SPUD are served on a first-come, first-serve basis. All new services operated by municipalities or public entities which discharge sewage into public waters requires submission and approval of a permit from the Department of Ecology.

Presently, there are four PUDs zoned in the vicinity of The Summit-at-Snoqualmie. However, no formal development applications are currently filed with Kittitas County for any of the PUDs. It is reasonably foreseeable that these PUDs will realize future residential and commercial development, but since no formal development plans exist, no foreseeable impacts on utilities can be evaluated, although it is probable that these future developments will cause an increase in demand for domestic water, electricity, solid waste disposal and fuel consumption that would parallel the future rate of development in the Snoqualmie Pass area.

Tables 4.13.6-1 and 4.13.6-2 present these and other reasonable foreseeable projects that have the potential to cumulatively affect utilities in the U. Yakima and S.F. Snoqualmie Watersheds, respectively.

Table 4.13.6-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Utilities

Project Name	Project Summary	Cumulative Effects on Utilities
Projects Not Associated with The Summit-at-Snoqualmie		
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	The I-90 modifications would overlap with the MDP in both space and time. During construction, use of power, water, communications and other utilities would be expected to increase cumulatively with implementation of the MDP.
U.S. West Telephone line	Installation of an underground telephone line in old road prism. This project was completed in 2001.	The installation of an underground telephone line did not overlap spatially at the site scale or temporally with the proposed MDP. However, the installation of phone lines at the site and 5th field scale would cumulatively improve communication line infrastructure in the Snoqualmie Pass area.
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of The Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap spatially and temporally with the MDP at the 5th field scale. While no detailed accounting of utility requirements is available, development of these sites, coupled with the implementation of the Action Alternatives, would cumulatively increase demands on utilities and infrastructure in the Snoqualmie Pass area.

Table 4.13.6-2:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed on Utilities

Project Name	Project Summary	Cumulative Effects on Utilities
Projects Not Associated with The Summit-at-Snoqualmie		
U.S. West Telephone line	Installation of an underground telephone line in the I-90 corridor	The installation of an underground telephone line did not overlap spatially at the site scale or temporally with the proposed MDP. However, the installation of phone lines at the site and 5th field scale would cumulatively improve communication line infrastructure in the Snoqualmie Pass area.
BPA Proposed Additional Power Lines	Supplemental DEIS to examine development of an additional powerline. Options include adding lines to existing towers or adding new towers.	The proposal to develop an additional power line would overlap spatially (in the 5th field) and temporally with the MDP. Under this project, there would be an increase in the capacity and availability of electrical power in the Snoqualmie Pass area
Snoqualmie Pass Utility District Permit Amendment	The project would extend water and sewer lines along Forest Service Road 4832 from the I-90 Hyak interchange for approximately 3,000 feet. The new lines would stop before reaching Gold Creek. Lines would be lain within the existing road right of way.	The extension of water and sewer lines would overlap spatially (in the 5th field) and temporally with the MDP. This project would increase the availability of sewer and water in the Snoqualmie Pass area.

4.13.7 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitments of utilities as a result of any Action Alternatives.

4.14 LAND USE

The land use analysis is presented under each alternative for the following categories: NFSL and private lands; within and adjacent to the Study Area.

4.14.1 Impacts – Alternative 1 (No Action Alternative)

4.14.1.1 Lands within The Summit-at-Snoqualmie Study Area

National Forest System Lands

Under Alternative 1, there would be no change to the land allocations occurring within The Summit-at-Snoqualmie Study Area. The existing developed facilities would be consistent with allocations established in the *MBSNF Forest Plan, as Amended* and the *WNF Plan, as amended*. Inclusion of 380 acres of AMA (ST-1 - Scenic Travel) lands in the Study Area would continue to be inconsistent with management direction for this allocation in the OWNF (see Section 1.2 - Tiering, Management Direction, U.S. Forest Service Policy).

Under Alternative 1, the opportunity for solitude in the unroaded portion of Alpental would remain unchanged from the existing condition.

Private Land

Under Alternative 1, there would be no proposed development on the ski area lands owned by Ski Lifts, Inc., or other parties, as part of the MDP.

Land use on private property would comply with established zone regulations except for lands zoned as Forest and Range by Kittitas County at Summit Central. However, buildings and structures associated with the operation and maintenance of the ski area were in place prior to the adoption of the zoning ordinance and are therefore grandfathered.

4.14.1.2 Lands Adjacent to The Summit-at-Snoqualmie Study Area

Under Alternative 1, there would be no changes to land allocations or zoning adjacent to the Study Area, including NFSL.

4.14.2 Impacts – Alternative 2

4.14.2.1 Lands within The Summit-at-Snoqualmie Study Area

National Forest System Lands

In Alternative 2, the SUP area of The Summit-at-Snoqualmie would increase by approximately 53 acres (see Figure 2.3.3-1, Alternative 2 Proposed Conditions). Under Alternative 2, a total of 433.01 acres of OWNF lands would be re-allocated from AMA (ST-1 - Scenic Travel) to AMA (RE-1- Developed Recreation). These lands include 380 acres in the existing SUP area, 53 acres in the SUP adjustment, and

0.01 acre at the existing cross-country warming hut. The inclusion of the 380 acres in the existing SUP area and the additional 53 acres into the Developed Recreation allocation would be consistent with the *WNF Forest Plan, as Amended*.

The amendment would be considered a non-significant Forest Plan amendment under NFMA on the basis of Criteria outlined in FSM 1922.51 – *Changes to the Forest Plan That are Not Significant.* Changes to the forest plan that are not significant can result from:

1. Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management;
2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management; and
3. Minor changes in standards and guidelines.
4. Opportunities for additional management practices that will contribute to achievement of the management prescription.

Within the existing SUP area, 380 acres of OWNF lands are allocated to AMA (ST-1), which is not consistent with their inclusion in the ski area SUP boundary and the presence/operation of ski area facilities within them. Presently, the *Silver Fir* chairlift and trails, Summit East-Summit Central crossover trails, and roads are located on this portion of the SUP area. Therefore, designation of this area as RE-1 would be the most consistent with its use and its presence within the SUP area. The Plan amendment would place the land in the appropriate management prescription for ski areas and would not significantly alter the multiple-use goals and objectives for long-term land and resource management (FSM 1922.51-1). The Plan amendment would not result in a change in standards and guidelines.

The construction of the *Internationale* lift at Alpental would not require any new roads, but the presence of the lift will reduce the opportunity for solitude during the non-skiing season.

Private Land

Under Alternative 2, the Ski Lifts, Inc. owned land at The Summit-at-Snoqualmie within King County would realize the development of a new maintenance building at Alpental. This development would be consistent with the CB zone.

Within Kittitas County, Ski Lifts, Inc. owned lands under Alternative 2 would undergo development of the mountain-top restaurant at Summit East, the new Central Base Lodge and Silver Fir Lodge at Summit Central, and renovation to the Thunderbird Lodge at Summit West. Chairlifts on private land that would be realigned include *Easy Gold* and *Mill Creek* at Summit East and *Easy Street*, *Ski School*, *Triple 60*, and

Holiday at Summit Central. These facilities and chairlifts would be on land that is zoned Forest and Range by Kittitas County, and would therefore be consistent with the current use in that zone. On the PUD parcel, the Silver Fir parking lot 2 would be expanded and the Silver Fir parking lot 4 would be built, consistent with the PUD zone for this parcel.

4.14.2.2 Lands Adjacent to The Summit-at-Snoqualmie Study Area

Land allocation and zoning adjacent to The Summit-at-Snoqualmie Study Area would not be impacted under Alternative 2.

The realignment of lifts and expansion of parking lot 1 at Summit West would take place within view of the PCNST under Alternative 2. However, this development would be similar in form to the existing ski area facilities that are currently in view of the trail inside The Summit-at-Snoqualmie Study Area (see Section 4.11 - Recreation and Section 4.15 - Visual Resources). The presence of developed recreation sites along the PCNST would be consistent with the multiple-use guidance in the National Trails system Act[72] and the *Comprehensive Management Plan for the Pacific Crest National Scenic Trail* (USDA 1982).

4.14.3 Impacts – Alternative 3

4.14.3.1 Lands within The Summit-at-Snoqualmie Study Area

National Forest System Lands

In Alternative 3, the SUP area of The Summit-at-Snoqualmie would increase by approximately 17 acres to connect the Summit Central and Summit East SUP Boundaries (see Figure 2.3.4-1, Alternative 3 Proposed Conditions). Under Alternative 3, a total of 397.01 acres of OWNF lands would be re-allocated from AMA (ST-1 - Scenic Travel) to AMA (RE-1- Developed Recreation). These lands include 380 acres in the existing SUP area, 17 acres in the SUP adjustment, and 0.01 acre at the existing cross-country warming hut. The inclusion of the 380 acres in the existing SUP area and the additional 17 acres into the Developed Recreation allocation would be consistent with the *WNF Forest Plan, as Amended*. The rationale for non-significance under NFMA is as described under Alternative 2.

Impacts to unroaded areas would be as described for Alternative 2.

Under Alternative 3, Ski Lifts, Inc. would buy approximately 440 acres of land from Plum Creek Timber in Section 21 (see Figure 2.3.4-3, Existing and Proposed Land Donation). Approximately 50 acres of this parcel would be retained as an in-holding for the *Mill Creek* chairlift and associated trail development, the remaining 390 acres would be donated to the Federal Government for USFS management. Upon the transfer of ownership, these lands would be incorporated into the SPAMA. The USFS would manage the donated land as LSH and it would be allocated as AMA (ST-1 – Scenic Travel).

[72] P.L. 90-543

As a result of the land donation, approximately 390 acres of additional land would be managed by the USFS. The acreage of area to be managed as Riparian Reserves in the Study Area would increase by approximately 183 acres, from approximately 522 acres of county buffers to approximately 705 acres of Riparian Reserves.

Private Land

Under Alternative 3, a total of 390 acres of Plum Creek land would be removed from private ownership (Forest and Range zone) and included in NFSL. Impacts to other private lands within The Summit-at-Snoqualmie Study Area in both King County and Kittitas County would be as described for Alternative 2.

4.14.3.2 Lands Adjacent to The Summit-at-Snoqualmie Study Area

Impacts to lands adjacent to The Summit-at-Snoqualmie Study Area would be as described under Alternative 2.

4.14.4 Impacts – Alternative 4

4.14.4.1 Lands within The Summit-at-Snoqualmie Study Area

National Forest System Lands

In Alternative 4, the SUP area of The Summit-at-Snoqualmie would increase by approximately 17 acres as described for Alternative 3 (see Figure 2.3.5-1, Alternative 4 Proposed Conditions). Re-allocation of 397.01 acres of OWNF lands would be as described for Alternative 3. Impacts to unroaded areas would be as described for Alternative 2.

Private Land

Under Alternative 4, private land zoning within The Summit-at-Snoqualmie Study Area in both King County and Kittitas County would be the same as Alternative 2.

4.14.4.2 Lands Adjacent to The Summit-at-Snoqualmie Study Area

Land Allocation and zoning adjacent to The Summit-at-Snoqualmie Study Area would be as described under Alternative 2.

4.14.5 Impacts – Modified Alternative 5

4.14.5.1 Lands within The Summit-at-Snoqualmie Study Area

National Forest System Lands

In Modified Alternative 5, the SUP area of The Summit-at-Snoqualmie would increase by approximately 53 acres as discussed under Alternative 2. The effects of the re-allocation of 433.01 acres of OWNF lands from AMA (ST-1 - Scenic Travel) to AMA (RE-1- Developed Recreation) would be as described for Alternative 2. The effects of the donation of 390 acres of private land into NFSL would be as described for Alternative 3. Impacts to unroaded areas would be as described for Alternative 2.

Private Land

Under Modified Alternative 5, impacts to private lands would be as discussed under Alternative 3.

4.14.5.2 Lands Adjacent to The Summit-at-Snoqualmie Study Area

Impacts to lands adjacent to The Summit-at-Snoqualmie Study Area would be as described under Alternative 2.

4.14.6 Cumulative Effects

In 1998, approximately 32,000 acres of private land, owned by Plum Creek Timber were exchanged for approximately 11,600 acres of NFSL. The long-term impacts of this exchange were focused on creating a multi-age forest ecosystem. In addition, the Federal Government has taken ownership of other private lands in the Snoqualmie Pass area, including lands in Sections 5, 7 and 25 of T21N, R 11E, as well as Sections 17 and 25, T22N, R11E. The Huckleberry Land Exchange and the proposed Cave Ridge Land Donation projects also result in Federal ownership of previously private lands in the Snoqualmie Pass area.

Including the 390-acre land donation under Alternatives 3 and 5, these activities result in a reduction in "checkerboard" ownership in the Snoqualmie Pass area, allowing for USFS Management of the NFSL for development of a multi-age forest ecosystem.

Tables 4.14.6-1 and -2 identify the effects of these, and other pertinent projects that have the potential to cumulatively effect land use in the vicinity of the Study Area.

Table 4.14.6-1:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Land Use

Project Name	Project Summary	Cumulative Effects on Land Use
Projects Not Associated with The Summit-at-Snoqualmie		
Kachess Vegetation Management	The campground contained old growth trees suffering from various stages of root rot. Hazard trees were identified in the Kachess Lake Campground through an exhaustive survey. All identified trees were removed during the winter of 2004. A small amount of timber was sold as merchantable, the rest was disposed of through firewood sales, lop and scatter, or burned.	The project does not overlap spatially or temporally with the MDP and is consistent with the OWNF LRMP. Therefore, no cumulative effects to land use have been identified.

Table 4.14.6-1:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Land Use

Project Name	Project Summary	Cumulative Effects on Land Use
Plum Creek Road Restoration	The Cle Elum Ranger District is performing a road analysis covering approximately 50-70 miles of harvest roads on 65,000 acres of land acquired in the last 5 years from Plum Creek Timber lands. Currently, approximately 18 miles of roads that were acquired and deemed to be unsafe or were already closed have been decommissioned by the Forest Service. Under the Proposed Action, approximately 30.57 miles of road would be decommissioned.	Decommissioning of these roads would overlap spatially and temporally with the MDP and other land management projects at the 5th field scale. Such road decommissioning would be consistent with the SPAMA goal of managing for LSH in the Snoqualmie Pass area, resulting in no cumulative effect to land use.
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	The project could improve wildlife habitat connectivity between the north and south Cascades through installation of culverts for wildlife crossings if those alternatives are selected. Approximately 50.9 acres would be impacted by road expansions. This project would overlap spatially and temporally with the MDP, thus Alternative 3 and Modified Alternative 5 would cumulatively enhance wildlife connectivity in the Snoqualmie Pass area, consistent with the SPAMA.
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	In the U. Yakima watershed, the acquired lands would be managed under the SPAMA allocation with a late-seral habitat preservation emphasis. The management of newly acquired lands would be beneficial to the forest ecosystem as long-term management goals are focused towards creating a multi-age forest ecosystem on these lands. The proposed land donation under Alternative 3 and Modified Alternative 5 would overlap in space at the 5th field scale and cumulatively add to the land managed as late-seral forest.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	The recent purchase of Sections 5, 17 and 25 of Township 21N Range 11E occur within portions of the Yakima River watershed, and would overlap spatially (at the 5th field) and temporally with the MDP. These acquired lands would be allocated to the SPAMA and managed with an emphasis for late-seral habitat preservation. The acquisition and management of these areas would result in a beneficial impact from management in NFSL system. In addition, the land donation proposed under Alternative 3 and Modified Alternative 5 would contribute to the cumulative beneficial effects resulting from other land acquisitions and donations.

Table 4.14.6-1:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Land Use

Project Name	Project Summary	Cumulative Effects on Land Use
Plum Creek Cascade Habitat Conservation Plan	A HCP was developed for the Plum Creek Timber Company to manage timber harvest and protect wildlife habitat over several 5th field watersheds in the vicinity of Snoqualmie Pass.	Approximately 52,100 acres of land is managed under the HCP, and overlaps spatially (at the 5th field) and temporally with the MDP. While not included in the NFSL, the purpose of the HCP is to improve conditions for wildlife on Plum Creek lands. On this basis, the effects of the HCP will cumulatively improve wildlife conditions in the Snoqualmie Pass area, when added to other habitat improvement projects. In addition, the land donation proposed under Alternative 3 and Modified Alternative 5 would contribute to the cumulative beneficial effects resulting from other land acquisitions and donations.
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of the Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap spatially and temporally with the MDP. These developments would be consistent with the PUD zone and would not cumulatively effect land use.
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the Upper Yakima River watershed to accelerate the development of late-successional forest structure. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	A total of 210 acres of forest would be commercially thinned to accelerate the development of late-successional forest structure. The impacts of this project would overlap spatially (in the 5th field) and temporally with the MDP. This project is consistent with the land allocations for this area. Thus, no cumulative effect to land use has been identified.

Table 4.14.6-1:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Land Use

Project Name	Project Summary	Cumulative Effects on Land Use
Snoqualmie Pass AMA Plan	Land management plan for the AMA emphasizing late-successional habitat maintenance and enhancement	Land management under the SPAMA would overlap spatially and temporally with the MDP. SPAMA's emphasis on LSH maintenance and enhancement, combined with the land management projects in the area, would be beneficial to the ecosystem and wildlife habitat, and would be consistent with the land allocations for the area. In addition, the land donation proposed under Alternative 3 and Modified Alternative 5 would contribute to the cumulative beneficial effects resulting from other land acquisitions and donations.
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the Okanogan-Wenatchee National Forest Land and Resource Management Plan.	The study of lands to determine suitability for preservation would overlap spatially and temporally with the MDP at the 5th field. This project has the potential to change land allocations to Wilderness, and, coupled with the land management projects in the area, could result in an improvement of wildlife habitat and ecosystems, consistent with SPAMA. In addition, the land donation proposed under Alternative 3 and Modified Alternative 5 would contribute to the cumulative beneficial effects resulting from other land acquisitions and donations.
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (West Keechelus subwatershed). The proposed project includes thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	The restoration of ecological conditions near Cold Creek would overlap spatially (in the 5th field) and temporally with the MDP. The acceleration of LSH, combined with the other land management projects in the area, would be beneficial to wildlife habitat and the ecosystem, consistent with SPAMA.
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (E. Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and fish passage improvements, and other restoration projects.	The restoration of ecological conditions through thinning and road obliteration would overlap spatially (in the 5th field) and temporally with the MDP. The acceleration of LSH, combined with the other land management projects in the area, would be beneficial to wildlife habitat and the ecosystem, consistent with SPAMA.

Table 4.14.6-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed on Land Use

Project Name	Project Summary	Cumulative Effects on Land Use
Projects Associated with The Summit-at-Snoqualmie		
Cave Ridge Land Donation	The Summit-at-Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	The donation of approximately 138 acres to the National Forest would overlap spatially and temporally with the MDP. Approximately 100 acres would be added to the Alpine Lakes Wilderness and the remainder would be managed to maintain its current unroaded character. The management of the donated lands, in conjunction with other land management projects in the area, would be beneficial to wilderness, habitat connectivity and the ecosystem.
Projects Not Associated with The Summit-at-Snoqualmie		
Huckleberry Land Exchange	Exchange of NFSL for 6,798 acres of Weyerheauser lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	Approximately 6,798 acres of Weyerhaeuser land was received by the Forest Service. The management of 702 acres as Late Successional Reserve, in conjunction with other land management projects in the area, would be beneficial to the wildlife connectivity and the ecosystem.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The recent purchase of Section 19 of Township 22N Range 11E occurs within portions of the S.F. Snoqualmie River watershed, and overlaps spatially (at the 5th field scale) and temporally with the MDP. These lands would be allocated to Late Successional Reserve. The management of the majority of these acquired lands as Late Successional Reserve, in conjunction with other land management projects in the area would be beneficial to wildlife connectivity and the ecosystem.

4.14.7 Irreversible and Irretrievable Commitments of Resources

Under Alternatives 3 and 5, Lands donated by Ski Lifts, Inc. to the Federal Government would no longer be available for timber harvest, as lands would be managed as LSH under Federal ownership. During this timeframe, the potential for timber harvest on this 390-acre parcel would be irretrievably lost. This loss would be reversible, in that the USFS could re-allocate the lands to an allocation that allows for timber harvest.

Aside from this loss under Alternatives 3 and 5, there would be no irreversible or irretrievable commitments of land use related to the existing or proposed land uses and allocations in the Study Area. Should the Purpose and Need for The Summit-at-Snoqualmie be eliminated, the management direction for the SUP area could be revised and the existing and proposed facilities could be removed from the Study Area.

4.15 VISUAL RESOURCES

Potential impacts to visual resources are presented for each alternative. This section will analyze impacts from four critical viewpoints. Conceptual sketches of proposed facilities on NFSL have been created (see Conceptual Sketch-1 through 6) and a visual simulation of proposed *Creek Run* and *Rampart* pods in Section 16 at Summit East for Alternative 2 (see Photo Simulation #1 Summit East in Volume 3).

4.15.1 Impacts – Alternative 1 (No Action Alternative)

Under Alternative 1, there would be no development resulting in impacts to Visual Resources. Visual conditions and trends would remain as described in Section 3.15 - Visual Resources.

Mt. Baker-Snoqualmie National Forest

Alpental

Under Alternative 1, developed ski facilities, including the Denny Mountain Lodge, the day lodge and other base area facilities would not reflect the current USFS Cascadian Architecture standards. However, ski area facilities would remain visually subordinate to the surrounding landscape of the Alpental valley. Clearing for ski trails would continue to repeat the natural form, line, color and texture of the natural surrounding landscape and remain visually subordinate to the surrounding environment. Facilities and development would continue to be characteristic of what one may expect to see when traveling in a developed alpine community. Development at Alpental would continue to meet the EVC of Moderately Altered and therefore, would continue not to meet the prescribed VQO of Retention.

The Summit

Under Alternative 1, existing ski area facilities along SR 906 at Summit West would not reflect the current USFS Cascadian Architecture standards except for the newly constructed Rental Center and facade to the Alpenhaus Lodge. Recently constructed structures would continue to meet the EVC of Moderately Altered and the prescribed VQO of retention would continue not to be met.

Historic ski trail clearing at Summit West would continue to remain uncharacteristic of any natural landscape and would continue to dominate the surrounding landscape. Ski trail clearings at Summit West would continue to meet the EVC of Moderately Altered and the prescribed VQO of retention would continue not to be met.

Okanogan-Wenatchee National Forest

At Summit West under Alternative 1, the maintenance facility would not reflect current USFS Cascadian Architecture standards. In addition, trails at Summit West would continue to dominate the surrounding landscape and continue to meet a Forest Service definition of Maximum Modification.

Under Alternative 1, trail clearing at Silver Fir and Summit East would continue to produce a strong form unrelated to natural occurrences. Although clearing would remain visually subordinate to the surrounding landscape, OWNF lands at The Summit would continue to meet the definition of Partial Retention, and the prescribed VQO of Retention would continue not to be met. The overall visual condition at Summit Central and Summit East would be Modification.

In addition, the existing power line traverse through the middle of Section 16 would continue to produce a strong clearing line and form that is uncharacteristic to the surrounding forested landscape. The area would continue to meet a VQO of Maximum Modification and the prescribed VQO of Retention would not be met.

Critical Viewpoints

In order to analyze potential visual impacts associated with proposed development on NFSL, four critical viewpoints were identified by the USFS IDT (see Figure 3.15.3-1, Critical Viewpoints). These viewpoints are intended to represent the most commonly traveled and used viewpoints by the public, from which development may affect the scenic quality and integrity of the area.

Snow Lake Trail

From the trail, the landscape would continue to appear unaltered, and development would not be visible or discernable to the casual observer. The landscape would continue to appear unaltered and ski area development would continue to not be visible or discernable to the casual observer. The landscape would continue to meet a prescribed VQO of middle-ground Retention.[73]

Pacific Crest National Scenic Trail

Two viewpoints along the PCNST are analyzed in this FEIS.

Development at Summit West (ski area facilities, chairlifts, maintenance shop, etc.) would remain clearly visible to the observer along the PCNST as one descends from Beaver Lake through the ski area. Development would remain visually subordinate to the surrounding landscape and continue to meet the definition of foreground Partial Retention.[74]

Trails at Summit West, as viewed from the PCNST (near Beaver Lake), would continue not to reflect any shape, form or pattern of natural occurrences. Although similar cut patterns would remain visible on all lands surrounding the Study Area, and background views are dominant along this portion of the PCNST, existing ski trail clearings at Summit West would continue to meet the definition of foreground Modification, as viewed from the PCNST (near Beaver Lake).

[73] Middle-ground refers to the viewing zone that is ½ to 4 miles from the observer.
[74] Foreground refers to the viewing zone within 0 to ½ mile from the observer.

The second viewpoint is located on the east side of I-90. Vegetative cover would continue to screen developed facilities from observers along the PCNST. As such, ski trail clearings and developed facilities at Summit West would continue to meet the definition of middle-ground Partial Retention from the PCNST on the east side of I-90.

I-90 Heading West

Trail clearing and ski area facilities represent a middle-ground view and would remain evident to the casual observer along I-90. Immediate foreground views along I-90 would continue to be dominated by I-90 itself and associated signage and development. Middle-ground views would continue to remain visually subordinate to the surrounding landscape in comparison to the developed foreground. The public lands adjacent to I-90 at The Summit would remain consistent with the EVC of Moderately Altered and would not meet the prescribed VQO of Retention.

4.15.2 Impacts – Alternative 2 (Proposed Action)

Under Alternative 2, The Summit-at-Snoqualmie would implement all projects documented in Section 2.3.3 - Alternative 2 - Proposed Action. Conceptual sketches of proposed facilities on NFSL have been developed (see Conceptual Sketch-1 through 6) and a visual simulation of proposed *Creek Run* and *Rampart* pods in Section 16 at Summit East for Alternative 2 (see Photo Simulation #1 Summit East).

Mt. Baker-Snoqualmie National Forest

Alpental

Under Alternative 2, clearing for lifts and trails at Alpental would be faintly evident to the casual observer and would continue to repeat the natural form, line, color and texture of the natural surrounding landscape and existing ski trail clearing. Trail development at Alpental would remain visually subordinate to the surrounding environment.

As viewed from Alpental Road near parking Lot 3, ski facilities (particularly the Visitor Service Building, lift realignments and *Pulse Gondola*) would reflect current USFS Cascadian Architecture standards (see Conceptual Sketches #1 and #2, respectively) and borrow from the naturally established form and line (e.g., peaked roofs, earth tones) of the surrounding natural landscape. Paving of Parking Lots 3, 4, 5, 6 and 7 and Alpental Road from Lot 4 to Lot 7 would result in a less natural texture and color, but would be consistent with adjoining paved roads and the developed character of the base area. Facilities would continue to be evident to the observer; however, these proposed and existing structures would continue to remain visually subordinate to the dramatic landscape comprising the Alpental valley and remain characteristic of what one may expect to see when traveling in a developed alpine community. Because development at Alpental would remain visually subordinate to the surrounding landscape, Alpental would continue to meet the definition of Modification, and the prescribed VQO of Retention would continue not to be met.

The *Pulse Gondola* would provide direct access to the mountain-top restaurant at Alpental (see Conceptual Sketch-3 and 4). The mountain-top restaurant would reflect current USFS Cascadian Architecture standards. The upper terminal of the *Pulse Gondola* and mountain-top restaurant would not be visible from Alpine Lakes Wilderness during the daytime. However, light from the restaurant would be discernible from the wilderness during the night time. Other Management Provision OMP42 (see Table 2.4-2) would be implemented to install low glare windows in order to minimize the visibility of such light from the restaurant.

Lighting from night skiing at Alpental would increase the amount of ambient reflection or night glare present in the area during the winter months. Additional impacts resulting from night skiing would not likely be discernable when compared to the extensive night skiing already operating at Alpental. OMP42 (see Table 2.4-2) would be implemented to provide low-glare, directional night lights in order to minimize the effect of additional night lighting.

The Summit

Clearing for lifts and trails on MBSNF lands at Summit West would repeat the form, line, and texture of existing ski terrain in the surrounding environment (as seen from near Beaver Lake). Given the existing vegetative patterns and the large scale of the surrounding landscape, these clearings would not be noticeable to the casual observer. Revegetation at Summit West would create tree islands that would reduce the visual impact of existing and proposed clearing. Proposed revegetation would create a trend of improvement, but would continue to meet the EVC of Moderately Altered.

Expansion of Parking Lot 1 would repeat the form of existing parking lots, and would not be noticeable to the casual observer. Paving of Parking Lot 1 would result in a less natural texture and color, but would be consistent with adjoining paved roads and the developed character of the base area. Base area structures and renovations to existing structures at Summit West on MBSNF (Slide-In Lodge expansion and relocation of lift terminals, fuel and maintenance facilities, etc.) would reflect current USFS Cascadian Architecture standards and meet the VQO of Modification (see Conceptual Sketch #6). While renovations would represent an improvement as compared to the existing visual condition, development at The Summit West Base Area overall would continue to meet the definition of Maximum Modification and the prescribed VQO of Retention would continue to not be met.

Okanogan-Wenatchee National Forest

The Summit

Clearing for lifts and trails on OWNF lands at Summit West would repeat the form, line, and texture of existing ski terrain in the surrounding environment and would not be noticeable to the casual observer. Revegetation at Summit West would create tree islands that would reduce the visual impact of existing clearings. The maintenance facility would reflect current USFS Cascadian Architecture standards (see Conceptual Sketch #5). Paving of Parking Lot 2 and the parking area at the maintenance facility would

result in a less natural texture and color, but would be consistent with adjoining paved roads and the developed character of the base area. Development on OWNF lands at Summit West would meet the definition of Partial Retention and the prescribed VQO of Retention would continue not to be met, although revegetation would create a trend of improvement in the overall visual quality of Summit West.

Clearing for lifts and trails in the *Rampart* and *Creek Run* pods at Summit East and new trails at Silver Fir would repeat the form, line, and color of ski existing ski trails in an area of currently uninterrupted forest. Landscape topography and vegetation would screen a majority of clearing. Visible clearings would repeat the form and line of existing openings in the forest canopy (see Photo Simulation #1). Clearings on OWNF land at The Summit would continue to meet a Forest Service definition of Partial Retention. Revegetation at Summit East would be less extensive than for Summit West. The visual effect of revegetation would not alleviate the visual effects of past development. However the establishment of new vegetation would contribute to an improving trend in the visual quality of the area. The prescribed VQO of Retention would continue not to be met on all of the lands at Summit Central and Summit East.

Although lights are currently installed, night skiing is not operated as frequently at Summit East, as compared to Summit Central and West. Night skiing on OWNF lands at Summit Central and Summit East would increase the amount of ambient light reflection and glare present in the area during the winter months. Other Management Provision OMP42 (see Table 2.4-2) would be implemented to provide low-glare, directional night lights in order to minimize the effect of additional night lighting.

Critical Viewpoints

Snow Lake Trail

Views along Snow Lake Trail across the valley to Alpental are screened by dense forest for the first 0.5 mile of the trail. From the upper portion of the trail, the landscape would continue to appear unaltered, and development is either not visible, or not discernable to the casual observer. The Mountaintop restaurant would not be discernable from Snow Lake Trail due to the surrounding landscape and distance from the viewer (see Illustration 4.15-1). The landscape would continue to meet the prescribed VQO of middle-ground[75] Retention.

[75] Middle-ground refers to the viewing zone that is ½ to 4 miles from the observer.

Illustration 4.15-1:
Alpental from Trail 1013 (Snow Lake Trail)

Note: Illustration 4.15-1 is not a photo simulation. It is not intended to represent conditions under Alternative 2. It is intended to show how distance and the surrounding landscape would not allow the mountain-top restaurant to be discernable to a viewer from Snow Lake Trail.

Pacific Crest National Scenic Trail

Proposed development at the base area of Summit West would not alter existing views from the PCNST as seen along the PCNST near Beaver Lake. Buildings and parking lots would remain clearly visible but visually subordinate to the surrounding landscape, and would continue not to meet the prescribed VQO of foreground[76] Retention.

Clearing at Summit West would repeat the form, line, and texture of existing ski terrain in the surrounding environment (as seen from near Beaver Lake). Given the existing vegetative patterns and the large scale of the surrounding landscape, these improvements would not be noticeable to the casual observer. Revegetation at Summit West would create tree islands that would eventually reduce the overall visual

[76] Foreground refers to the viewing zone within 0 to ½ mile from the observer.

impact of existing and proposed ski trail clearing. Summit West would continue to meet the EVC of Moderately Altered and the prescribed VQO of Retention would continue not to be met.

Development and clearing at Summit West would not alter views from the PCNST on the east side of I-90. Vegetative cover would continue to screen development from viewers along the PCNST on the east side I-90 and would continue to meet the definition of middle-ground Partial Retention. The prescribed VQO of Retention would continue not to be met.

I-90 Heading West

Immediate foreground views would continue to be dominated by I-90 and associated signage and development. Ski trail clearing and ski area development would comprise middle-ground views. Clearing associated with lift and trail improvements at The Summit would repeat the form, line, and texture of existing middleground views. Ski trail clearing on MBSNF land visible from I-90 would continue to meet the Forest Service definition of Maximum Modification rather than the prescribed VQO of Retention.

Clearing for lifts and trails in the *Rampart* and *Creek Run* pods at Summit East and new trails at Silver Fir would repeat the form, line, and color of ski existing ski trails in an area of currently uninterrupted forest. Landscape topography and vegetation would screen a majority of the clearing as seen from I-90. Visible clearings would repeat the form and line of existing patches in the forest canopy (see Photo Simulation #1 in Volume 3). Ski trail clearing on OWNF land would continue to meet the Forest Service definition of Partial Retention. The prescribed VQO of Retention would continue not to be met.

The clearing and development on the private lands at Summit Central and Summit East would continue to meet the Forest Service definition of Modification. The overall prescribed VQO of Retention would continue not to be met.

4.15.3 Impacts – Alternative 3

Mt. Baker-Snoqualmie National Forest

Alpental

Clearing and impacts associated with the proposed *Pulse Gondola* and mountain-top restaurant would not occur under Alternative 3. Impacts would otherwise be as described under Alternative 2.

The Summit

Impacts to MBSNF lands at The Summit would be as described under Alternative 2.

Okanogan-Wenatchee National Forest

The Summit

Clearing and impacts associated with the proposed *Creek Run* Pod would not occur under Alternative 3. Impacts would otherwise be as described under Alternative 2.

Critical Viewpoints

Snow Lake Trail

Impacts to the Snow Lake Trail would be as described under Alternative 2.

Pacific Crest National Scenic Trail

Impacts to the PCNST would be as described under Alternative 2.

I-90 Heading West

Impacts to the I-90 viewshed would not be noticeably different without the clearing for the *Creek Run* pod. Impacts to the I-90 viewshed would be as described under Alternative 2.

4.15.4 Impacts – Alternative 4

Mt. Baker-Snoqualmie National Forest

Alpental

Alternative 4 includes reduction of Lots 4, 5, and 6, and elimination of Lot 7. These changes would not be noticeable to the casual viewer. Impacts would otherwise be as described under Alternative 2.

The Summit

Impacts to MBSNF lands at The Summit would be as described under Alternative 2.

Okanogan-Wenatchee National Forest

The Summit

Clearing and impacts associated with the *Creek Run* and *Rampart* pods would not occur under Alternative 4. Aside from the comparatively better visual quality in Section 16, impacts would otherwise be as described under Alternative 2.

Critical Viewpoints

Snow Lake Trail

Impacts to the Snow Lake Trail would be as described under Alternative 2.

Pacific Crest National Scenic Trail

Impacts to the PCNST would be as described under Alternative 2.

I-90 Heading West

Impacts to the I-90 viewshed along Section 16 (Summit East) would be similar to Alternative 1 without the clearing for the *Creek Run* and *Rampart* pods. Aside from the vicinity of Section 16, impacts to the I-90 viewshed would be as described under Alternative 2.

4.15.5 Impacts – Modified Alternative 5

Mt. Baker-Snoqualmie National Forest

Alpental

Impacts to Alpental would be as described under Alternative 2.

The Summit

Impacts to MBSNF lands at The Summit would be as described under Alternative 2.

Okanogan-Wenatchee National Forest

The Summit

Clearing and impacts associated with the proposed *Creek Run* and *Rampart* pods would be reduced under Modified Alternative 5. Impacts would otherwise be as described under Alternative 2.

Critical Viewpoints

Snow Lake Trail

Impacts to the Snow Lake Trail would be as described under Alternative 2.

Pacific Crest National Scenic Trail

Impacts to the PCNST would be as described under Alternative 2.

I-90 Heading West

Impacts to the I-90 viewshed would not be noticeably different with reduced clearing for the *Creek Run* and *Rampart* pods. Impacts to the I-90 viewshed would be as described under Alternative 2.

4.15.6 Cumulative Effects

The checkerboard ownership, including timber harvest, and ski area activities, have altered the visual character of the Snoqualmie Pass area in the past. Ongoing development activities in the Snoqualmie Pass community continue to add to the developed character of the Pass. With implementation of the Northwest Forest Plan and the SPAMA, timber harvest on NFSL in the area has virtually been eliminated and the public lands at Snoqualmie Pass are generally managed for species that are dependent on late successional habitat. As a result, visual conditions on previously disturbed public lands is improving with the re-establishment of vegetation. In addition, past, ongoing and future land exchanges, acquisitions and/or donations of land to the Federal Government have/will contribute to improving visual quality.

Tables 4.15.7-1 and 4.15.7-2 present a discussion of these cumulative effects, as well as the effects of other projects that have the potential to cumulatively effect visual quality in the vicinity of Snoqualmie Pass.

Table 4.15.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Visual Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects on Visual Resources
Projects Not Associated with The Summit-at-Snoqualmie		
Kachess Vegetation Management	The campground contained old growth trees suffering from various stages of root rot. Hazard trees were identified in the Kachess Lake Campground through an exhaustive survey. All identified trees were removed during the winter of 2004. A small amount of timber was sold as merchantable, the rest was disposed of through firewood sales, lop and scatter, or burned.	The removal of hazard trees has reduced the canopy cover within the treated areas of the campground. Spatially, the vegetation removal was limited to the campground site, and did not overlap in space or time with the MDP or other identified cumulative effects. While the removal of trees would be evident in the foreground (at the campground), these activities would not alter the visual quality of the Snoqualmie Pass area to the casual observer.
Plum Creek Road Restoration	The Cle Elum Ranger District is performing a road analysis covering approximately 50-70 miles of harvest roads on 65,000 acres of land acquired in the last 5 years from Plum Creek Timber lands. Currently, approximately 18 miles of roads that were acquired and deemed to be unsafe or were already closed have been decommissioned by the Forest Service. Under the Proposed Action, approximately 30.57 miles of road would be decommissioned.	Currently, approximately 26.2 acres of roads have been decommissioned within the Yakima watershed. Both spatially and temporally, this road decommissioning would overlap with the road obliteration, and other restoration projects identified in the MDP alternatives. As a result, the road obliteration under the MDP and the Cle Elum Roads Analysis would cumulatively reduce the available road mileage in the U. Yakima 5th field watershed. Ongoing and future road decommissioning activities would remove unnatural lines and forms from the middleground and background views. When coupled with land exchanges and other projects that allow for re-establishment of forest vegetation, these projects would cumulatively improve visual quality at the 5th field scale.

Table 4.15.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Visual Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects on Visual Resources
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	Depending on which alternative is selected, approximately 50.9 acres of soils/vegetation would be impacted by road expansions. This project would directly overlap with the MDP both spatially and temporally. Alternatives 2 and Modified Alternative 5 would increase detrimental soil conditions in the Study Area, cumulatively reducing the potential for establishment of vegetation in the vicinity of Snoqualmie Pass. Alternative 3 and 4 would reduce detrimental soil conditions, cumulatively improving the potentialy for the establishment of vegetation. This project will exacerbate the already dominant effect of the I-90 corridor on the visual character of the area. However, the additional development will be similar in form and character to the existing highway, and would be consistent with the definition of Maximum Modification, as under the current condition.
I-90 Land Exchange	Existing private lands owned by Plum Creek Timber were exchanged for National Forest System Lands. The exchange was completed in 1998.	In the Yakima watershed, the acquired lands would be managed under the SPAMA allocation with a late-successional habitat preservation emphasis. The management of newly acquired lands will be beneficial to the forest ecosystem. Long-term management goals are focused towards creating a multi-age forest ecosystem. The management of these acquired lands would spatially overlap with the MDP at the 5th field scale, resulting in cumulative benefits to vegetation conditions under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no donation), the Plum Creek Land Exchange and other private land acquisitions contribute to overall improvement in vegetation conditions despite development in the MDP Study Area. The effects of these projects will improve visual quality at the 5th field scale.
Keechelus Dam Repairs	The Keechelus Lake dam was repaired in 2003. The existing dam was rebuilt in place to correct structural problems. The project has been completed. Approximately 70 acres of vegetation was cleared to provide a work corridor. The project impacted 3.8 acres of wetlands.	While the dam replacement did not overlap in time with the MDP, stabilization (i.e., “grow in”) of the site is projected to overlap with the MDP in space and time at the 5th field scale. Approximately 70 acres of vegetation was cleared to provide a work corridor. This project increased the evidence of a large clearing in the vicinity of the dam site and its effect on the visual character of the area. However, the additional development is similar in form and character to the previously existing disturbance and is consistent with the definition of Maximum Modification, as under the current condition.

Table 4.15.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Visual Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects on Visual Resources
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Sections 5, 17 and 25 of Township 21N Range 11E have been purchased.	The recent purchase of Sections 5, 17, and 25 of Township 21N Range 11E occur within portions of the Yakima River watershed. These acquired lands would be allocated to the SPAMA and managed with an emphasis for late-successional habitat preservation. The management of these acquired lands would spatially and temporally overlap with the MDP, resulting in cumulative benefits to vegetation communities under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange and other private land acquisitions would also contribute to overall improvement in vegetation communities in the vicinity of Snoqualmie Pass. In conjunction with other projects that allow for the re-establishment of vegetation, the effects of these projects will improve visual quality in the Snoqualmie Pass area.
Plum Creek Cascade Habitat Conservation Plan	A HCP was developed for the Plum Creek Timber Company to manage timber harvest and protect wildlife habitat over several 5th field watersheds in the vicinity of Snoqualmie Pass.	Approximately 52,100 acres of land is managed under the HCP. Protection of wildlife habitat would temporally and spatially (in the 5th field) overlap with the MDP, resulting in cumulative benefits to vegetation communities under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation). Under Alternatives 2 and 4 (with no land donation), the Plum Creek Land Exchange (described above) and the other private land acquisitions (described above) would also contribute to overall improvement in vegetation communities despite development resulting in the MDP Study Area. In conjunction with other projects that allow for the re-establishment of vegetation, the effects of the HCP will improve visual quality in the Snoqualmie Pass area.
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of the Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in both space and time with the MDP development. Alternatives 2 and 4 would increase detrimental soil conditions in the Study Area, and in conjunction with the private land developments and other ground disturbing activities, would cumulatively affect vegetation conditions. Impacts would result from construction of impervious surfaces and vegetation removal. This development would add to the developed character of the Snoqualmie Pass community. However, such development would be consistent with the existing development. Much of the development would not be seen from the main visual viewpoint of I-90.

Table 4.15.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Visual Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects on Visual Resources
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the Upper Yakima River watershed to accelerate the development of late-successional forest structure. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	A total of 210 acres of forest would be commercially thinned to accelerate the development of late-successional forest structure. Alteration of these stands would temporally and spatially (in the 5th field) overlap with the MDP. Short-term impacts resulting in soil disturbance would occur. Long-term beneficial visual impacts are anticipated from the development of late-successional habitat characteristics. In the short-term, the thinning may be discernable to the casual observer. Over the long-term, however, the establishment of LSH would improve the visual character of these stands. Coupled with other land acquisitions and forest management projects (described above), the thinning projects would cumulatively improve the visual quality of the Snoqualmie Pass area over time.
Snoqualmie Pass AMA Plan	Land management plan for the AMA emphasizing late-successional habitat maintenance and enhancement	Land management emphasizing late-successional habitat maintenance and enhancement under SPAMA overlaps spatially and temporally with the MDP. Management of lands under SPAMA, combined with the private land acquisitions and Alternative 3 and Modified Alternative 5 (with a 390-acre land donation), would cumulatively contribute to overall improvement in vegetation conditions, and would improve the visual quality in the area despite development resulting from implementation of the MDP.
I-90 Wilderness Study	Congressionally mandated study of 15,000 acres to determine the suitability for preservation as wilderness. This project has the potential to change land allocations of the Okanogan-Wenatchee National Forest Land and Resource Management Plan.	The study of lands to determine suitability for preservation as wilderness would overlap spatially (in the 5th field) and temporally with the MDP. This project has the potential to change land allocations within the OWNF, and combined with the previously described private land acquisitions and land donation proposed under Alternative 3 and Modified Alternative 5, would contribute to overall improvement in vegetation conditions despite development resulting from implementation of the MDP. If lands are reallocated to Wilderness under this project, the cumulative effect of this and other projects would be an improvement in the visual quality of the Snoqualmie Pass area.

Table 4.15.7-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Visual Resources in the Upper Yakima River Watershed

Project Name	Project Summary	Cumulative Effects on Visual Resources
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (West Keechelus subwatershed). The proposed project includes thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	The restoration of ecological conditions near Cold Creek would overlap spatially (in the 5th field) and temporally with the MDP. The thinning of stands would result in short-term soil disturbance and changes in canopy cover that may be discernible to the casual observer. In the long-term, the project would accelerate the development of late-successional habitat. Coupled with the land acquisition projects and forest management projects, the thinning project would cumulatively improve the visual quality of the Snoqualmie Pass area over time.
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (E. Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and fish passage improvements, and other restoration projects.	The restoration of ecological conditions through thinning and road obliteration would overlap spatially (in the 5th field) and temporally with the MDP. The thinning of stands would result in short-term soil disturbance and changes in canopy cover that may be discernible to the casual observer. In the long-term, the project would accelerate the development of late-successional habitat. Coupled with the land acquisition projects and forest management projects, the thinning project would cumulatively improve the visual quality of the Snoqualmie Pass area over time.

Table 4.15.7-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Visual Resources in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Visual Resources
Projects Associated with The Summit-at-Snoqualmie		
Alpental Covered Bridge Replacement	The existing covered footbridge at Alpental washed out during a storm in 2003. The Summit-at-Snoqualmie has replaced the bridge as of October 2005.	No new permanent impacts occurred as the new bridge was placed within the footprint of the old bridge. Spatially, the bridge replacement occurred within the site scale, and additional buildings would be constructed within several hundred feet of the bridge under the Action Alternatives. The re-establishment of riparian vegetation has been completed, and does not overlap temporally with the MDP proposal. The new bridge is visually similar to the old bridge (i.e., Cascadian style), and is therefore consistent with the EVC of Moderately Altered.

Table 4.15.7-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Visual Resources in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Visual Resources
Cave Ridge Land Donation	The Summit-at-Snoqualmie will donate 138 acres of property just west of Guye Peak to the National Forest. Up to 100 acres will be added to the Alpine Lakes Wilderness, and the remainder would continue to be managed in its current unroaded character.	The donation of 138 acres to the National Forest would overlap spatially and temporally with the MDP. Up to 100 acres will be added to the Alpine Lakes Wilderness and the remainder would continue to be managed in its current unroaded character. The management of these lands, combined with the other private land acquisitions, would constribute to the overall improvement in the visual character in the Snoqualmie Pass area.
Projects Not Associated with The Summit-at-Snoqualmie		
Huckleberry Land Exchange	Exchange of NFSL for 6,798 acres of Weyerheauser lands located in the I-90 corridor in the vicinity of Snoqualmie Pass. The land exchange was completed in 2001.	Approximately 6,798 acres of Weyerhaeuser land was received by the Forest Service. The management of 702 acres as Late Successional Reserves will be beneficial to the visual character of the landscape by incorporating these lands into NFSL management for late-successional habitat. The management of these acquired lands would spatially (at the 5th field) and temporally overlap with the MDP, resulting in cumulative benefits to vegetation communities under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation), the Plum Creek Land Exchange and other private land acquisitions contribute to the overall improvement in vegetation communities in the Snoqualmie Pass area.
Land Acquisitions: Cascade Conservation Partnership, TPL, LWCF, and PCTA	Purchase of private lands and probable donation to the National Forest System for management by the Forest Service. To date, Section 19 of Township 22N Range 11E has been purchased. These lands would be allocated to Late Successional Reserve.	The recent purchase of Section 19 of Township 22N Range 11E occurs within portions of the South Fork Snoqualmie River watershed, and overlaps spatially (at the 5th field scale) and temporally with the MDP. These lands would be allocated to Late Successional Reserve. The acquisition of these areas will result in a beneficial impact from management as NFSL. In conjunction with other projects that provide for re-establishment of LSH, the effects of these land acquisitions will improve the overall visual quality of the area, with a greater improvement under Alternative 3 and Modified Alternative 5 (with a 390-acre land donation).
McClellan Butte Trail Reconstruction Project	The project will relocate approximately 1.5 miles of trail to newly constructed trail or old road bed, abandon 1.5 miles of trail, and rehabilitate tread, drainage and switchbacks as required along the remainder of the 4.4-mile trail.	The Trail Reconstruction project overlaps spatially (at the 5th field scale) with the MDP. Relocation and new construction of trails would change the visual character at localized viewpoints. The changes would not be evident from the Snoqualmie Pass area.

Table 4.15.7-2:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects on Visual Resources in the South Fork Snoqualmie River Watershed

Project Name	Project Summary	Cumulative Effects on Visual Resources
Bandera Mountain/Mason Lake Trail Relocation Project	This project reorganized trail access to Mason Lake and Bandera Mountain in order to minimize social and resource impacts associated with the existing trails. The project involved construction of 1.5 miles of new trail, reconstructing 2.0 miles of existing trail and decommissioning 2.3 miles of existing trail.	The Trail Reconstruction project overlaps spatially (at the 5th field scale) with the MDP. Relocation and new construction of trails would change the visual character at localized viewpoints. The changes would not be evident from the Snoqualmie Pass area.
High Lakes Trail #1012 and Snow Lake Trail #1013 Reconstruction	This project repaired seven switchbacks on the Snow Lake Trail and reconstructed 2 miles on the High Lakes Trail from Snow to Gem Lake.	The Trail Reconstruction project overlaps spatially (at the 5th field scale) with the MDP. Relocation and new construction of trails would change the visual character at localized viewpoints. The changes would not be evident from the Snoqualmie Pass area.
Denny Salvage	This project would salvage approximately 50 mbf of trees utilizing a ground based logging system. All undamaged trees with secure root systems would be left.	The salvage of approximately 50 mbf would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term impacts resulting in the loss of forested areas would occur, and thinning may be discernible to the casual observer. In the long-term, the project, coupled with the land acquisition and forest management projects, would cumulatively improve the visual quality of the Snoqualmie Pass area over time.
I-90 Corridor Thin	The project involves commercially thinning approximately 338 acres in the I-90 Corridor. About 4.3 mmbf would be thinned from 14 units.	Commecial thinning of approximately 338 acres of forest would overlap spatially (in the 5th field) and temporally with the MDP. In the short-term, impacts to forested areas would occur, and thinning may be discernable to the casual observer. In the long-term, coupled with land acquisitions and forest management projects, this project would cumulatively improve the visual quality of the Snoqualmie Pass area over time.
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	The Tinkham Discovery Trail project would overlap spatially (at the 5th field scale) and temporally with the MDP. Construction of parking the parking area, trails, and viewing platform would change the visual character at localized viewpoints. The changes would not be evident from the Snoqualmie Pass area.

4.15.7 Irreversible and Irretrievable Commitments of Resources

To varying degrees, proposed development under the Action Alternatives represents essentially permanent modifications to the visual landscape within The Summit's existing SUP. Existing natural characteristics of modified areas would be irretrievably lost during the life of the ski area. The effect of tree removal and other similar development associated with the Action Alternatives would be an irretrievable commitment of visual resources for a duration equal to approximately one lifetime. Therefore, such development would be irreversible during a human lifetime. Over the long-term (longer than a human lifetime), development under the Action Alternatives would be reversible in that the various facilities could be dismantled and removed and the area revegetated or allowed to return to a natural state. While natural conditions could be achieved, visual resource values could not be returned to their predevelopment conditions in the foreseeable future.

4.16 NOISE

The noise analysis is presented under each alternative for both Construction and Operational Impacts.

4.16.1 Impacts - Alternative 1 (No Action Alternative)

Construction Impacts

Under Alternative 1, no proposed projects would be implemented. The Summit-at-Snoqualmie would continue to operate under its current SUP with no changes. Noise levels in the vicinity would remain consistent with current noise levels. Any future proposed projects with the potential to affect noise would be presented to the Forest Service and evaluated under the NEPA process.

Operational Impacts

Under Alternative 1, off-season operational noise impacts would be associated with maintaining existing operations, including maintenance of the lifts and ski trail network and associated infrastructure. Ski area maintenance would likely continue to occur during the summer months and would be short-term and temporary in nature. Maintaining ski trails and lift corridors would require periodic brushing or mowing to manage vegetation for safety purposes. These operations would increase short-term noise levels while the maintenance equipment was being operated, but would not increase the overall sound levels. Such activities would likely not result in noticeable noise impacts.

During the winter, noise generation associated with the operation of the ski area would continue as described under the existing condition. Traffic would continue to be the primary noise generator in the Snoqualmie Pass area. Avalanche control at Alpental would continue to be the primary source of noise that exceeds King County maximum allowable noise level standards.

4.16.2 Impacts Common to All Action Alternatives

Increased noise levels associated with construction of new trails, chairlifts, and support facilities would occur with implementation of all Action Alternatives. Additionally, there would likely be an incremental increase in noise levels associated with ski area operations with increased development at both The Summit and Alpental.

Construction Impacts

Noise levels resulting from construction would depend on the intensity of the construction activity (i.e., the number and types of construction equipment being used) and the duration of the construction activity. For all Action Alternatives, construction noise impacts would be temporary and would occur during non-winter months.

The types of equipment used for this project would typically generate noise levels between 80 and 90 dBA at a distance of 50 feet while equipment is operating. Construction equipment operation can vary

from intermittent to fairly continuous, with multiple pieces of equipment operating concurrently. Assuming that two trucks (90 dBA), a scraper-grader (87 dBA), a moveable crane (82 dBA), a compactor/roller (73 dBA), and a tractor (85 dBA) are operating in the same area, peak construction-period noise would generally be about 93 dBA at 50 feet from the construction site.

Blasting, involving the use of explosives, would occur to remove or fragment bedrock, rock outcrops and/or boulders from ski slopes. Blasting is considered an intermittent or impulse noise (not constant) and is temporary in duration.

Table 4.16.2-1 summarizes predicted construction noise levels at various distances from the construction site, conservatively assuming no atmospheric absorption or attenuation by trees (in column two) and accounting for attenuation of coniferous trees (in column three). Foliage and ground cover are assumed to provide attenuation of up to 14 dBA according to a study by the Forest Service (Harrison et al. 1980).

Table 4.16.2-1:
Construction Noise Levels Near a Typical Construction Site

Distance from Construction Site (feet)	Line-of-Sight Noise Level (dBA)	Noise Level with Tree Attenuation (dBA)
50	93	93
100	87	75
200	81	69
400	75	61
800	69	55
1,600	63	49
3,200	57	43
6,400	51	37

As shown in Table 4.16.2-1, noise levels associated with construction would exceed the King County standard of 60dBA (see Table 3.16.1-1) at distances less than 400 feet. This short-term impact would be localized to the construction site, and most construction related noise would be generated within the on-mountain portions of the Study Area (e.g., *Rampart*, *Creek Run* and *Internationale* chairlifts, up-mountain restaurants).

Operational Impacts

With implementation of any of the Action Alternatives, sounds and noise levels would be similar to those that are currently experienced in and adjacent to the Study Area, including the operation of chairlifts, snow grooming equipment, and vehicle traffic along I-90, SR 906, and within the parking lots. A doubling of sound energy (3 dBA) is generally considered the level of human perception. Although sound levels would be elevated over existing conditions due to the more developed nature of the site, it is not

anticipated that ski area operation noise levels would increase by more than 3 dBA under any of the Action Alternatives. As a result, no measurable impact is expected.

4.16.3 Impacts - Alternative 2

Construction Impacts

Under Alternative 2, noise associated with implementation of the proposed projects, including excavation and construction of new chairlifts, trails, and buildings would be the most noticeable noise impacts associated with the project.

For each of the four base areas, the closest receiving location was identified in order to determine noise impacts associated with construction. At Alpental, the closest residential development is approximately 2,000 feet from proposed lift construction and paving. Although the majority of these residences are empty during the summer construction months, impacts were identified at approximately 16-60 dBA depending on tree attenuation. At Summit West, several commercial buildings are located across SR 906 within 500 feet of proposed construction activity. Noise levels during construction periods would likely reach 80 to 90 dBA at the site, with attenuation to less than 60 dBA at these sites (see Table 4.16.2-1). At Summit Central, the only non-ski area operations buildings include the Eidelweiss Condos, which are typically vacant during the summer. Regardless, these condos are approximately 1,000 feet from proposed construction activities and would experience noise levels between 49 and 55 dBA as a result of project implementation. Lastly, the Suncrest and Sundance condos at Summit East are located on private lands adjacent to the proposed *Easy Gold* chairlift realignment. Due to the close proximity of these buildings to the construction area (approximately 200 feet), noise levels could reach 69 to 81 dBA during realignment of the upper terminal. These levels would subside as construction is focused further away from the condos.

A helicopter would be used for installation of chairlift towers and terminals at Alpental and Summit East, as well as for the construction of the mountain-top restaurant at Alpental. During this period, localized sound levels would be quite high relative to other times of the year. Section 11 of Ordinance 3139, Section 601 states that sounds originating from aircraft in flight are exempt from the maximum allowable noise levels described in Chapter 3 (King County Courthouse letter dated June 5, 2001). In Kittitas County, excessive noise emanating from engines or motors within 200 feet of a dwelling unit could be deemed a disturbance. Since residential areas within the Study area are typically located 1,000 to 2,000 feet from proposed construction activities, the operation of a helicopter is not expected to exceed any noise standards.

As stated in the Section 3.11 - Recreation, the PCNST is accessed via a trailhead east of Alpental Road. It crosses underneath I-90 at the intersection of Alpental Road and SR 906 and then traverses through Summit West on the MBSNF side of the ski area as it works its way past Beaver Lake (see Figure 2.3.2-1, Alternative 1 Existing Conditions – The Summit). Because the trail actually crosses under I-90, hikers

along this portion of the trail currently experience noise levels associated with vehicular traffic. Due to the urban nature of the trail in this area, construction noises associated with the proposal would not result in impact to PCNST users, beyond those impacts that are currently present in the area, or that would be expected at a ski area.

Operational Impacts

Although implementation of this proposal would occur in three phases (see Table 2.6-1), full implementation of Alternative 2 would result in noise levels and sounds similar to those that are currently experienced within the Study Area, including the operation of chairlifts, snow grooming equipment, and vehicle traffic in and around the ski area. Sound levels would be elevated over existing conditions due to the more developed nature of the site; however, no measurable impact would be expected. The primary noise generation in the Snoqualmie Pass area would continue to be vehicle traffic. Ski area avalanche control would not be altered under Alternative 2. Alternative 2 would generally remain compliant with local noise regulations.

4.16.4 Impacts - Alternatives 3, 4, and Modified Alternative 5

Alternatives 3-5 propose reduced development with respect to Alternative 2. As a result, anticipated noise impacts resulting from implementation of each of these alternatives would likely be similar to or less than that disclosed for Alternative 2. Because Alternative 2 would maintain compliance with local noise ordinances for construction and operations, implementation of Alternatives 3-5 would also comply with these stipulations. Alternative 3 would reduce helicopter noise at Summit East due to the elimination of the Creek Run chairlift and associated trails. Alternative 4 would eliminate the need for helicopter use for lift installation at Summit East as development in Section 16 has been excluded.

4.16.5 Cumulative Effects

No past, present, or reasonably foreseeable future actions have been identified within the Snoqualmie Pass area that would contribute cumulatively to noise effects. Population increases in adjacent communities and PUDs may result in additional vehicular traffic along I-90 and SR 906; this potential increase in general traffic would be insignificant and discountable with respect to the amount of noise generated by the roadways.

Proposed modifications to I-90 would result in temporary impacts from increased noise levels during construction. Avalanche control along I-90 would continue under all alternatives in this EIS. The ski area operation would have no bearing on highway avalanche control. With no increase in avalanche control under the Action Alternatives, cumulative noise generation associated with the detonation of explosives would not be expected in increase beyond existing levels.

Tables 3.16.5-1 and 3.16.5-2 present a listing of projects in the Snoqualmie Pass area along with a brief discussion of the anticipated cumulative effects of the projects.

Table 4.16.5-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Noise

Project Name	Project Summary	Cumulative Effects on Noise
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last 5 years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately 2 per year.	The culvert replacements would overlap spatially (at the site and 5th field scale) and temporally with the proposed MDP. Combined with the other projects in this table and the Action Alternatives, the culvert replacement would result in short-term construction noise.
Projects Not Associated with The Summit-at-Snoqualmie		
I-90 East	WSDOT proposes to modify and widen 15 miles of I-90 between Easton and Snoqualmie Pass.	Depending on which alternative is selected, approximately 50.9 acres of soils/vegetation would be impacted by road expansions. This project would directly overlap with the MDP in both space and time. This project will exacerbate the already-dominant effect of the I-90 corridor on the noisy character of the area resulting from the presence of the Interstate. During periods of construction at the ski area, the noise from I-90 and the ski area would cumulatively increase the possibility of exceeding noise standards.
Keechelus Dam Repairs	The Keechelus Lake dam was repaired in 2003. The existing dam was rebuilt in place to correct structural problems. The project has been completed. Approximately 70 acres of vegetation was cleared to provide a work corridor. The project impacted 3.8 acres of wetlands.	The dam replacement did not overlap in time with the MDP in time or space. As a result, no cumulative noise impacts are anticipated in conjunction with the MDP implementation.

Table 4.16.5-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Noise

Project Name	Project Summary	Cumulative Effects on Noise
Private Land Developments	There are four Planned Unit Developments (PUD) zoned in the vicinity of the Summit-at-Snoqualmie covering a total of 798 acres. No formal development applications are currently filed with Kittitas County for any of the PUDs. Development of some lots has occurred in the past. The PUDs currently identified are Hyak Estates (79 acres), Ski Acres Estates (19 acres), Chikamin Vista/Gold Creek Valley (479 acres), Mountain Grandeur 1 (145 acres), and Mountain Grandeur 2 (76 acres).	Potential development of housing units, condominiums, and retail would overlap in both space and time with the MDP development. This development would add to the noisy character of the Snoqualmie Pass community. Coupled with MDP implementation, as well as other construction projects in the area, these developments would increase the potential for exceedences of the county noise standards during construction.
Commercial Thinning Projects	Several thinning projects have occurred or been proposed within the Upper Yakima River watershed to accelerate the development of late-successional forest structure. Currently one 70-acre project is active and two 70-acre projects have been proposed and are awaiting approval.	A total of 210 acres of forest would be commercially thinned to accelerate the development of late-successional forest structure. Alteration of these stands would temporally and spatially (in the 5th field) overlap with the MDP. Given the remote nature of these projects, it is anticipated that silvicultural activities would not cumulatively increase noise in the area, with the exception of the equipment entering and leaving the Snoqualmie Pass area.
WSDOT road de-icing	Application of sand and chemical deicers to roadway surfaces	The application of sand and chemical deicers on roadways overlaps spatially and temporally with the MDP. Temporary impacts to noise would result due to deicing vehicle operations during the winter months.
Roaring Thin Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (West Keechelus subwatershed). The proposed project includes thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and restoration of shoreline habitat adjacent to Lost Lake and Cold Creek.	The restoration of ecological conditions near Cold Creek would overlap spatially (in the 5th field) and temporally with the MDP. The thinning of forests to accelerate late-successional habitat would result in short-term noise impacts from logging operations that would overlap temporally with the implementation of the MDP. Cumulative increases in construction noise are not expected to be measurable at the 5th field scale due to the distance between project areas.

Table 4.16.5-1:
Cumulative Effects of Past, Present, and Reasonably Foreseeable Projects in the Upper Yakima River Watershed on Noise

Project Name	Project Summary	Cumulative Effects on Noise
East Keechelus Restoration	The goal of this project is to restore ecological conditions in the Upper Yakima watershed (E. Keechelus subwatershed). The proposed project has not been initiated. The project is expected to include thinning to accelerate late-successional habitat structure in plantations, obliteration of roads, and fish passage improvements, and other restoration projects.	The restoration of ecological conditions through thinning and road obliteration would overlap spatially (in the 5th field) with the MDP. The thinning of forests to accelerate late-successional habitat would result in short-term noise impacts from logging operations that would overlap temporally with the implementation of the MDP. Cumulative increases in construction noise are not expected to be measurable at the 5th field scale due to the distance between project areas.

Table 4.16.5-2:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed on Noise

Project Name	Project Summary	Cumulative Effects on Noise
Projects Associated with The Summit-at-Snoqualmie		
Culvert Replacement	Approximately 10 existing culverts have been replaced or repaired within the last 5 years at The Summit-at-Snoqualmie. Generally, culverts are replaced at a rate of approximately 2 per year. Therefore, approximately 20 culverts will be replaced over the life of the MDP.	The culvert replacements overlap in space and time with the MDP at the site scale. Combined with the implementation of the MDP, culvert replacement would result in short-term construction noise increases at the site scale.
Projects Not Associated with The Summit-at-Snoqualmie		
BPA Proposed Additional Power Lines	Supplemental DEIS to examine development of an additional powerline. Options include adding lines to existing towers or adding new towers.	The proposed development of additional powerlines would overlap spatially (in the 5th field) and temporally with the MDP. Short-term noise impacts could occur due to construction activities and vehicles.

Table 4.16.5-2:
Cumulative Effects of Past, Present and Reasonably Foreseeable Projects in the South Fork Snoqualmie River Watershed on Noise

Project Name	Project Summary	Cumulative Effects on Noise
South Fork Snoqualmie Road Storage, Road to Trail and Decommissioning Project	This project involves the redcution in maintenance level (ML) on 11 roads (26.3 miles). 19.4 miles would be reduced to ML 1 (closed to motorized access) and utilized as loop and destination trail routes; 2.7 miles would be closed - placed in storage for future forest management; 1.1 miles would be removed from the transportation system and converted to trail; approximately 22.2 miles of spur roads mostly associated with roads proposed for reduction to ML 1 would be closed and removed from the Forest Road Transportation System.	This project overlaps spatially (at the 5th field scale) and temporally with the MDP. Temporary noise impacts from construction vehicles used for road abandonment would occur.
Denny Salvage	This project would salvage approximately 50 mbf of trees utilizing a ground based logging system. All undamaged trees with secure root systems would be left.	The salvage of approximately 50 mbf would overlap spatially (in the 5th field) and temporally with the MDP. Short-term noise impacts could result due to construction equipment and tree removal activities.
Annual Road Maintenance	Brushing/blading of roads on a rotating schedule as funds allow. Includes roads 55, 5510, 58, and road 9030 and 9031 systems.	The brushing and blading of roads would overlap spatially (in the 5th field) and temporally with the MDP. Short-term noise impacts could occur due to maintenance equipment.
I-90 Corridor Thin	The project involves commercially thinning approximately 338 acres in the I-90 Corridor. About 4.3 mmbf would be thinned from 14 units.	The commercial thinning of approximately 338 acres would overlap spatially (in the 5th field) and temporally with the MDP. Short-term noise impacts could result due to construction equipment and tree removal activities.
Snoqualmie Pass Utility District Permit Amendment	The project would extend water and sewer lines along Forest Service Road 4832 from the I-90 Hyak interchange for approximately 3,000 feet. The new lines would stop before reaching Gold Creek. Lines would be lain within the existing road right of way.	The extension of water and sewer lines would overlap spatially (in the 5th field) and temporally with the MDP. Short-term noise impacts could result due to construction activities and equipment.
Tinkham Discovery Trail	The project involves building an interpretive loop trail that includes trail construction, wet area bridging, four elevated viewing platforms, construction of 25-vehicle trailhead parking with amenities, and construction of connector trails.	This project would overlap spatially (at the 5th field scale) and temporally with the MDP. Short-term construction noise impacts would result due to construction activities and equipment.

4.16.6 Irreversible and Irretrievable Commitments of Resources

The production of noise by itself does not consume resources (e.g., water, vegetation); it is a byproduct of increased development resulting in more noise (e.g., traffic to the site, increased maintenance, avalanche control). To the extent that increased development increases overall noise levels around the project site, then the project would reduce the quality of the recreation experience from a noise perspective, although any noise impacts would be similar to the existing condition. Consequently, increased noise represents an irretrievable commitment of the recreation resource during the period of increased noise (i.e., the recreation quality of the site would be reduced during noise-making activities). These effects, however, would be reversible in that noise generating facilities and activities could be removed.