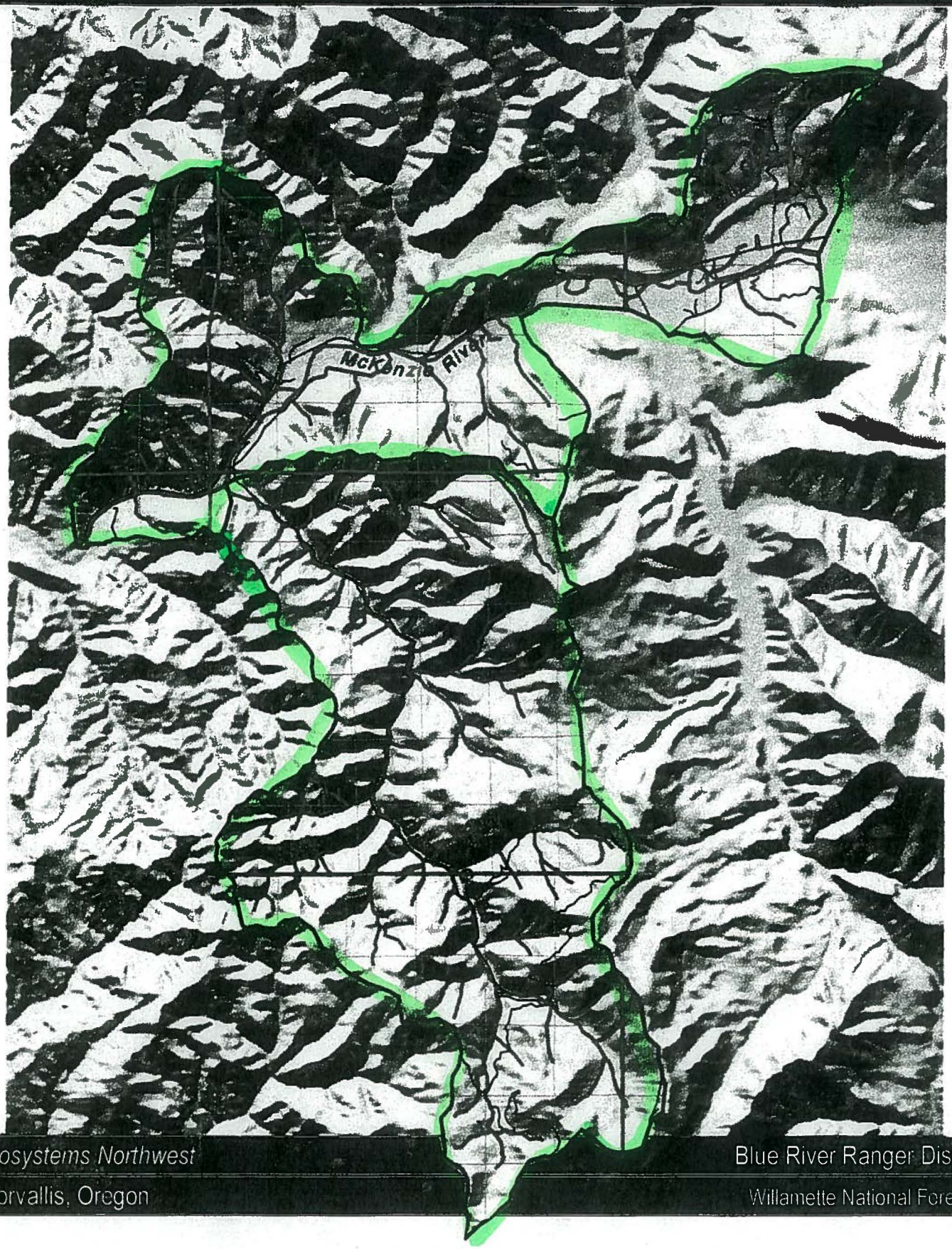
Quartz Creek and Minor Tributaries Watershed Analysis



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for

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Section I: Introduction

PURPOSE OF DOCUMENT

This document describes the findings of a watershed analysis that was performed on the drainage areas of Quartz Creek and of the McKenzie Minor Tributaries. Both drainage areas are located in the Willamette National Forest near Blue River, Oregon (Map 1).

This watershed analysis followed the federal version of watershed analysis which is briefly described later in this section. The analysis identified a set of issues relating to the condition of the forest, streams, soils, wildlife and human interactions. These issues were developed into an examination of how the watershed functions and a description of the current watershed condition. The findings from this analysis are to be used by the Forest Service as a guide to plan future projects in the analysis area. Watershed analysis does not replace the existing guidance such as the forest management plans, but builds upon existing plans to provide a sense of how projects and activities in one part of the watershed such as road construction or decommissioning project may interact and effect other areas of the watershed such as wildlife corridors, or fish habitat in downstream reaches. Watershed analysis will provide guidance for future monitoring activities, restoration projects, and riparian reserves.

DOCUMENT ORGANIZATION

This document is organized into the following sections:

INTRODUCTION--(this section) describes document purpose and document organization.
WATERSHED CHARACTERIZATION--a brief description of watershed analysis and a background context of the Quartz Creek and Minor Tributaries watersheds.
REFERENCE AND CURRENT CONDITION--a more detailed description of the condition of the watershed that compares current conditions to historic or reference conditions. This section is organized into sections that address separate topics or structuring elements:

- Geology and Geomorphology
- Streams, Fisheries and Riparian Zones
- Vegetation
- Wildlife
- Recreation

SYNTHESIS--a summary and integration of findings from the **Reference and Current Conditions** section and a discussion of the importance of the findings.

BACKGROUND AND PURPOSE OF WATERSHED ANALYSIS

A watershed analysis is a process where the available information about a watershed is gathered in order to characterize the condition of the landscape. It is a "taking stock" of the landscape and an attempt to understand how the watershed functions naturally and how management activities have altered watershed functions. Watershed analysis in this document refers to the federal version as directed by the Northwest Forest Plan and described in the document, *Record of Decision and Standards and Guidelines*, (1994) and the document, *Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis*, Version 2.2 (1995). Performance of watershed analysis is required on federal forests of the Pacific Northwest and northern California for areas defined to be sensitive or high-value watersheds called Key Watersheds, in inventoried roadless areas, and/or to revise or modify the widths of protected riparian buffers along streams and waterways. However, it has become the policy of both the Forest Service and the Bureau of Land Management to include all their lands in a watershed analysis.

Watershed analysis usually includes an area of federally managed lands located in a common drainage, called a watershed. The size of the watershed is not so important as the similarity of issues or management concerns about the area. Therefore watershed analyses typically includes an area that is physically connected through a common drainage system or two or more adjacent drainage systems and has some set of common management issues. Watershed areas between 20 and 200 square miles are recommended as appropriate sizes for watershed analysis. Watershed analyses are typically performed by either the Forest Service or Bureau of Land Management, depending on the agency that manages the majority of the federal lands in the watershed. In rarer cases, the analysis is contracted out to private firms specializing in resource management and environmental studies. In all cases, watershed analysis is based upon readily available data as time and resources typically do not allow detailed surveys or field research to be performed.

The intent of watershed analysis is to produce a document that describes the watershed in terms of structuring elements common to most ecosystems. These structuring elements typically include geomorphology, soils, vegetation, hydrology, fish and wildlife, and human management and human uses. The analysis focuses largely on the current condition contrasted with the reference or pre-management condition. It is the intent of the analysis to answer the broad question "Is the current condition beyond the range of natural variability?" Answering this question is difficult as quantitative measures of reference condition are often not readily available. If the analysis determines that the current condition is beyond the range of natural historic variation, causes of the current condition are sought and the extent and importance of the change in condition is examined. Finally, the analysis attempts to place the findings of

condition in context with the findings of conditions of the other structuring elements.

A watershed analysis provides guidance that federal land managers use to develop new projects and perform other management activities on the watershed. A watershed analysis allows managers to develop a more comprehensive approach to solving problems and moving the watershed toward desired conditions. Another outcome of watershed analysis is the development of strategies for evaluating and monitoring the landscape from a ecosystem perspective. This new approach moves the agencies away from single-issue management and towards multi-issue management.

WATERSHED CHARACTERIZATION

Location

Quartz Creek and McKenzie Minor Tributaries watersheds are composed of a series of smaller, named drainages. Collectively, the area will be referred to as the Minor/Quartz watersheds, or simply the "analysis area". The analysis area is located near the town of Blue River, Oregon, 40 miles east of the Eugene-Springfield metropolitan area (Map 2).

The analysis area includes 27,000 acres of the entire Quartz Creek watershed and 20,600 acres of the Minor Tributaries. Both Quartz Creek and the Minor Tributaries are composed of smaller named drainages (Map 3). Notable smaller drainages include Elk Creek in the Northwest portion of the area, Mill Creek in the Northeast portion, and a series of subdrainages in Quartz Creek. All drainages eventually flow into the McKenzie River (Map 3). The area is characterized by a relatively flat floodplain area along the McKenzie River. At higher elevations, the landform is a highly dissected and steeply sloped terrain. The flat McKenzie floodplain area is mostly privately owned and is relatively densely populated with rural residences and small, unincorporated communities. The tributary drainages are essentially uninhabited, being under industrial forest ownership or part of the Willamette National Forest.

Distinguishing features

- **Mixed ownership**--Less than half of analysis area is under federal management. Approximately 40 % is within the boundaries of the Blue River Ranger District of the Willamette National Forest. A small portion (5 %) is under management by the McKenzie Ranger District of the Willamette National Forest. The other 55 % is under private ownership with the largest block of private lands owned by Rosboro Lumber Company of Springfield, Oregon.
- **McKenzie River**--The drainages are part of the McKenzie River basin. The McKenzie River is a high-profile river famous for recreational fishing, boating, and tourism. The river is home to 22 species of native fish and several more

introduced species; it is one of the most intensively stocked rivers in Oregon. The McKenzie is also host to the last remaining healthy stocks of bull trout west of the Cascades and host to the only native Chinook salmon stocks of significance in the Willamette River system. The river is the source of drinking water for the city of Eugene, Oregon. Where it enters the Willamette River in Eugene, it approximately doubles the Willamette's flow and is therefore an important source of drinking water to downstream communities such as Corvallis.

- **Highway 126 corridor**--The small communities of Blue River, Rainbow, and Finn Rock together with rural residential development along the McKenzie River present a local population that live in the watershed and are users of the forest. In addition, State Highway 126 parallels the river and brings a larger group of recreational users both to and through the area. Issues of concern include access on Forest Service roads, access to the river, and conflicts between competing uses. Although the analysis watersheds are relatively small and the recreational use away from the river corridor is light, the area includes forests that are visible and accessible from the heavily used highway corridor.
- **Highly erosive**--The project area is located in the Cascades region, a geologically young and active area that is prone to landslides, earthflows and high rates of erosion. Landslides, torrent events and mass wasting, while completely normal and even desirable over a large scale and long term developmental scale, can be catastrophic on a local scale and over a shorter time period. These geomorphic processes are not very predictable. A number of recent slope failures have occurred in the analysis area. At least five tributaries to the lower portions of Quartz Creek show signs of recent torrent events; Indian Creek has undergone recent channel scouring; two areas in Quartz Creek show signs of road-related slope failure. Mill Creek has sustained a series of slope failures along the road at the top of the watershed. Elk Creek, which has had very little entry for harvest, has at least one recent landslide.
- **Intensive Forest Harvests**--On the west side of the Cascades including the Pacific Coast, a combination of mild climate, deep soils, and high amounts of rainfall contribute to very high growth rates for trees. Harvesting of forests on private lands began during the turn of the century and intensified during the 1950s. Nearly all of the private lands have been harvested at least once and most is now in younger age classes. Harvesting of forests on federal lands accelerated during the 1970s. At least one-third of the federal forests in upper Quartz Creek were harvested during the period 1976-1993. At least half of the federal forests in Mill Creek have been harvested over the last 50 years. Roads were constructed on federal lands in the Elk Creek sub-watershed but harvesting never occurred to any extent and the area is now designated a late-successional reserve.

Land Allocations

Much of the management of the forest is dictated by a set of Forest Service goals and objectives, commonly called standards and guidelines. These

standards and guidelines are found in the document, *Willamette National Forest Land and Resources Management Plan* (1990), commonly called the Forest Plan. The Northwest Forest Plan amended all forest plans for forests within the range of the northern spotted owl by adding a set of seven additional land management allocations (*Record of Decision* 1994). These seven land allocations, together with the existing standards and guidelines, set the sideboards for management options for specific locations in the forest and are shown in Map 4.

Important points of the land allocations include the following:

- **Late-Successional Reserves** are designated for large portions of the federal lands in the analysis area--most of the west half of upper Quartz Creek and the Elk Creek watersheds. Late-Successional Reserves are to be managed to move forests toward habitat for late-succession species. Management may focus on roads and possible closures, reducing fragmentation of forest blocks, wildlife travel corridors, and silvicultural prescriptions to develop multi-storied stands, snags, woody debris, and other components of late successional forest habitats.
- **Adaptive Management Area** is also designated for a large portion federal lands in the analysis area. These include much of the federal lands bordering private lands along the McKenzie River corridor and the northeast portion of the analysis area that contains Mill Creek watershed. This adaptive management area is part of what is called the Central Cascades Adaptive Management Area with a designated emphasis of intensive research on ecosystem and landscape processes, stream management, and accelerated development of late successional conditions (Section D of the *Record of Decision* 1994).
- **General Forest—Intensive Timber Management**, also known as Matrix is a third large portion of federal lands. These areas include federal lands outside the other six categories of designated areas by the *Record of Decision* (1994). Most timber harvesting and other silvicultural activities will be conducted in Matrix lands according to the established standards and guidelines. However, matrix should also be managed as both potential connectors of Late-Successional Reserves and as zones of early seral habitat.
- **Private lands** occupy over half of the Quartz Creek watershed and slightly less than half the area of the Minor Tributaries. The watershed analysis does not place any requirements upon management activities on private lands. Management of federal lands will take into account how the outcomes of the federal management activities are affected by the adjacent private lands, such as access and wildlife concerns. In addition it is important to consider how federal management may affect activities on the private lands.
- **Sensitive species** if identified within a land allocation unit, may require special allocations. For example, a 100-acre Late-Successional Reserve is required around known owl activity centers.
- **Scenic** designations require that any management activities meet visual quality objectives as described by the established standards and guidelines (Section IV, Willamette National Forest Plan 1992).

- **Riparian Reserves** are set widths or buffers along streams and water bodies in which management activities are restricted to those that promote maintenance and restoration of aquatic systems, the spatial connectivity provided by riparian zones within watersheds, and the native riparian-dependent species (Aquatic Conservation Strategy objects listed in the *Record of Decision* 1994). These widths are typically equal to twice the height of a site-potential tree on fish bearing streams, lakes, and natural ponds. The widths are generally half that on non-fish bearing streams, constructed ponds, and wetlands.

Geology

Quartz Creek is located near the eastern boundary of the Western Cascades Physiographic Province, which is primarily composed of volcanic rocks that become younger towards the east (Priest et. al. 1983). Volcanic rocks underlying the analysis area range from about 20-million years to perhaps as young as 4-million years. Northwest trending faults, which developed concurrent with the most active volcanic period, have influenced the orientation of major rivers and tributary streams, including Quartz Creek. Over time, the more recent lava flows (such as those exposed on the eastern side of the Quartz Creek watershed) became more mafic (dark colored) and included a greater proportion of basalts and basaltic-andesites. This marks the beginning of the transition to the younger High Cascades Volcanic Province and some of the ridge-top volcanics which are lithologically similar to the oldest of the High Cascade rock units to the east.

The western half and lower portions of the Quartz Creek watershed, and the Elk Creek watersheds on the north side of the McKenzie, are largely underlain by undivided tuffaceous sedimentary rocks, basalt flows and volcanic tuffs of Miocene and Oligocene age. This unit falls within an age range of about 17-to 32-million years in age, with rock units in Quartz Creek nearer the younger end of the scale (Walker and McCloud 1991). This Western Cascade geologic unit consists of a heterogeneous assemblage of continental volcanic deposits, including flows and breccias of basalt and basaltic-andesite, as well as interstratified deposits of volcaniclastic deposits of ash-flow and air-fall tuffs, breccias, volcanic mudflows (lahars), tuffaceous sedimentary rocks and volcanic conglomerates. Lower, older parts of the formation exhibit low-grade metamorphism with primary mineral alteration. The unit has been locally intruded by small granitoid stocks and dikes, sills, and plugs of basaltic andesite and basalt.

Upper parts of the "Tu" rock unit found in the western Quartz Creek watershed grade into younger flows and clastic rocks of Miocene age. These form both midslopes and upper slopes of the eastern side of Quartz Creek, as well as most of the upper portions of the Castle Rock area south of the McKenzie and the Mill Creek watershed north of the McKenzie. These rocks, designated "Tfc" on the geologic map (Map 5), consist of basaltic andesite and andesite lava flows and

flow breccias, volcanic mudflow deposits (lahars) and volcanic conglomerates. Fine-grained tuffs and volcanic sedimentary rocks are less common in this eastern, ridge top rock unit. Rocks in this younger unit range in age from about 10-to 17-million years.

Locally, younger ridge-capping andesites, basalts and basaltic andesites of Pliocene (Tbaa) or upper Miocene (Trb) age form a relatively resistant upland surface. These rocks are of middle and upper Miocene (10- to 17- million years) and upper Miocene to Pliocene (4- to 9- million years) in age. These resistant basalt and andesite flows and flow breccias are the youngest volcanic rocks of significant outcrop in the Quartz Creek analysis area. They occur in the extreme upper Mill Creek watershed as well as the western, southern, and eastern ridge-top margins of the Quartz Creek basin (Map 5).

Scattered around the Quartz Creek watershed, mostly at high elevations, are relatively small outcrops of intrusive volcanic plugs, dike swarms, and near vent flows and breccias indicating the location of past volcanic activity. The are termed "vent complexes" and may consist of basalt, andesite and combinations between these rock compositions (these are labeled Tmv on Map 5). Some of these types of igneous rocks never reached the earth's surface and instead cooled and solidified at some depth before being exposed by more recent erosion. These Miocene-age intrusive rocks include medium and fine-grained diorite, gabbro and granite-like rocks that outcrop along the McKenzie River in the far western part of the analysis area (Thi on Map 5). This later isolated unit is known as the Nimrod stock, a 17- million year old quartz-rich igneous intrusion located just downstream from the confluence of Quartz Creek and the McKenzie River. The Quartz Creek watershed likely received its name from this quartz-rich granitic outcrop (Dill 1996).

Much younger than the volcanic and igneous intrusive rock units described above, several different types of Quaternary deposits exist throughout the Quartz Creek and Minor Tributaries analysis area. Pleistocene glacial deposits (Qg) exist in the upper part of the Quartz Creek watershed and the eastern part of the Mill Creek watershed, and glacio-fluvial sediments (Qgf) occupy the McKenzie Valley upstream from its confluence with Blue River. The upland deposits (Qg) include unsorted boulders, gravels and sand deposits in what are probably remnant morrainal deposits from the small glacier that occupied the very headwaters of Quartz Creek. Glacial deposits in the lower Mill Creek watershed were likely deposited by or at the same time as the McKenzie Valley glacier made its furthest advance down the river valley.

The poorly sorted glacial outwash deposits (Qgf) of the McKenzie Valley form the sediments (boulders, cobbles, and gravels) through which the river presently makes it course. Along side these deposits, in several locations, are elevated terrace deposits of a slightly older age. These terraces occur near the mouth of Mill Creek, as well as downstream from Blue River on the right bank of the

McKenzie. The High School and Blue River Ranger Station are built on this surface.

Several large prehistoric Quaternary landslide deposits have been mapped in this portion of the McKenzie River basin (Qls in Map 5). These include 1) a large middle slope landslide deposit now expressed as a broad, low-gradient bench in the eastern part of the Quartz Creek watershed; 2) a long, low gradient terrace-like bench on the left bank of the main stem of the McKenzie River south and east of Blue River; 3) a foot-slope landslide deposit below Castle Rock; and 4) a large, low gradient, bench-like landslide deposit which occupies over half of the Mill Creek watershed in the far north eastern corner of the watershed analysis area.

Each of these Quaternary landslides is over a square mile in area and represents slope movement which likely occurred in a wetter and cooler climatic regime. The landslide deposits typically consist of unstratified deposits of broken rock and soil mixtures (called colluvium). They most commonly occur where thick sections of basalt and andesite lava flows are underlain by clay-rich volcanic tuffs. These weathered and altered tuffs form a weak surface where large landslide failures developed. The massive landslide deposits are stable in the current geologic and climatic setting.

Finally, the lower McKenzie River valley, as well as the lower valley of Quartz Creek, contains Holocene and Recent deposits of sand, gravel and silt that are worked by these rivers. These deposits form the active flood plains and channel fills, as well as local talus slopes and slope wash areas where eroded sediment has been deposited over the last few thousand years.

Geomorphology and Geomorphic Processes

The bedrock formations that were originally deposited or "volcanically extruded" across the landscape of the Quartz Creek analysis area have been significantly modified by subsequent erosion processes since late Miocene times. Pleistocene glacial processes were active in the upper Quartz Creek watershed, leaving deposits and sculpting headwater areas, while valley glaciers, and associated glacio-fluvial outwash rivers, have repeatedly occupied portions of the McKenzie River valley. River valley morphology and accumulated sediments along the McKenzie owe their existence to several pulses of valley glaciers followed by extensive aggradation by glacial outwash streams during glacial retreat of the late Pleistocene.

Approximately 3- to 5- million years ago, regional uplift of approximately 20 cm/1000 years increased local elevations by up to 500 meters (Blue River Watershed Analysis 1997). Subsequent fluvial erosion and landslides have sculpted the watersheds and hillslopes to produce a deeply dissected terrain as uplift and mountain building continued. As a result, channel gradients are now

steeply concave and most tributaries are lined with steep inner gorge slopes that are the result of the continued uplift and channel incision.

Following late Pliocene uplift of the High Cascades, fluvial down cutting and slope steepening accelerated the rates of erosion and mass soil movement in the Quartz Creek analysis area. Several large areas of ancient landslides and slump earth flow topography displaying subdued relief and undulating terrain developed both in upper middle slope areas as well as along the foot slopes of steep valley margins (see Map 3). Steep terrain in areas of volcaniclastic bedrock and associated soils has been sculpted largely by debris slides, debris avalanches and debris torrents. These are especially common in the steep forested watersheds and tributary basins of Quartz Creek, Elk and Cone Creek, and along the steep slopes south of the McKenzie River.

The contact between the younger, more resistant ridge-capping basalt flows, and the more altered underlying Western Cascade volcanics is a common location of landsliding, especially in the eastern half of the study area. As the older, altered, volcaniclastic rocks are exposed on the steep valley side slopes, they weather to clay more quickly than the overlying rocks and are prone to increased rates of erosion and slope failure (Blue River Watershed Analysis 1997). Lack of resistant ridge-capping formations in the western portions of the analysis area, including Quartz Creek, directly expose the more easily eroded, less stable volcaniclastic deposits, producing a uniformly dissected topography. In both settings, fluvial erosion, creep and landsliding on steep slopes, and lateral channel erosion in lower gradient valleys, prevents the widespread formation of deep colluvial soils except in the more protected environments, such as river terraces, ancient landslide surfaces, upland benches and other low gradient slopes.

A variety of soils have developed on the landforms of the Quartz Creek analysis area. Their characteristics and specific physical properties, both in the undisturbed state and as a function of various types of disturbance, are fully described by Legard and Meyer (1973). Resistant bedrock and cool temperatures limit chemical modification of resistant volcanic bedrock units and local ridge-capping basalts protect underlying fine-grained breccias from quick decomposition. Weathering of the weaker, altered volcaniclastic rocks develops clay-rich soils that are prone to landslides and fluvial processes. Sheet wash and rill erosion in the undisturbed forest setting is thought to be a minimal component of the sediment budget of any of the tributary watersheds. Heavy forest cover limits the physical exposure of erodible materials except where landsliding, tree throw or fire has completely removed vegetation and surface litter. Overland flow in undisturbed areas is uncommon due to low precipitation intensities and generally high infiltration rates (Swanson et. al. 1987).

Soils in the area have a loamy surface horizon, ranging from silty-clays to sandy and gravelly loams. Because of aggregation of primary soil particles by organic

matter and other agents, porosity of surface soils is 60 to 70 %, over half of which is macropore space (Ranken 1974). Subsoil porosities are also high. The pore-size distribution of the soil account for two important hydrologic properties: 1) all water enters the soil and travels by subsurface flow to streams (Harr 1977), and 2) soil is able to retain 30-40 cm of water in the top 120 cm (Dryness 1969) which is important for vegetation during the dry summers. These conditions of high porosity and steep slopes cause headwater streams to respond very quickly to changes in rainfall rate (Harr 1977).

Streams and Hydrology

Quartz Creek is a fourth-order stream and the largest stream, after the McKenzie River, in the analysis area. Quartz Creek has a relatively wide floodplain in the lower three miles. The channel gradient is less than 2 %. Above this point, the valley is more constrained and channel gradient increases to 4 % and continues to increase upstream. Given its large discharge and steep gradient, Quartz Creek can develop significant hydrologic scour. However, the channel shows surprisingly little entrenchment. This is likely due to the abundant cobble and boulders in the bed that absorb energy and resist down cutting by the channel. As a result, there are relatively high amounts of side channels and the stream is still connected to its floodplain. The smaller tributary streams tend to have steep channel gradients and constrained valleys. Discharges vary with seasonal rainfall and a relatively high number of streams in the analysis area show signs of recent scour and torrent events. Five tributaries to Quartz Creek below Doe Creek have recently torrented: Coffee Creek, Sugar Creek, Fawn Creek, and at least two unnamed tributaries. Indian Creek shows signs of scour and bedload mobility. The unnamed tributary to the east of Mill Creek shows signs of recent, intense down cutting.

Large deposits of bedload consisting of gravels, cobbles, and small boulders exist at the confluences of the larger streams and the McKenzie River. In contrast, the Blue River has insignificant bedload deposits at its confluence with the McKenzie. This contrasts suggests that undammed tributaries are moving large bedload materials to the McKenzie and are an important source of coarse sediment to the McKenzie. Lack of coarse sediment contribution and reduced peak flows as a result of dam construction on the Blue River and the South Fork McKenzie River have been hypothesized to be the cause loss of channel complexity and reduction in the quality of fish habitat in the McKenzie River (Minear 1994).

Resident fish in thye streams of the analysis area are mostly cutthroat trout and sculpin with lesser numbers of rainbow trout, speckled dace, and red-sided shiners. As most stream have no fish passage barriers at their confluences with the McKenzie, it may be presumed that some of the McKenzie fish may utilize the tributaries on occasion. None of the streams are known to host sensitive the species, spring chinook or the bull trout to any extent. However, the lower

portion of Quartz Creek may have in the past, and may currently, provide limited spawning habitat for spring chinook and foraging habitat for bull trout. Steelhead may occasionally use portions of lower Quartz Creek. Steelhead are not considered native to the McKenzie basin, being introduced by stocking. It is not completely understood why steelhead are not native; it is speculated that the falls in the Willamette River at Oregon City were not passable during the fall when steelhead entered the river (J. Ziller, pers. comm.). The lower portion of Elk Creek has potential for anadromous spawning habitat. The confluence of Elk Creek with a side channel of the McKenzie is thought to have been historically important as a nursery for chinook fry. Two chinook salmon fry were counted in Mill Creek during fish surveys in 1993.

Stream surveys have been performed on Quartz Creek, Indian Creek, Lytle Creek, Buck Creek, Elk Creek, and Mill Creek. The surveys generally noted moderate levels of channel entrenchment, low densities of woody debris in most channels, low percent of stream area in pool habitat, and occasional stretches of poor riparian canopy cover. However, pools were relatively deep and good pocket pool water occurs in the most riffles. Relatively high numbers of side channel habitat was also noted. There appears to be a good range of substrate sizes. Cobble embeddedness was often high in some streams. The habitat in the streams themselves appear to be in moderately good shape. Cutthroat trout are widely distributed throughout the streams of the analysis area.

Vegetation

The analysis area lies in three vegetation zones defined by elevation (Franklin and Dyrness 1973). Most of the study area is in what is called the Western Hemlock Zone--defined as forests succeeding toward a climax species of western hemlock. This zone ranges between the elevations of 1000 feet at the McKenzie River to about 3500 feet. Lying just above the Western Hemlock Zone is a narrow band of what is called the Transition Zone spanning 700 feet of elevation. The Silver Fir Zone extends from an elevation of 4200 feet to 5100 feet and includes the higher portions of the analysis area--the highest ridges of Elk and Mill Creek watershed and the southern ridges of Quartz Creek. Scattered mountain hemlock may occur on Sardine Butte which rises to just over 5200 feet elevation. Regardless of what the climax species would eventually be, the dominant tree species in all these zones is Douglas-fir.

Natural, pre-European settlement fire regimes in the project area can be inferred from studies in nearby areas (Morrison and Swanson 1990, Connelly and Kertis 1992). Fires were generally large, up to 10,000 acres or more in size. Burns were not typically complete. Within an area burned by a fire there would be patches where all trees were killed and patches with little or no tree mortality. Fires may have been more frequent along the McKenzie River, a travel corridor for Indians and European settlers. Fires may also have been more frequent on south slopes. Before logging, the predominant forest age class was 60-150

years in the south-facing Minor Tributaries and was old-growth 350-500 years old south of the McKenzie River.

Much of the analysis area has been harvested once in the last 40 years. The private land, which makes up over half the study area, has almost all been harvested, and contains second growth stands ranging from 2- to 50-years old. Very little old-growth remains on private land in the Quartz Creek basin. At least 30 % of the forests on federal lands in Quartz Creek was harvested during the period between 1976 and 1993. At least 50 % of the forests on federal lands in Mill Creek has been harvested over the last 50 years. Most of the federal lands in the Minor Tributaries south of the McKenzie River were acquired in a land swap with International Paper and had already been harvested. Federal lands in Elk Creek have not been harvested. Patches of old-growth remain in the upper Quartz Creek basin and many are linked together. These, in many cases, abut the Fall Creek Late-Successional Reserve to the southwest of the analysis area.

Size classes of canopy trees on federal lands are seedling to pole size in logging units, 21-30 inches in the uncut upper portion of the Minor Tributaries and over 30 inches in the old-growth patches and strips in upper Quartz Creek. The private land in lower Quartz Creek contains medium-sized (21-30") second growth, poles (9-21"), and saplings (1-9").

The condition of riparian forests in the study area vary by ownership and by watershed. On federal lands, riparian zones can be described by an inner riparian zone dominated by hardwoods and an outer zone composed of conifers. The hardwood zone varies in width between 10 and 30 feet along the smaller, more constrained streams, to over 100 feet in the wider floodplains such as that along the lower portions of Quartz Creek and the McKenzie River. Riparian hardwood species include red alder, vine maple, bigleaf maple, and willow. The inner riparian zone is often in a state of recovery from the most recent flood event and consists of even-aged stands of alder. Gradually, in the absence of disturbance, this zone will succeed to conifer dominance as is now occurring the lower portions along Quartz Creek. The outer riparian zone of conifers grades into the upland forest and its proximity to the active stream channel is determined by the width of the inner, hardwood-dominated inner riparian zone. Common species in the outter riparian zone are Douglas-fir, western hemlock, and western redcedar. Approximately half the stream lengths on federal lands are composed of large conifers (i.e., >21 inches diameter at breast height) in the outer riparian zone (the zone beyond the inner riparian, hardwood dominated but still within 100 feet of the stream). However, the upper portions of Mill Creek, all of Lytle Creek, and the lower portions of Indian Creek are notably lacking in large conifers within 100 feet of the stream.

Recreation

The majority of recreation and tourism activities in the project area occur near the McKenzie River due to easy access and abundant opportunities. This area is within easy driving distance of Eugene metropolitan area, State Highway 126 parallels the river and is a major travel route to the Cascades and central Oregon. Major activities in the river corridor are whitewater rafting, fishing, and camping. One developed campground, Delta, is within the project area. The Delta Nature Trail is adjacent to the campground and offers an interpreted old growth walk.

An increasing number of recreationists and travelers are using parts of the analysis area. A number of commercial guides offer both rafting and fishing opportunities, and commercial use of the river has grown by 2-8 % per year in recent years (P. Raab, pers. comm.). Although accurate counts of private recreationists on the river are not available over a long time period, recreation managers feel that private use has grown even faster than commercial use. Recent data on campground occupancy in the nearby McKenzie Ranger District show growth of 2-4 % per year, but use of Delta Campground in this analysis area has not grown in recent years. The designation of StateHighway 126 as a National Scenic Byway has coincided with a 20 % increase in visits to the McKenzie Ranger Station on weekends (P. Raab, pers. comm.).

Because of the heavy use along State Highway 126 and the mainstem of the McKenzie, scenic quality of the surrounding hillsides is a major issue. Clearcuts on both private and public land can detract from individuals' perception of scenic vistas. Since much of the land in this area had been, until recently, in private ownership, there has been less sensitivity to recreationists' concerns when designing harvests. Maintaining visual quality in future timber management decisions will help to reduce conflict between timber management and other human uses in the river corridor.

Recreation use in the remainder of the project area beyond the McKenzie River corridor appears to be relatively light. There is a well-developed road, Forest Service Road 2618, following Quartz Creek that affords access to the creek at multiple bridges and pull-outs on Land owned by the Rosboro Lumber Company. However, there is little evidence of creek use or dispersed campsites in this area. A local boater claims that the first 5 miles of Quartz Creek provide whitewater rafting and kayaking opportunities during high water. Recent floods have opened up the mouth of the river, and there is very little woody debris in the channel to impede progress or pose safety hazards.

Recent logging operations are readily visible from the road through private land, detracting from its value as a scenic drive. Hunting is allowed on the private Rosboro land where it doesn't conflict with forest management activities. Otherwise, private land is generally gated and recreation access is by permit.

The National Forest Boundary begins about 9 miles up , Forest Service Road 2618, and the surrounding forest immediately becomes more visually attractive for travelers and recreationists. However, there still appears to be limited use of this area, probably due to the availability of recreation resources that are more attractive and readily accessible along the McKenzie River. There are no developed campgrounds in this part of the watershed, and few trails. The Indian Ridge Trail, on the edge of the Quartz Creek watershed, is popular for hunters, berry pickers, and bear grass pickers. There is a short trail that users have established to Slate Rock, a popular climbing site. There is also evidence of dispersed camping in the area by hunters.

There is also little recreation use in the Minor Tributaries area, outside of the McKenzie River corridor. There are older maps of the Elk Creek area which show trails. This area is now gated, but the gate is not locked. The gate is normally left open by Forest Service personnel but is apparently closed by local residents that use the road for hiking and wish to discourage vehicle use. The road along the south of the main stem Mckenzie, sometimes called the Powerline Road, is used by hunters and mountain bikers, as well as those driving for pleasure. There are a few dispersed camping sites along this road, as well as signs of depreciative behavior such as illegal dumping.

Economy

The communities in the vicinity of the project are highly dependent on tourism. McKenzie Bridge and Blue River have lodging, restaurant, and retail stores that serve tourists. There are also guiding services and an acclaimed golf course (Tokatee). Recreationists visiting this area spend money in the local economy, which then gets spent on labor and inputs through a multiplier effect.

SECTION II: KEY ISSUES

ISSUES AND KEY QUESTIONS

The development of issues helps to focus the scope of a watershed analysis. Key questions, address the issues and serve to focus the investigation of the watersheds.

The Blue River Ranger District provided a draft list of issues and questions to be considered for this watershed analysis. After initial research and consultation with agency personnel and interested members of the public, the following list of issues was developed. The issues are organized by domains as recommended by the *Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis* (1995). These questions serve to focus the process of investigation. It was recognized that not all questions could be answered completely due to incomplete existing information. However, listing of all important questions serves to highlight areas that should be explored completely, and if not answerable, identified for further study.

Aquatic and Riparian Domain

1. Areas within the watersheds are composed of weak sedimentary tuffaceous rocks capped by resistant volcanic basalt. This condition creates over steepened slopes where the two layers meet. Mass wasting is common. Soils formed from colluvium can be unstable. Combinations of high rainfall and management practices such as road construction, timber harvest, and slash treatments often trigger erosional events and may have increased the frequency of mass wasting and surface erosion. These events can result in increased delivery of sediment to streams.

Where are the zones of highest risk?
How are erosional processes affected by the following?
- *road construction practices and maintenance*
- *harvests*
- *historic fires and future prescribed natural fire*

How are erosional processes affecting the delivery of sediment to the tributary streams and the McKenzie River?

2. Quartz Creek appears to have sustained high flows during the 1996 floods and some tributaries shows signs of torrent events. In stream reaches with high gradients, flood flows and torrent events can create excessive hydraulic scour, removing fine substrate and woody debris. Erosion of toe slopes of mass wastes during low-flow periods can contribute to sedimentation of pools in low-gradient reaches. Streams appear to have low amounts of woody debris. Riparian zones in the lower, privately owned reaches are not

expected to provide large conifers for some time. Therefore, the riparian zones of the Forest Service lands will likely be the critical source of woody debris and may require special management. Dams on major tributaries to the McKenzie River have moderated peak flows since the 1960's. Reduced peak height and frequency have changed the river character. Sediment contribution from free flowing tributaries such as Quartz Creek may play a more important function now.

How have peak flow events and management activities altered the following?

- *stream channel and fish habitat*
- *riparian areas and floodplains*
- *in-stream erosion processes*

What changes in water quality may have occurred as a result of management activities?

- *stream temperature*
- *turbidity*

How has fire influenced the aquatic habitat in this landscape historically, and how would future prescribed natural fire or management ignited fire implementation affect their maintenance?

3. Private lands can be affected by changes in channel morphology that results from management practices such as road construction and maintenance, timber harvest, prescribed natural fire, and fish habitat manipulation.

What is the historic pattern of channel changes along the McKenzie River? Which properties are most susceptible to changes in channel morphology?

4. Management and practices on private lands such as timber harvesting, construction, stream bank protection measures, and septic tank location may have altered historic channel change patterns and water quality.

Where and what actions on private lands might be affecting natural channel morphological processes and water quality?
What private landowner activities are regulated by county, state, and federal regulations, and how are they impacting beneficial uses?

5. The McKenzie River is a key watershed and provides important habitat for at least 12 species of native fish in the analysis area. The McKenzie in the analysis reach has also been stocked with rainbow trout as early as 1921. Summer steelhead have been stocked since 1968. Bull trout, a proposed threatened species under the Endangered Species Act, use the McKenzie as a migratory corridor in the analysis area. A final decision on the listing of bull trout by the US Fish and Wildlife Service is due June 12, 1998. The McKenzie is considered to be the most important remaining sub-basin for naturally reproducing spring chinook in the Willamette River basin. The upper Willamette River spring chinook were proposed for a threatened listing on February 26,

1998. A final decision is scheduled for February, 1999. Populations of cutthroat trout exist in semi-isolation above natural fish passage barriers.

What role do the tributaries in the analysis area play in providing refuge for aquatic organisms, especially for spring chinook and bull trout?
What is the condition of the stream habitat in the tributaries for native resident fish?
What management-created, fish passage barriers exist? What problems do they pose?

6. In the past, riparian areas were often damaged during timber harvesting as the riparian areas contained easily accessible trees and afforded the access routes into watershed. Several reaches of streams in the analysis area have low densities of large conifers in their riparian zones. Riparian zones have received new focus from the Northwest Forest Plan because of the important role they play in stream function and in providing for special habitat. Existing riparian habitat must be adequately protected to provide these recognized functions.

What is the condition of the riparian habitat?

- *shading*
- *potential for large woody debris recruitment into streams*
- *in-stream erosion*

What is the role of natural disturbance in structuring the current conditions?
Where are areas that require restoration?
Will the riparian reserves adequately function to meet all objectives outlined in the ROD?
What criteria could lead to interim riparian reserve adjustments, and where are some of the areas that fit these criteria?

Terrestrial Domain

1. Management activities within these forests, including timber harvest, road building, and fire exclusion, may have altered community composition or created patterns and conditions that are outside of the historic range of variability. The biological diversity of the watershed may have been altered. The west half of Quartz Creek federal lands and most of Elk Creek are designated as a late-successional reserves. There may be opportunities for restoration activities. For example, past harvest patterns may have created fragmented habitats for late-successional wildlife species, or second growth stands may need thinning to help develop multi-storied canopies. A large block of Quartz Creek is in private holdings and is likely being managed with quite different objectives than Forest Service lands. This private block largely separates the two late-successional reserves. Opportunities may exist for coordination between the Forest Service and the private industrial timber managers with respect to issues such as fragmentation, wildlife habitat, corridors, and road maintenance.

What is the array and landscape pattern of forested plant communities in this watershed?
What processes caused these patterns?
How does the current conditions affect future land management objectives or ecosystem function?
How will the implementation of prescribed natural fire or management ignited fire affect the vegetation on this landscape?

2. Levels of large woody debris and snags in managed forests, including plantations, campgrounds, roadsides, may be outside of the historic range of natural variability for unmanaged forest systems. This could impact a variety of species that depend on these structural elements for habitat.

What is the historic natural range of variability for large woody debris and snags on this landscape?
Have management activities altered the landscape condition significantly outside the historic range for snags and large woody debris?
Have management threshold levels been achieved? Where are conditions outside of "acceptable" ranges?

3. Future land management strategies focused on the maintenance or development of late-successional forest species may result in diminished availability of habitat for early seral species.

What species are associated with early seral habitats?
What is the historic and projected future availability of early, mid, and late seral habitat over time in this watershed?
How will the availability and distribution of these habitat types affect species associated with them over time?

4. The majority of sensitive and rare plant species that are known or suspected to occur in the watershed occupy non-forested areas (special habitats). These areas, though protected by standards and guidelines in the Forest Plan, are generally un-mapped and un-surveyed. It is unknown what their current contribution to biodiversity on the landscape is or what threats they may be receiving.

What kind of special habitats are present within the watershed?
What are the locations of the special habitats?
What threatens the continued stability or functioning of these special habitats?
What wildlife and botanical species of interest are associated with these areas?

5. The Northwest Forest Plan requires surveys and management for numerous species of wildlife, fungi, lichens, bryophytes and vascular plants (ROD Table C-

3). The location and potential distribution of many of these species within the watershed is unknown.

What C-3 species potentially occur in the watershed based on their known range and habitat requirements?
What Table C-3 wildlife and plant species are known to occur in the watershed?
Do the ROD standards and guidelines adequately protect existing habitat and provide long-term habitat for species of concern listed within the ROD?

6. The Forest Service must continue to contribute to the recovery of identified threatened and endangered fish and wildlife species. Northern spotted owls are known to nest in the analysis area and require special management.

What other threatened or endangered species are known to occur or potentially could occur within the analysis area?
What is the condition of the populations of these species and the condition of their habitat?
What is the status of threatened and endangered species recovery, and how is this watershed contributing to recovery goals?

7. Elk hunting and viewing is popular recreational outlet. Elk habitat is likely to decline in areas managed for late-successional reserves. Road management for the watershed may be affecting the quality of wildlife habitat and hunting opportunities.

What are the current road densities and network within the watershed?
How do roads currently impact wildlife habitat and hunting opportunities?

Social and Economic Domain

1. There are linkages between the recreational use of the watershed and the local economy. Future increases in recreation use, or residential development, while providing economic benefits, may conflict with resource conditions and/or recreation experiences.

How important is recreation use in the watershed to the local economy?
Are there current or likely future conflicts between recreation use and resource conditions and/or recreation experiences?

2. Impacts to the scenic quality of natural features may be occurring from degradation caused by harvest units.

What management existing conditions are inconsistent with the scenic

allocations within the Forest Plan? What areas of the watershed are highly visible from the major recreation and travel corridors and would be impacted by future harvest activities?

3. Prescribed natural fire may conflict with air quality standards.

What was the historical air quality in the late 1800's?
What is the current National Ambient air quality standards and benchmark for our area?

4. Roads and trails may be affecting sensitive areas, or conflict with land use allocation objectives.

Are there roads and trails leading forest users into sensitive areas such as riparian areas or special habitat?
If so, what and where are they?
Is current or future projected levels of use in conflict with their desired future condition?
Are existing road management measures being violated?
What are current road use patterns and are they expected to change in the future?

5. Road standards may not be appropriate to current and anticipated uses, and funding of those standards may/may not be adequate.

Are road standards appropriate to anticipated uses?
Can proper maintenance occur based upon funding outlooks?

6. Human uses may be in conflict with the ability to maintain elk habitat. Effectiveness of existing habitats may have been altered.

What is the HE_R within the watershed?
What are the seasonal impacts of human uses during winter, early summer, summer, and fall?

7. Areas within this watershed may contain prehistoric and historic sites. Management activities within the watershed may have impacted these areas.

What are the major human uses, including tribal uses?
Where are these sites in the watershed, and how were/are they used?