SECTION 9

RATTLESNAKE CREEK SUB-BASIN
SHORELINE INVENTORY ANLYSIS
DISK #5

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RATTLESNAKE CREEK SUB-BASIN OVERVIEW

Portions of the following text have been primarily taken, in whole or in part, from the following reports: (USFS, 1997:1998)

The Rattlesnake Creek watershed is located in central Washington State, on the southern Wenatchee National Forest. The Rattlesnake Creek watershed encompasses an area of 133.8 square miles (85,610 acres). Within the watershed, the U.S. Forest Service manages 49,768 acres (58%) of legislated Wilderness within the William O. Douglas Wilderness and 26,432 acres (31%) of nonwilderness lands (Figs. R3 and 4). Privately owned or managed lands account for the remaining 9,408 acres (11%) of the watershed lands. The Washington State Department of Natural Resources and Washington State Department of Fish and Wildlife administer the majority (90%) of nonfederal lands, with the remaining 10% of nonfederal lands consisting of small, private parcels (United States Forest Service [USFS], 1997).

Rattlesnake Creek flows predominantly to the east and drains the area around Mt. Aix, the highest point in the William O. Douglas Wilderness (elev. 7766 ft.) to the confluence with the Naches River at an elevation of 1995 feet. The headwaters of this basin extend west to a point near Apple Lake, which is approximately four miles east of the crest of the Cascade Mountains (USFS, 1997).

Annual precipitation grades from 80 inches in the western highlands to 20 inches at the confluence with the larger Naches River. Most precipitation occurs from November through March and falls as snow in the upper elevations. This highland region encompasses 47% of the watershed and is not commonly subject to intense melting during winter months. Precipitation in an additional 43% of the Rattlesnake Creek Basin is snow-dominated and is subject to milder winter temperatures. Within this area, 9.3% is commonly influenced by rain-on-snow processes that produce significant hydrographic pulses and floods in the lower mainstem. Less than 1% of the basin is considered under the influence of rain-dominated precipitation.

Stream gradients are extremely steep in the western headwaters, in many places exceeding 60%. Classic U-shaped glacial valleys dominate the upper and western portions of the watershed, transitioning eastward into a mid-basin that is dominated by mass-wasting processes, before entering a steep, V-shaped canyon. The northern and southern edges of the basin are defined by massive anticlinal ridge structures related to tectonic compression. Rattlesnake Creek emerges from the main canyon just above RM 3, below which the floodplain widens into a classic alluvial floodplain.

GEOLOGY

The bedrock geology of the Rattlesnake Creek watershed is predominately volcanic in origin, with lesser amount of fluvial sandstone (Fig. R1). Bedrock includes Grande Ronde Basalt and the Fife's Peak formation, among others. Upper members of the

Grande Ronde Basalt are exposed in the eastern portion of the watershed, forming Devils Table, the eastern portions of Bethel Ridge, and steep escarpments along the lower portion of Rattlesnake Creek. The Fife's Peak formation is comprised of interbedded andesite and basalt breccias, tuffs, and lava flows. Breccias and tuffs were deposited mainly as lahars and debris flows. Compared to the overlying Grande Ronde Basalts, the Fife's Peak formation is relatively incompetent. This association is responsible for a majority of the large earthflows found in the drainage (USFS, 1997).

Geomorphology

The Rattlesnake Creek basin has been divided into geomorphic terranes based on the dominant expression of the landscape. Bedrock geology is predominantly volcanic, with secondary sedimentary formations. The structural geology has influenced landform and geomorphic processes. Uplift, faulting, and folding has influenced landform and geomorphic processes in the Rattlesnake Creek watershed. As is common south of the Olympic-Wallowa lineament, folding and faulting in the eastern two-thirds of the watershed tends to trend east-west. This orientation is expressed through a normal fault which roughly parallels the watershed boundary along the North Fork of the Rattlesnake Creek, and anticlines along Rattlesnake Creek and Bethel Ridge. West of the confluence of Hindoo Creek and Rattlesnake Creek, steep north-south trending normal faults associated with the emplacement and subsequent collapse of the Mount Aix cone structurally control landforms (USFS, 1997).

Glaciation has played an important role in landform development, as evidenced by generally U-shaped valleys of the North Fork Rattlesnake, Dog, Hindoo, and Rattlesnake creeks. Till deposits are present in these drainages, as are morainal features and till that has been eroded through mass wasting, largely obscuring its features. In the central part of the watershed, uplift, folding, and faulting of the Ohanepecosh formation has given rise to steep, incised V-shaped valleys, where rocks were spared glacial erosion, but experienced severe erosion from wetter Pleistocene conditions (USFS, 1997).

The wetter climatic conditions in the Pleistocene are thought responsible for the numerous, large landslides found in the Eastern portion of the watershed. Today, these earth flows are important near-surface aquifers, and often contain numerous seeps, springs, and bogs. In places, these large failures may be responsible form damming of channels with subsequent deposition of sediment upstream of failure deposits and downcutting through and below these deposits (USFS, 1997).

Twenty different major landforms are mapped and distributed throughout the Rattlesnake Creek basin. The two terranes constituting the SMP jurisdiction are the Alluvial Fans/Toe Slopes and Floodplain (USFS, 1997).

The Alluvial Fans/Toe Slopes terrane consists of gently sloping alluvial and colluvial deposits at the base of steeper slopes and draw mouths. Slopes are generally less than 20 percent on fans and 35 percent on colluvial deposits. Alluvial fans are cone-shaped clastic wedges located at the mouths of relatively steep, confined tributary streams.

Drainage channels on the fan surface are subject to diversion and routing changes. Subsurface water storage capacity is relatively high (USFS, 1997).

The Floodplain terrane is a relatively flat surface occupying a valley bottom adjacent to major streams. It is comprised of unconsolidated sediments deposited by lateral migration of streams, flood events, and impoundments. Slopes are generally less than 20 percent. Sediments are commonly stratified, but vary with location in floodplain and depositional process. Ponds, marshes, and overflow channels occur with a range of finer-grained deposits. These landforms are occupied by well-defined, low-gradient perennial steams. Subsurface groundwater storage capacity is relatively high. Fluctuation of ground water is characteristic. Flooding is a relatively common experience in this terrane, but surface runoff rarely occurs (USFS, 1997).

VEGETATION

Within the Rattlesnake Creek watershed, the natural vegetation is generally distributed along a gradient of moisture and temperature. Four major vegetation groups can be described: the dry forest group, mesic forest group, the wet forest group, and the non-forest group. Of these, the mesic forest group and non-forest group predominate within the SMP jurisdiction. North aspects, riparian areas, and mid-elevations support mesic forest vegetation consisting of wet grand fir and Western hemlock plant series. These communities comprise approximate 14 percent (12,168 acres) of the Rattlesnake Creek watershed. Approximately 28 percent (24,155 acres) of the watershed is comprised of non-forest vegetation types that include the mesic, wet, and wet shrub meadows, and the deciduous and gravel bar riparian communities (Fig. R2).

Riparian

The Rattlesnake Creek watershed supports 644 acres of riparian community type. Riparian communities occur on the banks and shorelines of rivers, creeks, and ponds. Riparian communities are significantly influenced by perennial or intermittent water, high water-tables, and associated soils. Hydrology, solar exposure, and air temperature and humidity are key factors associated with this ecosystem. Two riparian types have been identified within the Rattlesnake Creek watershed: deciduous and gravel bar (USFS, 1997).

The deciduous riparian type (458 acres) is characterized by mountain alder, black cottonwood, red-osier dogwood, prickly currant, blue elderberry, wood's rose, and willow. The gravel-bar riparian type (186 acres) occurs along and within rivers and large streams, and is one of constant change. Willow, black cottonwood, quaking aspen, mountain alder, several species of sedge, and various grasses characterize the natural vegetation of this community (USFS, 1997).

Proposed, Endangered, Threatened, and Sensitive (PETS) Plants

Documented, systematic surveys for PETS plants have been conducted in the Rattlesnake Creek watershed since 1988. However, as of 1996, only an extremely small portion of

the watershed had been included in these surveys. A significant portion of these surveys were conducted in coniferous forest habitats, and very few surveys were conducted in riparian habitat along the Rattlesnake Creek. Those PETS plants most likely to occur within the SMP jurisdiction are *Cypripedium montanum* (mountain lady's-slipper), which is common along benches above streams and *Luina stricta* (strap-leaf luina) which is commonly found in mesic to wet meadows at higher elevations (USFS, 1997).

The diversity of habitat conditions present within the Rattlesnake Creek watershed provides potentially suitable habitat for several sensitive plant species not presently documented to occur within the watershed (USFS, 1997).

Noxious Weeds

The State of Washington describes weeds as "any plant which, when established, is highly destructive, competitive, or difficult to control by cultural or chemical practices." In general, they are either introduced or early seral native species that become established on sites that have experienced ground-disturbing activities. Noxious weed surveys in the Tieton River basin are limited. Reconnaissance has been, for the most part, incidental along roadway from vehicles. Noxious weed species of primary concern within, on the approach to, or threatening the Bumping River watershed that are most likely to occur within the SMP jurisdiction include: *Artemesia absinthinum* (absinth wormwood), *Centaurea diffusa* (diffuse knapweed), *Chrysanthumum leucanthumum* (oxeye daisy), *Cichorum intybus* (chicory), *Cirsium vulgare* (bullthistle) and *C. arvense* (Canada thistle), *Hypericum perforatum* (St. Johnswort), *Linnaria dalmatica* (dalmatian toadflax), and *Verbascum thapsus* (common mullein) (USFS, 1997).

WILDLIFE

Regarding solely the SMP jurisdiction, riparian areas constitute the predominance of wildlife habitat types. Riparian areas are the most critical wildlife habitats, as seen by the disproportionate use of them as compared to other habitat types by wildlife. There is also greater wildlife species diversity in riparian habitat as compared to other habitat types (USFS, 1997).

Some of the characteristics that make riparian areas important to wildlife are: 1) access to food, cover, water, and space (riparian areas always afford water, and often all four components), 2) increased diversity of plant species and structural diversity within the community, 3) linear shape (maximizes the development of edge, which is quite productive in terms of wildlife use), 4) micro-climates that differ from surrounding areas (wildlife are attracted to these areas and some are dependent on it), and 5) provide migration routes, travel corridors, and connectivity between habitat types (USFS, 1997).

The acres of historic habitat availability was most likely similar to existing conditions. Construction of roads, past harvest activities, livestock and big game grazing, and noxious weed invasion has reduced the effectiveness of this habitat (USFS, 1997).

Proposed, Endangered, Threatened, and Sensitive (PETS) Wildlife Species

Five wildlife species, either currently inhabiting or with the potential to inhabit the Rattlesnake Creek watershed, are federally-listed as either threatened or endangered (American peregrine falcon, Northern spotted owl, gray wolf, Northern bald eagle, and grizzly bear), only the Northern spotted owl and Northern bald eagle are known to occur within the watershed. Habitat is present for all five species, with the possible exception of the grizzly bear.

The Northern bald eagle was federally listed as threatened in Washington, Oregon, Minnesota, Wisconsin, and Michigan in 1978. At the same time, bald eagles were listed as endangered in the remaining coterminous 48 states, due to population declines resulting from DDT use, shooting, poisoning, habitat alteration, changes/declines in prey base, and human disturbance. In 1995, the status of the bald eagle was re-classified to threatened throughout the lower 48 states. In 1999, the U.S. Fish and Wildlife Service proposed removing the bald eagle from the Endangered Species Act list. A decision is pending.

Nesting habitat for this species consists of mature to old-growth stand conditions, usually within 0.5 miles of large bodies of water that are ice-free in the spring (breeding season) and support and abundant fishery. Nests are built in large, open trees with heavy lateral limbs, and are used year after year. Snags are also needed to provide perch and roost sites. Bald eagle feed primarily on fish during the summer months. Historically, nesting habitat occurred within the Rattlesnake Creek watershed. Currently, there are no known nesting pairs of bald eagles within the watershed, however, there is one active territory within the adjacent Tieton River watershed.

In addition to nesting habitat, wintering bald eagle habitat, both roosting and foraging, must also be present to support existing populations and allow for increases in the populations and recovery of the species. Winter habitat consists of ice-free bodies of water with an abundant fishery and/or large winter waterfowl populations. Winter habitat also includes big-game winter ranges where winter-kill carrion provides a food source. Snags are needed for perch and day-time roost sites, and contiguous mature to old-growth stands are needed for nocturnal roosts. The overall quality of available wintering habitat within the Rattlesnake Creek watershed has increased from historic acres. Although the number of roost structures has decreased due to numerous timber sales, the installation of an elk fence, starting in 1948, has resulted in concentrated numbers of wintering elk and deer in the lower portion of Nile, Dry, Oak, and Rattlesnake creeks, resulting in increased big-game winter carrion availability. Bald eagles have been documented using this winter habitat for a number of years.

The peregrine falcon was federally listed in 1970 due to population declines that began in the 1950s and 1960s resulting from the ingestion of prey species containing elevated levels of DDT. Historical nesting habitat is very similar to the acres of current nesting habitat. Approximately 4053 acres of suitable habitat (cliffs adjacent to water) exist in the Rattlesnake Creek watershed. Peregrine falcon reintroductions within the adjacent Tieton River watershed from 1989 to 1991, and the American River watershed from 1991 to 1994. Peregrines established a new territory and occupied and reproduced young within the Tieton River watershed. No active peregrine falcon eyries are known to exist

in the Rattlesnake Creek watershed, although several individual birds have been seen at various times. Two known active peregrine territories are known to exist adjacent to the watershed, one each to the north and south (USFS, 1997).

The gray wolf was federally listed in 1978. As the pre-eminent predator of large ungulates, the gray wolf is more dependant on availability of its prey species than on any specific habitat type. The level of human access is an important consideration in the assessment of wolf habitat. Roads alone do not impede wolf activity; rather, it is the deliberate, accidental, and incidental human-caused mortality associated with road access that impacts wolf survival. U.S. Forest Service personnel conducted limited wolf surveys in the Rattlesnake Creek watershed in 1994. As of 1997, there were no known Class 1 (confirmed) gray wolf observations within the watershed, however, there were several confirmed sightings on adjacent lands (Packwood and Cle Elum Ranger Districts). There had been several Class 2 (highly reliable) gray wolf observations within the Naches River watershed, with a few within the Rattlesnake Creek watershed (USFS, 1997).

The grizzly bear was federally listed as threatened in 1975 due to declining populations as the result of habitat loss and overhunting. Grizzly bears require large, wild, mountainous areas rich in food (high elevation meadows, shrubfields, avalanche chutes, lowland meadows, and marshes). Denning habitat, used from late fall through March, is often located in high elevations on steep slopes with deep snow accumulations. Spring emergence habitat is lower elevations containing drainages with avalanche chutes and ungulate winter ranges. In late spring to early summer, grizzly bears follow plant phenology to higher elevations. Pre-denning habitat, used in late summer and fall, finds grizzlies transitioning to fruits and nuts as well as other herbaceous material. Essential grizzly bear habitat includes all the components of denning, spring emergence, summer and pre-denning habitat, along with isolation from human disturbance. The Rattlesnake Creek watershed contains habitat suitable for grizzly bears, however, certain parts of it are ineffective due to human disturbance caused from extensive road development and numerous residences, and human activity. While there are no known confirmed sightings within the Rattlesnake Creek watershed, grizzly bears have been confirmed as occurring within the Wenatchee National Forest to the north (USFS, 1997).

Numerous other threatened or sensitive wildlife species that are either known to occur within the Tieton River watershed, or for which the watershed provides suitable habitat, are of concern to a variety of state and federal management agencies (USFS, 1997).

FLOW

The Rattlesnake Creek watershed is east of the Cascade Crest, in the rainshadow of the Cascade Mountain range. The climate in this watershed ranges from generally mild and moist at higher elevations in the western portions to dry at the eastern edge. Average annual precipitation ranges from over 80 inches in the higher elevations on the western boundary to approximately 20 inches near the confluence with the Naches River. The majority of annual precipitation falls as snow in the November through March period.

Most of the Rattlesnake Creek watershed is within the highland zone (40,530 acres – 47.3%). In addition, 36,982 acres (43.2%) are within the snow-dominated zone, 7866 acres (9.2%) are classified as rain-on-snow zone , and the remaining 233 acres (<1%) are in the rain-dominated zone (USFS, 1997).

A very minimal amount of flow data has been collected in the Rattlesnake Creek watershed. A gauging station was operated intermittently by the U.S. Bureau of Reclamation near the Nile Road bridge. Rattlesnake Creek exhibits a normative hydrograph that is not influenced by irrigation storage or withdrawals above the SMP reaches. Base flow in August and September is approximately 20 cubic feet per second (cfs). Typical high flows, related to normal snowmelt, are approximately 285 cfs. The hundred-year flood event is expected to reach 9,430 cfs at the mouth of the creek.

In general, the Rattlesnake Creek watershed has relatively low canopy closures and a high percentage of area in low elevations which resulting in a high risk of rain-on-snow flood events. Timber harvest over a large percentage of the non-wilderness portion of the watershed has probably increased melt rates and contributes to increased rates of surface runoff. Tractor yarding, followed by tractor piling of slash, was a common harvest technique until the late 1980s. Compaction leads to increased rates of runoff and can degrade water quality. The areas with concentrated harvest activities also have the highest road densities, which can affect runoff rates and timing by reducing canopy cover, increasing soil compaction, and increasing drainage density. This can result in increased peak flood flows and increased stream-channel scouring (USFS, 1997).

Water from the Rattlesnake Creek basin contributes to flows in the Naches and Yakima rivers, portions of which are diverted downstream for irrigation and domestic purposes. The average annual water yield from the Rattlesnake Creek basin contributes approximately 12 percent of the annual flow in the lower Naches River. The City of Yakima has proposed building a dam on the mainstem Rattlesnake Creek in order to provide storage and regulation of flows for diversion downstream for domestic use. None of the several sites investigated were feasible due to the geologic instability of the potential locations (USFS, 1997).

Hyporheic Flow

Information on groundwater resources within the Rattlesnake Creek watershed is limited. Water emerging as numerous springs along the margins and internal to the floodplain in the glacial valleys indicates substantial hyporheic flow within these landforms. Restricted floodplain width in the canyon reach, and bedrock outcroppings indicate reduced hyporheic potential in the mid-portions of the basin. Hyporheic flow within the constrained floodplain sediments of both SMP reaches is expressed as upwelling water in side-channel and spring creeks. These areas are present near valley walls, but are not extensive. Reach 1, a depositional reach, is expected to contain an active hyporheic flow path between the head of the reach and the Rattlesnake Creek.

Water within the Rattlesnake Creek watershed also probably plays an important role in recharge of groundwater aquifers utilized in the Yakima Valley for domestic and

irrigation uses. The Rattlesnake Creek area is included in the Rattlesnake groundwater subbasin of the Upper Naches basin (Kinnison and Sceva, 1963 in USFS, 1997). Some of the groundwater from the Rattlesnake Creek basin probably re-enters and augments surface waters in the lower Naches River. There are no known domestic or irrigation wells within the National Forest lands in the basin (USFS, 1997).

Irrigation

No flow regulation occurs in the Rattlesnake Creek basin although the basin has been subject to reservoir evaluations numerous times. Flow in the SMP jurisdiction of Reach 1 is altered during summer months from several surface-water diversions for private lands in the Nile area.

SALMON

Fish Distribution

Salmonids are present in Rattlesnake Creek and its tributaries. Rattlesnake Creek supports populations of spring chinook, summer steelhead, and coho. Resident populations of rainbow trout (redband), brook trout, cutthroat trout, bull trout, mountain whitefish are present, as well as sculpin and other fish species, in Rattlesnake Creek and several of its tributaries (Washington Department of Fish and Wildlife [WDFW]. 1998, USFS, 1997).

Rattlesnake Creek provides spawning and rearing habitat, as well as deep pools for adult holding habitat for spring chinook. Resident Rainbow trout (redband) are known to occur in Rattlesnake Creek, from the mouth to about the wilderness boundary and in several tributaries. All life stages of redband trout use the areas where they are known to occur. Little is known about the distribution of summer steelhead in the watershed, but they are known to occur, and it is assumed that their distribution is similar to that of the redband trout. Adult steelhead enter Rattlesnake Creek in February, and spawn in March, April, and May. Fry emergence has been estimated to occur from May to August (Conf. Tribes and Bands of the Yakama Nation, 1990, Harvester, 1997 in USFS, 1997).

Bull trout, brook trout, and westslope cutthroat trout occur from the mouth of Rattlesnake Creek to near the confluence with McNeil Creek. All of the known bull trout spawning habitat occurs in the William O. Douglas Wilderness. Adults greater than 20 inches in length have been observed spawning in Rattlesnake Creek; based on size, it is likely that these are fluvial individuals. It is possible that there are both resident and fluvial individuals in the Rattlesnake Creek system. Resident individuals are those which spend their entire life in a headwater stream, and fluvial individuals rear and spawn in relatively small tributaries, and spend the rest of their life in mainstem rivers. Rattlesnake Creek provides spawning rearing, and resident habitat for brook trout (USFS, 1997).

Passage

No anthropogenic structural barriers have been identified in the Rattlesnake SMP jurisdictions. Unscreened irrigation diversions are present within the SMP jurisdiction.

Both natural and anthropogenic barriers exist upstream of the SMP jurisdictions within National Forest lands.

SALMON HABITAT

Channel Condition

The condition of stream channels is influenced by upstream channels, because inputs (runoff, large woody debris, fine sediment, and coarse sediment) from upstream channels help shape channels downstream. The condition of stream channels is also influenced by upslope condition and processes. Channel segments respond to inputs based on confinement and gradient. Based on confinement and gradient combinations and the resulting characteristics, stream segments can be divided into four channel-response types. The response type implies the role each segment plays in the channel network. The categories of response types include: source, transport, response/transport, and response. In general, the stream channel of Rattlesnake Creek within the SMP jurisdiction is a transport type, with two very short segments of equilibrium type (a 0.3 mile and a 0.17 mile segment) found in of Reach 2 (USFS, 1997).

The vast majority of Rattlesnake Creek, within the SMP jurisdiction, consists of response channels. Response channels occur in valleys constructed from alluvial deposition, have well-developed floodplains, have a channel slope of less than or equal to 2%, have a riffle/pool bedform morphology, and are responsive to upstream channel changes (change in input of coarse or fine sediment, change in input of large woody debris, or change in flows). Response channels provide important spawning and rearing habitat for trout and salmon. Equilibrium stream types are the most efficient stream types, exhibit well-developed floodplains, tend to occur in alluvial valleys with low elevational relief, are predominantly riffle/pool streams with a high number of pools, but are very sensitive to disturbance. These channel types generally provide high-quality fish habitat, including resting pools. Channel substrate and floodplain sediments are comprised of a complex mosaic of large cobbles grading to fine silts (Bumping/American Watershed Analysis, 1998).

The majority of the mainstem Rattlesnake Creek and its tributaries function to provide a source of material (coarse and fine sediment, large woody debris) and to transport this material.

No actual sediment or turbidity data has been collected in Rattlesnake Creek, however, during stream surveys qualitative observations regarding streambank stability and fine sediment have been recorded. The only information regarding substrate conditions on the lower Rattlesnake Creek pertained to the uppermost segment of the SMP jurisdiction. Within this segment, many cut banks were noted and identified as significant fine sediment sources. This reach was rated as “properly functioning,” because cobble was the dominant substrate and embeddedness was not recorded. No further information was found providing discussion of substrate conditions throughout the majority of the SMP jurisdiction (USFS, 1997).

Channel stability is thought to be naturally low in the confined reaches of Rattlesnake Creek and is associated with flashy peak flow associated with rain on snow events and rapid snow melt (USFS, 1998). Deposition in Reach 1 and 2 of the SMP jurisdiction is extensive and has been amplified by lateral confinement in Reach 1. Fine sediments are not thought to be a problem with the exception of the Three Creeks area (USFS 2001).

Riparian Habitat

The condition of riparian reserves across the Rattlesnake Creek watershed is highly variable. Within the SMP jurisdiction of lower Rattlesnake Creek, the riparian reserves are rated as "properly functioning" since very little management activity has occurred in the riparian areas (USFS, 1997).

A complex mix of deciduous trees, shrubs, and conifers dominates the riparian community. Reach 1 is an active flood zone and once contained an extensive cottonwood gallery forest interspersed with conifers (Stanford and Snyder 2000 DRAFT). Anthropogenic confinement of intense flood events has led to excessive disturbance processes that have altered riparian community succession and channel stability. Habitat in the lower SMP reach is degraded due to lateral floodplain confinement, irrigation withdrawal, bridge/dike constriction, and channel clearing associated with 1996 flood.

Large Woody Debris

Large woody debris is woody material derived from tree limbs, boles, and roots, in various stages of decay. The production and accumulation of large woody debris is dependent on several factors, including: plant association, successional stage, insect and disease activity, weather events (e.g., relative to blowdown), fire return intervals, decay rates, and vegetative management activities (Graham et al. 1994 in Rattlesnake Creek Watershed Analysis, 1998).

Several segments of Rattlesnake Creek and its tributaries were surveyed for large woody debris (LWD) by the U.S. Forest Service. The inventory protocol identified LWD/mile, streambank armoring, and substrate as evaluation parameters. Large woody debris/mile is a good indicator of habitat quality. (Peterson et al. 1992, Wash. Forest Practices Board, 1993 in USFS, 1998)

The Wenatchee National Forest Plan calls for at least 100 pieces (80% > 12" diameter, 20% > 20" diameter and 50 feet long) of LWD per mile. Rattlesnake Creek, throughout the SMP jurisdiction, does not meet the Forest Plan standard. (USFS, 1998).

Large woody debris is an important input factor for stream channels within forested vegetative types. Large woody debris for streams in the Bumping River watershed is primarily contributed from debris flows. Once LWD is in the channel, it slows water velocities, resulting in fine and coarse sediment sorting and deposition. Therefore, the presence or absence of LWD determines how a channel will respond to inputs of fine and coarse sediment and runoff. (USFS, 1998).

Off-Channel Habitat
Off-channel habitat is important as rearing habitat for juvenile salmonids, and important as refugia during high flows. The SMP jurisdiction of lower Rattlesnake Creek is rated as "properly functioning" due to the amount of available habitat that consists of side channels (Rattlesnake Watershed Plan, 1997).

Water Quality
A very limited amount of water-quality data has been collected in the Rattlesnake Creek watershed. The state water-quality standards that are most applicable to Rattlesnake Creek include fecal coliform, dissolved oxygen, temperature, and turbidity. All surface water in the Rattlesnake Creek watershed must meet the state Class AA Extraordinary standards. Based on these standards, the highest designated beneficial use for the basin is "salmonid spawning and rearing" habitat. Rattlesnake Creek was designated as "water quality limited" by the state Department of Ecology on the 1996 and 1998 lists of impaired waterbodies for exceeding water quality standards for temperature (USFS, 1997).

Monitoring and review of existing data in compliance with the Clean Water Act regulations for non-point source pollution identified anomalous levels of several minor elements (lead, copper, zinc, arsenic, and selenium) in fine-grained sediments. The presence of these minerals were attributed to the high levels of these elements in the volcanic geologic materials in the area. (Fuhrer et al. 1994 in USFS, 1997).

Several monitoring sites for stream water temperature have been measured. Recording thermograph measurements were taken at several sites in the Rattlesnake Creek watershed beginning in 1991. Temperatures in tributaries are meeting the state water quality standard of 61F for most of the summer months, with occasional periods of exceedance in some of the streams. Maximum temperatures in the mainstem of Rattlesnake Creek near the Forest Service boundary have typically exceeded the 61°F for over two weeks of the mid-June through September measurement period. The maximum seven-day average of daily maximum temperatures, which is an indicator of sustained temperatures was established at 58°F in the Wenatchee Forest Plan. This seven-day average was also exceeded in lower Rattlesnake Creek for most of the summer measurement periods (USFS, 1997).

Riparian canopy closure was also assessed to determine the extent of altered stream shading levels in the Bumping River watershed. A significant percentage of the channels in the Rattlesnake Creek watershed has less than 70 percent crown closure. Water temperatures most likely have been only minimal affected by removal of riparian shading due to timber harvest and road locations (USFS, 1997).

High temperatures have been observed in late summer within the SMP jurisdiction reaches. Although numerous studies have noted high temperatures above Forest Service standards (58°F) in Rattlesnake Creek and its tributaries, there is little variation in stream temperatures today when compared to data from 1935 (USFS, 1997).

RATTLESNAKE CREEK SUB-BASIN REACH DESCRIPTIONS

Rattlesnake Creek is divided into two reaches that span the eastern 5-miles of the much larger drainage system (Fig. R5; Table R1). The Rattlesnake Creek SMP jurisdiction is divided into two distinct reaches. Reach delineation was made based on gradient, landforms, and land use. **Reach 1** comprises the lower 0.7 miles of Rattlesnake Creek from its confluence and represents the critical stream intersection with the Naches River. This reach is unstable and exhibits a very active channel migration zone, occupying over 42% of the SMP jurisdiction. Land use has constricted the historic floodplain. A major bridge structure locks the channel in place. Significant deposition occurs above this bridge structure and channel stability is affected below the bridge. This reach is a critical connection with the Naches River system and is used by anadromous and resident fish, including Bull trout. **Reach 2** is a 4.3-mile long, transitional reach that represents the lower end of Rattlesnake Canyon and its entry onto the broader floodplain of the Nile Valley. This reach exhibits a broad floodplain marked by steep canyon walls in the upper portions of the reach that, in places, confine widened alluvial floodplains before moving through an entrenched, meandering canyon and then opens to a broad floodplain at the lower end. The broad floodplains found at both the upper and lower end of the reach add complexity to the entrenched and meandering canyon area. The area upstream of Reach 2 is not included under SMP jurisdiction.

REACH 1

General Description

The Reach 1 SMP jurisdiction extends from the confluence with the Naches River up Rattlesnake Creek for 0.7 miles. Occupying the lower end of the Nile Valley, Reach 1 has been subject to anthropogenic alteration throughout the historic period. Construction of a bridge across this dynamic segment of the creek has proven problematic, and several bridges have been replaced following flood damage. The monumental bridge structure and its associated roadbed that now constrains the stream is a major impediment to normal depositional and channel processes.

ABIOTIC- See Rattlesnake Physical Map and Rattlesnake Physical (Soil Characteristics) Map *(Rattlesnake_Physical.pmf and Rattlesnake_Soil_Characteristics.pmf)*

Geology/Landforms (Table R2)
Reach 1 is located in a structural, synclinal valley related to the Olympic Wallula Lineament (OWL) and the rising anticlines to the south, north, and east of the reach. Glacial processes in the headwaters and a massive mid-basin landslide provide ample sediments that are moved rapidly through the main Rattlesnake Creek Canyon and across the lower floodplain as inputs into the Naches River System. Throughout this reach, the surficial geology is predominately one of alluvium. Approximately 50% of the reach is within the 100 year floodplain.

Soils/Soil Properties (Table R2)
Reach 1 is dominated by alluvium (100%) (Washington State Department of Natural Resources [WDNR], 2000). Silt loam soils, derived from Holocene floodplain processes with loess and volcanic ash additions, dominate within the SMP jurisdiction. Within this reach, 22.2% of the soils are Aquic, a direct reflection of surface and hyporheic flow across and through the floodplain (Yakima County, n.d.c). Soil permeability is primarily rapid throughout the entire SMP jurisdiction, runoff is classed as predominantly slow and the hazard of erosion is rated as generally slight (USDA Natural Resources Conservation Service **[**NRCS], 2003).

Stream Type/Channel Form (Table R3)
Channel form throughout Reach 1 is currently classified as pool-riffle. Channel conditions are extremely degraded. Prior to anthropogenic confinement, this floodplain expressed a braided channel at its junction with the Naches River. This reach was channelized following the 1996 flood as agencies responded to protect private land and rebuild transportation infrastructure. Pools, LWD, and habitat diversity are judged to be poor. The riparian vegetation was removed following the 1996 flood and any LWD was hauled to the mouth of the creek (B.Watson in Haring 2001). In many ways, the spatial extent and configuration of the anthropogenic floodplain does not correspond with the upstream hydrographic and sediment dynamics. Approximately 42.6% of the reach has

been identified as having a high potential for being in the channel migration zone, with another 5.3% having a moderate potential (Yakima County, n.d.b).

Stream Flow
Reach 1 of Rattlesnake Creek exhibits a normative hydrograph that is not influenced by irrigation storage or withdrawals above the reach. However, there is one diversion located within the SMP jurisdiction. Base flow in August and September is approximately 20 cfs. Typical high flows, related to normal snowmelt, are approximately 285 cfs. The hundred-year flood event is expected to reach 9,430 cfs in Reach 1 of the SMP (USFS, 1997).

Hyporheic Flow
Given the high proportion of the SMP jurisdiction and greater floodplain underlain by alluvium and given the unconfined nature of the floodplain through this reach, the hyporheic zone is expected to be extremely widespread. The nature of both the deposits and increasing confinement within this reach suggest hyporheic flow mainly in the form of percolation.

BIOTIC- See Rattlesnake Biological Map *(Rattlesnake Biological.pmf)*

Natural Vegetation (Table R4 and R5)
Upland
Historic vegetation lies within the ponderosa pine association (as designated by ICEMP). Potential vegetation is also the ponderosa pine association. GAP analysis data similarly estimates that the vegetation communities in Reach 1 are dominated by ponderosa pine (78.6%) and oak (21.4%) (WDFW, 2004a).

Riparian
Formerly, riparian vegetation within Reach 1 contained cottonwood, aspen, willow, and a diversity of riparian plants associated with a braided stream courses. Today, riparian vegetation is comprised of both deciduous shrubs and trees interspersed with a coniferous overstory dominated by Douglas fir in the middle stages of succession that covers approximately 55.6% of the reach.

Currently, riparian conditions within Reach 1 are degraded, in the early stages of succession and subject to increased disturbance frequencies, largely the result of confinement associated with the need to protect agricultural and residential development. Considerable channel clearing and straightening occurred in association with the 1996 flood.

Wetlands
Wetlands occupy 27.7% of the SMP jurisdiction (United States Fish and Wildlife Service [USFWS], 2003). An additional 0.4 acres of wetland may be classified as associated wetlands within the final SMP jurisdiction, either intersecting the draft SMP jurisdiction boundary directly or being located in the 100-year floodplain.

Wildlife

Aquatic (Table R6)

Spring chinook, summer steelhead, and bull trout move through and spawn in Reach 1. rainbow trout, brook trout, and sculpin also utilize the habitat provided by this reach (WDFW, 2004c). There are no barriers to fish passage, although low flow and high temperatures have been noted in this reach in late August and September.

Avian

No Wildlife Heritage location exists in the SMP jurisdiction (WDFW, 2003).

Terrestrial (Tables R5 and R7)

GAP analysis data indicates that all of the reach may provide habitat for one species of current concern, namely the Townsend's big-eared bat (WDFW, 2004c). Approximately, 94.0% of the SMP jurisdiction is classified as Priority Habitat for Rocky Mountain elk and 96.8% for mule deer (WDFW, 2004b). These areas are designated because of the critical habitat elements they possess during winter months, providing moderate quality and amounts of winter range, as well as being located in a big game migration corridor.

CULTURAL MODIFICATIONS - See Rattlesnake Cultural Modifications Map *(Rattlesnake_Cultural_Modifications.pmf)*

Land Use (Table R8)

Of the SMP jurisdiction lands within Reach 1, 70.5% remain vacant, and 22.1% is occupied by residential development (Yakima County, 2004a). The Washington State Department of Natural Resources is the dominant public owner of land within the SMP jurisdiction, holding title to 92.5% (WDNR, 2003).

Transportation (Table R10)

Transportation infrastructure covers 7.5% of the SMP jurisdiction, with a total of 0.8 miles of roadway in the SMP. There are no bridge crossings across Reach 1 (Washington State Department of Transportation [WDOT], 2004).

Revetments (Table R10)

There are no revetments found within the SMP jurisdiction of Reach 1.

CULTURAL JURISDICTIONS - See Rattlesnake Cultural Jurisdiction Map *(rattlesnake_cultural_jurisdictional.pmf)*

Zoning (Table R9)
Current zoning within the SMP jurisdiction of Reach 1 is predominantly Remote/Extremely Limited (95.5%) (Yakima County, 2004b). A minor portion of the jurisdiction is zoned Mountain Rural (4.5%), which is represented by a single area of concentrated single-family residences. This latter area is at particular risk of flooding. The entire reach is designated as Conservancy by the current SMP.

Cultural Resources
There are no Archeological Site Form records of cultural sites within the SMP jurisdiction of Reach 1 on file with the Washington State Historic Preservation Office (Washington State Historic Preservation Office [WSHPO], 2004).

DOE Sites/facilities and 303(d) Listings
There are no DOE sites/facilities or 303(d) listed segments noted in the SMP jurisdiction of Reach 1 (Washington Department of Ecology [WDOE], 1998).

ECOLOGICAL FUNCTION SUMMARY

Reach 1 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
High Runoff soils: 19.8% High erosion soils: 19.8% High soil permeability: 72.4% Channel migration: 42.6% 100-Year Floodplain: 50%	Wetlands: 27.7% Vacant/natural: 70.5% Priority habitats: 2 Species of concern: 1 Anadromous habitat: 0.7 mi Total fish species: 6	Public land: 100%	Principal land use: Vacant/natural >10% Imperviousness: 37.9% Roads: 0.8 mi

Ecological functions along Reach 1 are principally impaired by residential development, which covers 22.1% of the jurisdiction. This land use, in addition to the 0.8 miles of roads, account for the majority of the estimated 37.9% of the reach that is greater than 10% impervious. Upland vegetation has been removed and replaced with buildings and lawns, which can promote increased runoff and nonpoint source pollution. Riparian conditions are degraded, in the early stages of succession and subject to increased disturbance frequencies, largely the result of confinement associated with the need to protect agricultural and residential development. Much of the reach is presently undeveloped (70.5%), while 27.7% is covered by wetlands. The reach provides habitat for one species of concern, the Townsend's big-eared bat, as well as two priority habitats

for Rocky Mountain elk and mule deer, and aquatic habitat for six fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES- See Rattlesnake Opportunities for Protection Map *(Opp_Protection.pmf)*

The following list refers to the similarly numbered locations on the digital ecological protection maps for Rattlesnake Creek.

1) Rationale: Existing riparian buffer adjacent to urban area protecting a recognized anadromous spawning habitat. Suggested Action: Work with private landowners to protect riparian buffer.
2) Rationale: Existing riparian buffer adjacent to urban area protecting a recognized anadromous spawning habitat. Suggested Action: Work with private landowners to protect riparian buffer.
3) Rationale: Marginal wetlands protecting a recognized anadromous spawning or rearing habitat. Suggested Action: Work with landowners to protect wetlands.

ECOLOGICAL RESTORATION OPPORTUNITIES- See Rattlesnake Opportunities for Restoration Map *(Opp_Restoration.pmf)*

The following list refers to the similarly numbered locations on the digital ecological restoration maps for Rattlesnake Creek.

1) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing area in a residential area. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion, runoff control and reduced application of pollutants.
2) Rationale: Marginal riparian buffer protecting an anadromous spawning or rearing area in a residential area. Suggested Action: Work with private landowners to establish a larger riparian buffer and provide education regarding erosion, runoff control and reduced application of pollutants.

REACH 2

General Description

Reach 2 is a 4.3-mile long, transitional reach that represents the lower end of Rattlesnake Canyon and its entry onto the broader floodplain of the Nile Valley. This reach exhibits a broad floodplain marked by steep canyon walls in the upper portions of the reach that, in places, confine widened alluvial floodplains before moving through an entrenched, meandering canyon and before opening to a broad floodplain at the lower end. The Little Rattlesnake Creek joins Rattlesnake Creek at the lower end of Reach 2.

This reach functions as a critical connection between upper-Rattlesnake Creek Basin and Little Rattlesnake Creek and the Naches River Basin and is used by anadromous and resident fish, including Bull Trout.

ABIOTIC- See Rattlesnake Physical Map and Rattlesnake Physical (Soil Characteristics) Map *(Rattlesnake_Physical.pmf and Rattlesnake_Soil_Characteristics.pmf)*

Geology/Landforms (Table R2)

Reach 2 is in a canyon setting that is structurally related to the Olympic Wallula Lineament (OWL) and the rising anticlines to the south, north, and east. Grand Ronde Basalt flows dominate the landscape south of the reach while the rising topography to the north is a complex mixture of Grand Ronde Basalt and older Cascade-derived sedimentary tuffs, breccias, pumice and lava flows derived from lahars, debris flows and fluvial slurries. The basalts are younger than the Cascade-derived materials and the basalt is more competent rock, resulting in massive landslides in the middle basin and along the canyon slopes. Although most of these valley walls lie just outside the SMP jurisdiction, their influence on the shape and hill slope processes of the reach are significant landscape features.

The SMP Jurisdiction of Reach 2 is dominated by two distinct floodplain landforms set apart by an entrenched canyon. Steep valley walls, even when the floodplain approaches 1,000 feet in width, bound the majority of the reach. Glacial processes in the headwaters and a massive mid-basin landslide provide ample sediments that are moved rapidly through the main Rattlesnake Creek Canyon. The two, broad-floodplain areas in Reach 2 act as sediment storage areas, while the middle canyon area serves as a transport reach. Approximately 35.2% of the reach is within the 100 year floodplain.

Minimal anthropogenic influences occur in the reach with the exception of the stream junction with Little Rattlesnake Creek, where issues of entrenchment have been raised related to road construction and channel clearing (Haring 2001).

Geological hazard within Reach 2 are from rain-on-snow event flooding and from over-steepened slopes.

Soils/Soil Properties (Table R2)
Reach 2 is dominated (75.4%) by alluvial deposits (WDNR, 2000). Silt loams dominate soils within the SMP jurisdiction, however, soils vary significantly with respect to slope. Within this reach, 70.9% of the soils are Aquic, a direct reflection of stream a hyporheic flow across and through much of the floodplain (Yakima County, n.d.c). Soil permeability is primarily very rapid and rapid, runoff is classed as primarily slow and the hazard of erosion is rated as slight (NRCS, 2003).

Stream Type/Channel Form (Table R3)
Channel form throughout Reach 2 is currently classified as pool-riffle. Channel conditions, with one major exception, are properly functioning (USFS, 1997). The area from the intersection of Little Rattlesnake Creek downstream was channelized following the 1996 flood as agencies responded to protect private land and rebuild transportation infrastructure. This portion of the reach is degraded with respect to pool habitat, LWD, and habitat diversity. The riparian vegetation was removed following the 1996 flood and any LWD was hauled to the mouth of the creek (B.Watson in Haring 2001). Above the stream junction with the Little Rattlesnake a pool-riffle channel type predominates. Questions have been raised about pool depth and frequency changes over the last 60 years (USFS, 1997), but Reach 2 is considered to be properly functioning with respect to pools, LWD, and habitat diversity above the Little Rattlesnake.
Approximately 5.8% of the reach has been identified as having a high potential for being in the channel migration zone (Yakima County, n.d.b).

Stream Flow
Reach 2 of Rattlesnake Creek exhibits a normative hydrograph that is not influenced by irrigation storage or withdrawals above or within the reach. Base flow in August and September is approximately 20 cfs. Typical high flows, related to normal snowmelt, are approximately 285 cfs. The hundred-year flood event is expected to reach 9,430 cfs in Reach 2 of the SMP (USFS, 1997).

Hyporheic Flow
Given the high proportion of the SMP jurisdiction and greater floodplain underlain by alluvium and given the unconfined nature of the floodplain through this reach, the hyporheic zone is expected to be extremely widespread. The nature of both the deposits and increasing confinement within this reach suggest hyporheic flow mainly in the form of percolation.

BIOTIC- See Rattlesnake Biological Map *(Rattlesnake Biological.pmf)*

Natural Vegetation (Table R4 and R5)

Upland

Historic vegetation lies within the ponderosa pine association (as designated by ICEMP). Potential vegetation is also ponderosa pine association. GAP analysis data also indicates that the vegetation community in Reach 2 is entirely dominated by ponderosa pine vegetation (WDFW, 2004a)

Riparian

Reach 2 riparian vegetation is judged to be in good condition above the Little Rattlesnake stream intersection. The riparian zone contains cottonwood, aspen, willow, and a diversity of riparian plants associated with the broad floodplain areas and becomes a very narrow band in the mid-reach canyon section. Conifers are present in the riparian zone and play a major role in supplying LWD to Reach 2. At and below the confluence of Little Rattlesnake Creek, riparian vegetation is degraded due to confinement and channel clearing activity. Head-cutting and entrenchment in the Little Rattlesnake has been identified as a problem (Haring 2001). Yakima County riparian data does not cover the SMP jurisdiction; however, other estimates of riparian vegetation range between 18.8% (USFS, 2003) and 20.3% (WDFW, 2004b). Examination of air photography for the reach suggests the WDFW measurements to be a conservative estimate.

Wetlands

Wetlands occupy 26.3% of the SMP jurisdiction (USFS, 2003). An additional 4.4 acres of wetland may be classified as associated wetlands within the final SMP jurisdiction, either intersecting the draft SMP jurisdiction boundary directly or being located in the 100-year floodplain.

Wildlife

Aquatic (Table R6)

Spring chinook, summer steelhead, and bull trout move through and spawn in Reach 2. rainbow trout, brook trout, and sculpin also utilize the habitat provided by this reach (WDFW, 2004c). There are no barriers to fish passage.

Avian

No Wildlife Heritage location exists in the SMP jurisdiction (WDFW, 2003).

Terrestrial (Tables R5 and R7)

GAP analysis data indicates that all of the reach may provide habitat for one species of current concern, namely the Townsend's big-eared bat (WDFW, 2004a). In addition, approximately 60.2% of the SMP jurisdiction is classified and Priority Habitat for Rocky Mountain elk and 60.2% for mule deer (WDFW, 2004b). These areas are designated because of the critical habitat elements they possess during winter months, providing moderate quality and amounts of winter range, as well as being located in a big game migration corridor.

CULTURAL MODIFICATIONS - See Rattlesnake Cultural Modifications Map ***(Rattlesnake_Cultural_Modifications.pmf)***

Land Use (Table R8)
Of the SMP jurisdiction lands along Reach 2, 98.9% remain vacant (Yakima County, 2004a). The Washington State Department of Natural Resources and the Washington Department of Fish and Wildlife are the public owners of land within the SMP jurisdiction, holding title to 20.4% and 44.3%, respectively (WDNR, 2003).

Transportation (Table R10)
Transportation infrastructure covers 0.5% of the SMP with a total of 0.2 miles of roadway in the SMP.

Revetments (Table R10)
There are no revetments found within the SMP jurisdiction of Reach 2.

CULTURAL JURISDICTIONS - See Rattlesnake Cultural Jurisdiction Map ***(rattlesnake_cultural_jurisdictional.pmf)***

Zoning (Table R9)
Current zoning within the SMP jurisdiction of Reach 2 is predominantly Forested Watershed (85.2%) and Remote/Extremely Limited (14.8%)(Yakima County, 2004b). Approximately 100% of the reach is designated as Conservancy by the current SMP.

Cultural Resources
There are no Archeological Site Form records of cultural sites within the SMP jurisdiction of Reach 2 on file with the Washington State Historic Preservation Office (WSHPO, 2004.).

DOE Sites/facilities and 303(d) Listings
One 303(d)-listed stream segment is found in the SMP jurisdiction of Reach 2 totaling 0.9 miles in length: excursions for high temperatures in late summer (WDOE, 1998). This listing does not appear to be the result of anthropogenic changes to the watershed (Lindhorst in Haring 2001).

ECOLOGICAL FUNCTION SUMMARY

Reach 2 Characterization Summary

Hazard Potential	Habitat Conditions	Public Access	Key Modifications
Steep Slopes: 23.7% High erosion soils: 15.8% High soil permeability: 64.4% Channel migration: 5.8% 100-Year Floodplain: 35.2%	Wetlands: 26.3% Vacant/natural: 98.9% Priority habitats: 3 Species of concern: 1 Anadromous habitat: 4.3 mi Total fish species: 6	Public land: 100%	Principal land use: Vacant/natural >10% Imperviousness: 1.7% Roads: 0.2 mi

Ecological functions along Reach 2 are principally impaired by industrial and residential development, which covers only 1.1% of the jurisdiction. These land uses, in addition to the 0.2 miles of roads, account for the majority of the estimated 1.7% of the reach that is greater than 10% impervious. There is one 0.9 mile 303(d)-listed stream segment found in the SMP jurisdiction and no DOE sites/facilities. Much of the reach is presently undeveloped (98.9%), while 26.3% is covered by wetlands. Riparian vegetation is judged to be in good condition above the Little Rattlesnake stream intersection, and degraded at and below the confluence, largely due to confinement and channel clearing activity. Conifers are present in the riparian zone and play a major role in supplying LWD. While Yakima County riparian data does not cover the SMP jurisdiction, other conservative estimates of riparian vegetation range between 18.8% and 20.3%. The reach provides habitat for one species of concern, the Townsend's big-eared bat, as well as three priority habitats and aquatic habitat for six fish species, including anadromous fish.

ECOLOGICAL PROTECTION OPPORTUNITIES- See Rattlesnake Opportunity for Protection Map *(Opp_Protection.pmf)*

The following list refers to the similarly numbered locations on the digital ecological protection maps for Rattlesnake Creek.

1) Rationale: Existing riparian buffer of natural vegetation on privately owned land protecting a recognized anadromous spawning habitat. Suggested Action: Work with private landowner to protect riparian buffer.
2) Rationale: Existing riparian buffer of natural vegetation on privately owned land protecting a recognized anadromous spawning habitat in an area with high soil erosion potential. Suggested Action: Work with private landowner to protect riparian buffer.
3) Rationale: Existing wetlands protecting a recognized anadromous spawning habitat. Suggested Action: Work with landowner to protect wetlands.
4) Rationale: Existing riparian buffer of natural vegetation on privately-owned land protecting a recognized anadromous spawning habitat in an area with high soil

erosion potential. Suggested Action: Work with private landowner to protect riparian buffer.

ECOLOGICAL RESTORATION OPPORTUNITIES- See Rattlesnake Opportunity for Restoration Map *(Opp_Restoration.pmf)*

The following list refers to the similarly numbered locations on the digital ecological restoration maps for Rattlesnake Creek

1) Rationale: 303d conditions reported within stream. Suggested Action: Mitigate 303d conditions.

APPENDIX

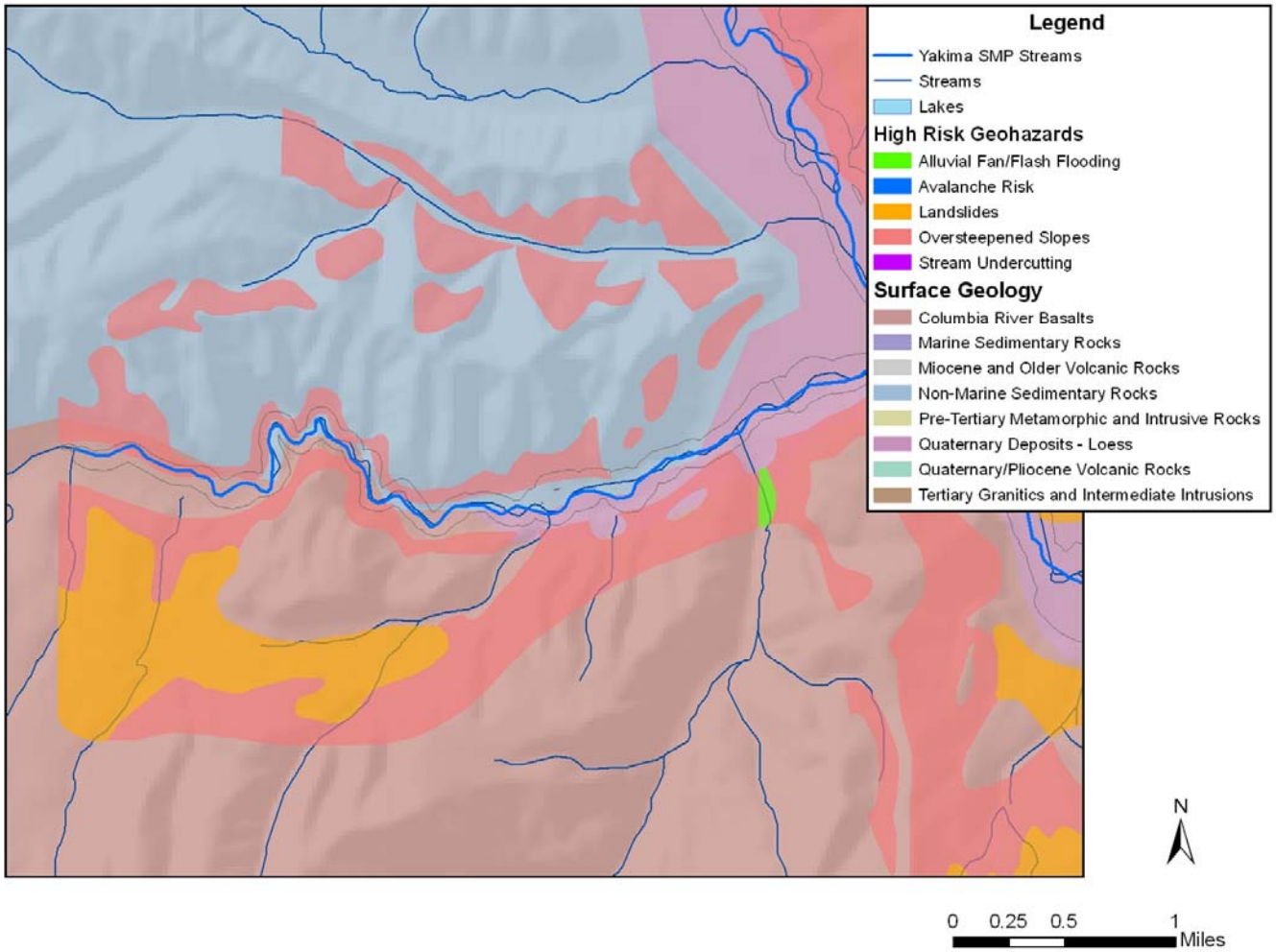

Figure R1. Geology and Geohazards in the Rattlesnake Creek Sub-basin.

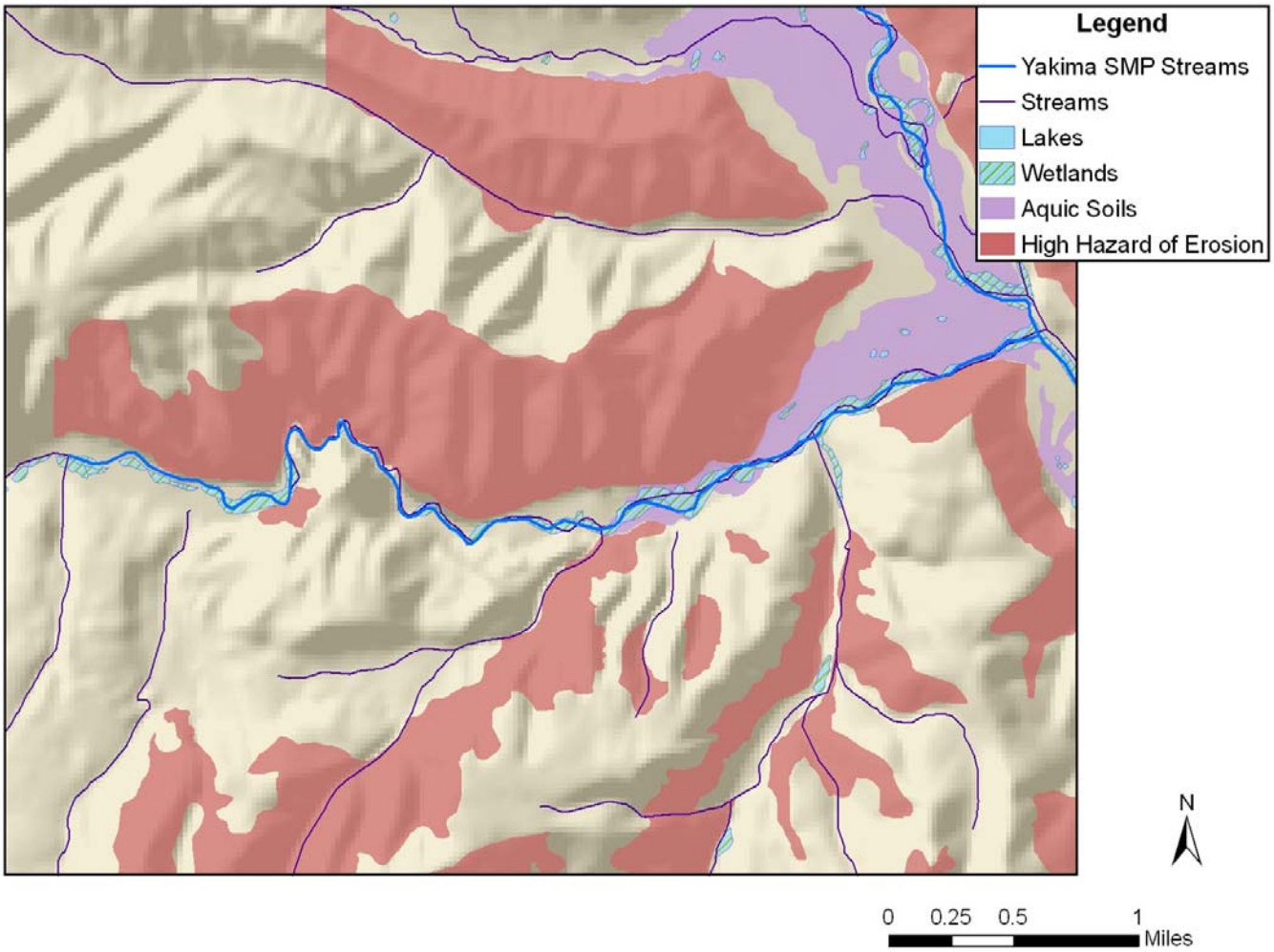

Figure R2. Wetlands and Soil Characteristics in the Rattlesnake Creek Sub-basin.

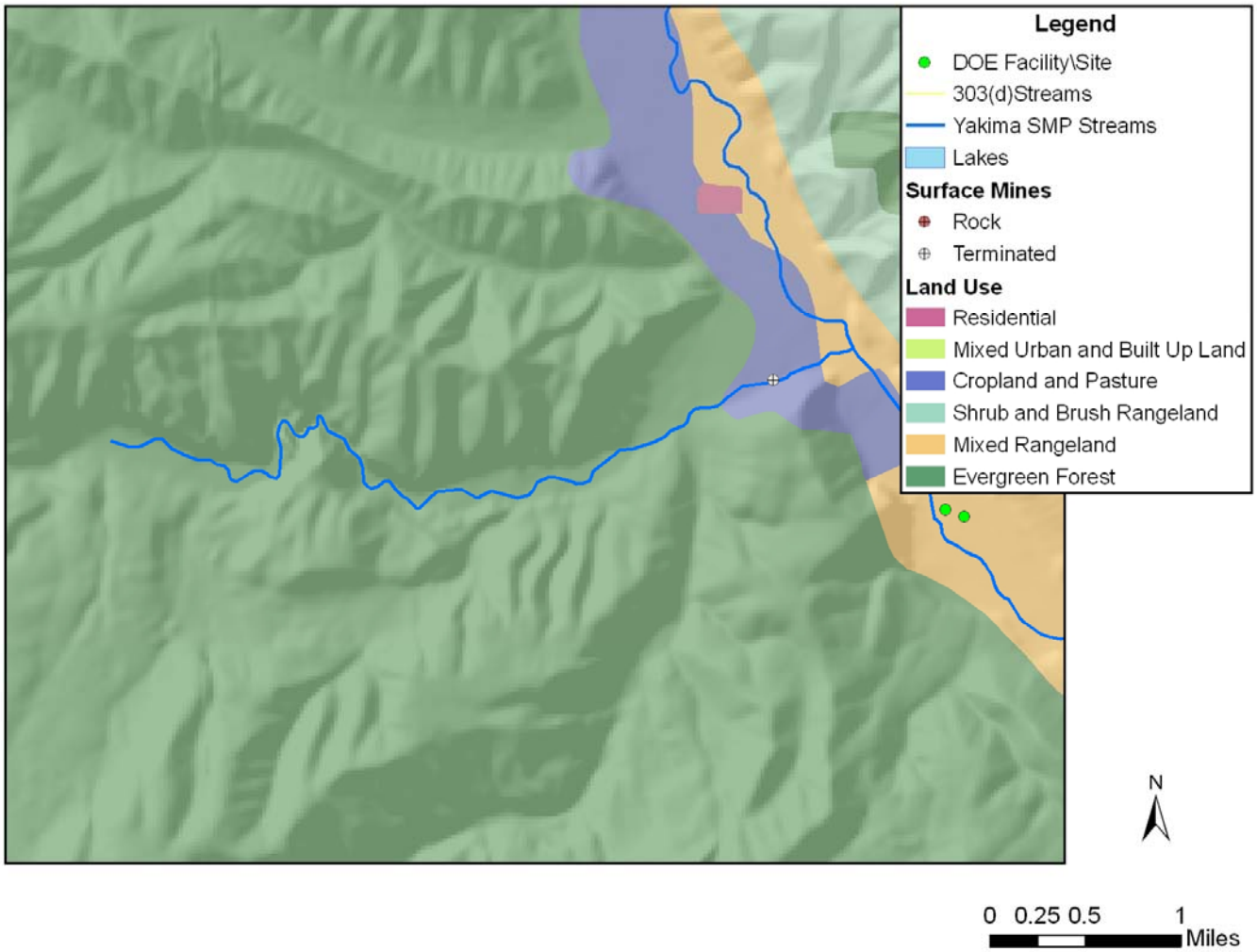

Figure R3. Cultural Modifications in the Rattlesnake Creek Sub-basin.

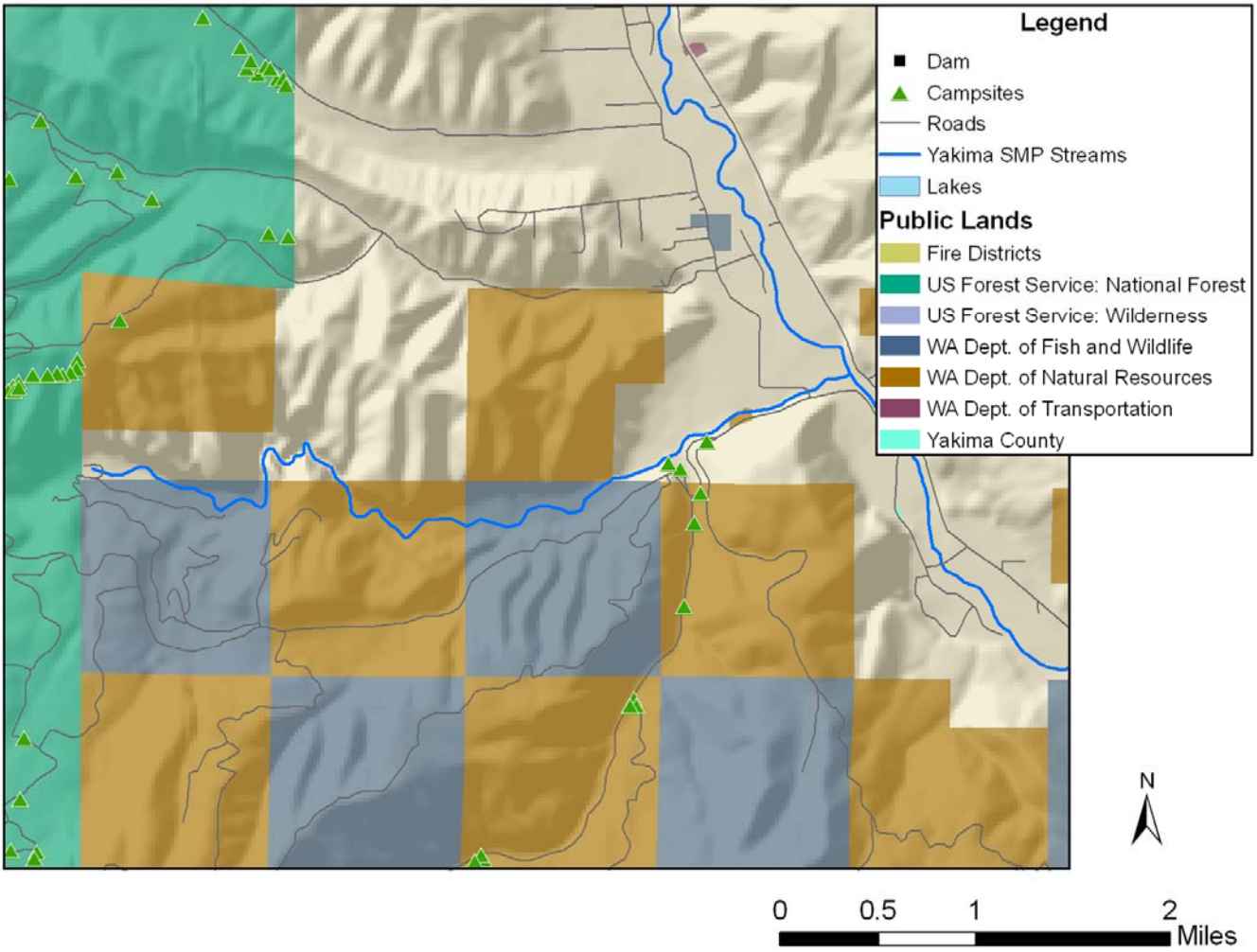

Figure R4. Public Resources and Access in the Rattlesnake Creek Sub-basin.

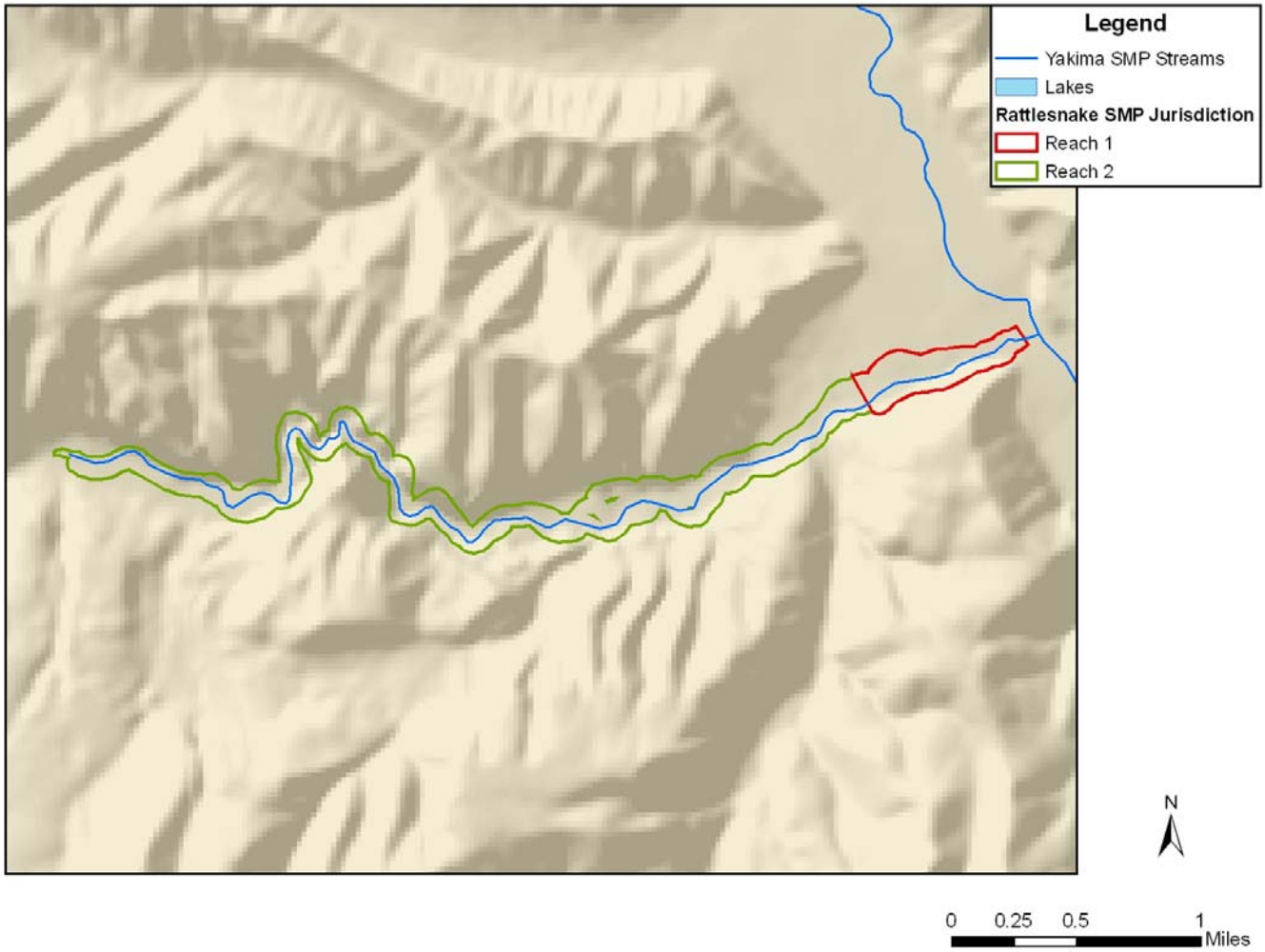

Figure R5. SMP Jurisdiction Breaks for the Rattlesnake Creek Sub-basin.

Table R1. SMP Reach Breaks for Inventory Analysis, Rattlesnake Creek Sub-basin.

Reach	Length	Start	Reach Break Justification	End
1	0.70 Miles	SE¼, NE¼, S3, T15N, R15E	Geomorphic: Confluence with Naches. Floodplain widens throughout short section near confluence with Naches. Landuse: Changes from evergreen forest to cropland and pasture. Small farms and agricultural use on flat floodplain.	NE¼, SW¼, S3, T15N, R15E
2	0.01 Miles	NE¼, SW¼, S3, T15N, R15E	Land use: Changes from forest to cropland and pasture	SW¼, SW¼, S6, T15N, R15E

Table R2. Geology, Geohazards, and Soil Characteristics for Rattlesnake Creek.

	Geology		Geohazard		Soil Characteristics						Aquic
REACH											Soils
	Lithology	Area	Geohazard	Area	Permeability	Area	Runoff	Area	Hazard of Erosion	Area	Area
		(%)		(%)		(%)		(%)		(%)	(%)
1	Alluvium	100.0	No Data	No Data	moderate	19.8	medium	0.6	high	19.8	70.9
			100-Year Floodplain	50.1	moderately rapid	7.1	rapid	19.8	moderate	0.6	
Area: 63.8 Acres					moderately slow	0.6	slow	79.6	slight	79.6	
					rapid	72.4					
2	Alluvium	75.4	Oversteepened Slopes (Intermediate Risk)	2.7	moderate	0.6	medium	19.0	high	15.8	22.2
	Basalt Flows	20.2	Oversteepened Slopes (High Risk)	21.0	moderately rapid	4.0	slow	68.4	moderate	3.2	
Area: 310.3 Acres	Continental Sedimentary Deposits or Rocks	4.4	100-Year Floodplain	35.2	moderately slow	18.4	N/A	12.6	slight	68.4	
					rapid	22.3			N/A	12.6	
					very rapid	42.1					
					N/A	12.6					

Table R3. Stream Channel Characteristics for Rattlesnake Creek.

REACH	Stream Lengths		Channel Migration	
	Total Streams (Miles)	**SMP Stream (Miles)**	**Potential**	**Area (%)**
1 Area: 63.8 Acres Length: 0.70 Miles	0.7	0.7	high moderate	42.6 5.3
2 Area: 310.3 Acres Length: 4.3 Miles	4.5	4.3	high	5.8

Table R4.Habitat Characteristics for Rattlesnake Creek.

REACH	Wetlands Area (%)	Riparian Areas Area (%)
1 Area: 63.8 Acres	27.7	No Data
2 Area: 310.3 Acres	26.3	No Data

Table R5. Ecological Characteristics for Rattlesnake Creek.

REACH	Priority Species & Habitats		Barriers		Forest Type/Series		Successional Stage	
	Habitat	Area (%)	Type	Species Blocked	Plant Series	Area (%)	Forest Type Stage	Area (%)
1 Area: 63.8 Acres	Elk Mule and Black-Tailed Deer	94.0 96.8	N/A	N/A	Doug Fir Riparian Rural / AG	55.6 10.7 33.7	Douglas Fir - Mid	55.6
2 Area: 310.3 Acres	Elk Mule and Black-Tailed Deer Riparian Zones	60.2 60.2 20.3	N/A	N/A	Douglas Fir Riparian Rock	71.9 18.8 9.2	Douglas Fir - Mid Douglas Fir - Late	11.7 60.2

Table R6. Fish Characteristics for Rattlesnake Creek.

REACH	Anadromous Fish						Bulltrout		Resident Fish	
	Presence		Spawning		Rearing					
	Species	Length (Miles)	Species	Length (Miles)	Species	Length (Miles)	Presence	Length (Miles)	Species	Length (Miles)
1 Length: 0.7 Miles	Spring Chinook Summer Steelhead	0.7 0.7	Spring Chinook Summer Steelhead	0.7 0.7	N/A	N/A	Currently Occupied	0.7	Eastern Brook Trout Rainbow Trout Sculpin	0.7 0.7 0.7
2 Length: 4.3 Miles	Spring Chinook Summer Steelhead	4.3 4.3	Spring Chinook Summer Steelhead	4.3 4.3	N/A	N/A	Currently Occupied	4.3	Eastern Brook Trout Rainbow Trout Sculpin	4.3 4.3 4.3

Table R7. GAP Analysis of SMP Jurisdiction for Rattlesnake Creek.

REACH	GAP Analysis			
	Mammals		Vegetation	
	Type	Area (%)	Type	Area (%)
1 Area: 63.8 Acres	Townsend's Big-Eared Bat	100.0	Oak Ponderosa Pine	21.4 78.6
2 Area: 310.3 Acres	Townsend's Big-Eared Bat	100.0	Ponderosa Pine	100.0

Table R8. Land-use Characteristics for Rattlesnake Creek.

REACH	Land Use		Land Use Type on Rapid Runoff Soil		Impervious Surface	
	Type	**Area (%)**	**Type**	**Area (%)**	**Range**	**Area (%)**
1	Industrial - Transportation	7.5	Industrial - Transportation	3.1	0	62.2
	Residential - Single Family	22.1	Residential - Single Family	22.1	1-10	0.0
Area: 63.8 Acres	Vacant/Natural	70.5	Vacant/Natural	47.2	11-25	30.4
					26-50	0.0
					51-75	0.0
					76+	7.5
2	Industrial - Transportation	0.5	Vacant/Natural	36.5	0	98.0
	Residential - Single Family	0.6			1-10	0.4
Area: 310.3 Acres	Vacant/Natural	98.9			11-25	1.2
					26-50	0.0
					51-75	0.0
					76+	0.5

Table R9. Cultural Jurisdiction Characteristics for Rattlesnake Creek.

REACH	Zoning		Public Land Ownership		Environmental Designation (1981)	
	Type	Area (%)	Owner	Area (%)	Designation	Area (%)
1 Area: 63.8 Acres	Mountain Rural	4.5	Not Identified	7.5	Conservancy	100.0
	Remote/Extremely Limited	95.5	WA Dept. of Natural Resources	92.5		
2 Area: 310.3 Acres	Forested Watershed	85.2	Not Identified	35.3	Conservancy	100.0
	Remote/Extremely Limited	14.8	WA Dept. of Fish and Wildlife	44.3		
			WA Dept. of Natural Resources	20.4		

Table R10. Transportation Characteristics for Rattlesnake Creek.

REACH	Length of Revetments		Total Road Length (Miles)	Length of Railroads		Bridge Crossing (#)
	Type	Length (Miles)		Active (Miles)	Abandoned (Miles)	
1 Length: 0.7 Miles	N/A	0.0	0.8	0.0	0.0	0
2 Length:4.3 Miles	N/A	0.0	0.2	0.0	0.0	0