

Draft Rock Creek Subbasin Summary

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Northwest Power Planning Council

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DRAFT: This document has not yet been reviewed or approved by the Northwest Power Planning Council

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Rock Creek Subbasin Summary

FISH AND WILDLIFE RESOURCES

Subbasin Description

General Location

Rock Creek Subbasin consists of several small watersheds and encompasses an area of 223.2 sq. miles (578.1 sq. km) in southeastern Washington. Rock Creek drains into the Columbia River about 12 miles upstream of John Day Lock and Dam (Figure 1).

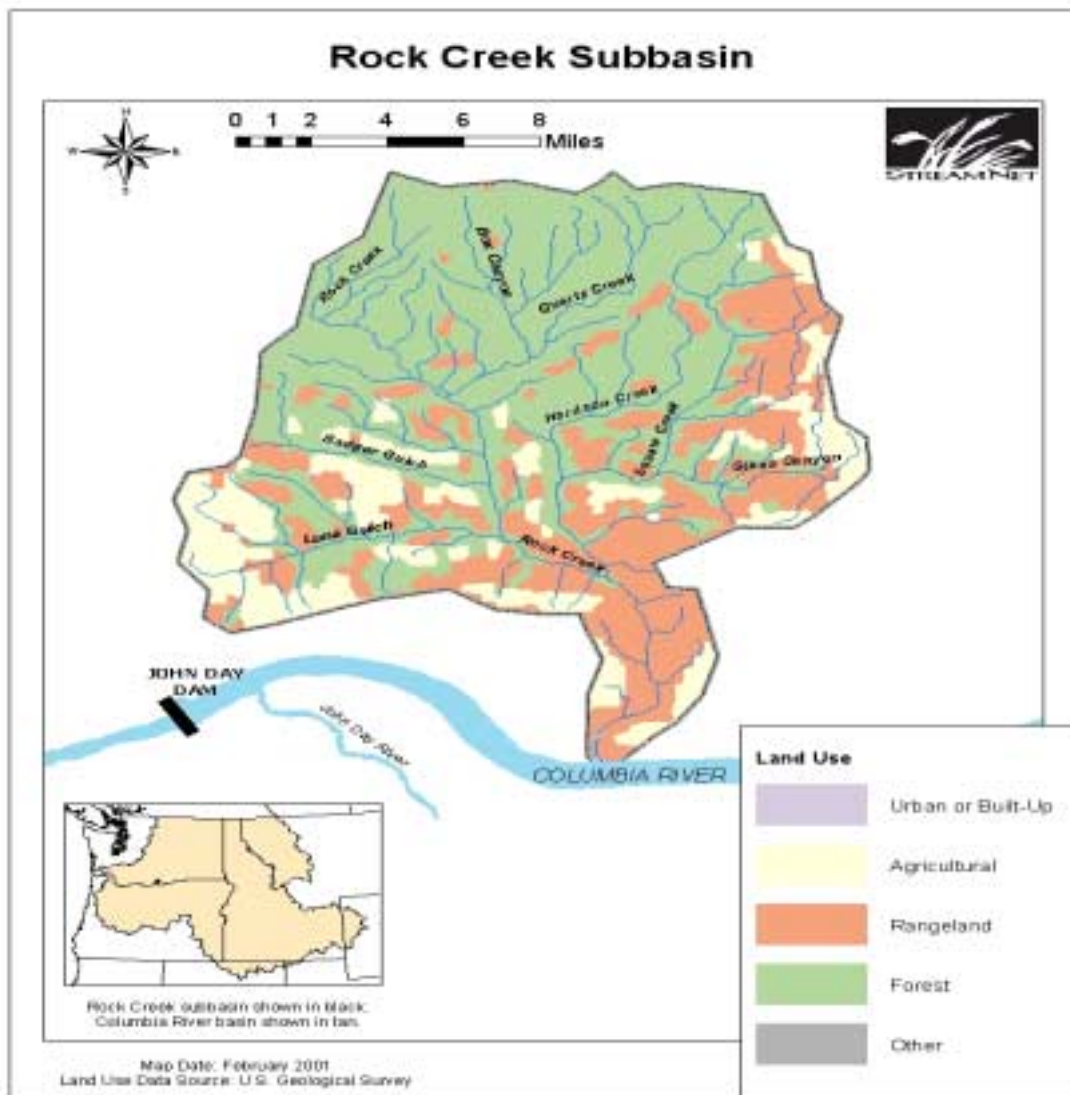


Figure 1. Location of Rock Creek subbasin, major streams and land use

Drainage Area

The drainages in the Rock Creek subbasin originate in the Simcoe Mountains along Bickleton Ridge, which forms the northern boundary of the subbasin and the southern boundary of the Yakama Indian Reservation. Most of the streams flow in a southerly to southeasterly direction to Lake Umatilla, the portion of the Columbia River impounded by the John Day Lock and Dam. The major streams include Badger Gulch, Harrison, Luna Gulch, Quartz and Squaw creeks as well as Rock Creek.

Climate

Climate over the entire subbasin is typical of the continental climate that occurs on the east side of the Cascades. Average daily temperatures range from 70° F in the summer with maximums commonly above 90° F and 37° F in the winter (Lautz 2000).. Annual precipitation ranges from 35 inches in the headwaters of Rock Creek to less than 10 inches in the southern half of the subbasin (Kresch 1998). Generally, about 75-85% of this precipitation occurs between November and May.

Geology/Topography/Soil

The geology of the subbasin is dominated by extensive basalt flows having a total thickness of up to 5000 feet. The basalt in these flows erupted between 14 and 15.5 million years ago, forming fissures along the Snake River where Washington, Oregon, and Idaho join (WDNR 1998). The erosion-resistant nature of these flows resulted in the creation of deep (500 to 800 feet) steep-walled canyons with ragged outcrops and in severely constrained floodplain development along substantial portions of the streams within this subbasin (Lautz 2000).

Often the period between eruptions was long enough to allow development of lakes and streams on the down-warping basalt surface. These bodies of water deposited layers of sand, silt, clay, and volcanic ash forming sedimentary beds between some of the basalt flows. Also present are a variety of forbs indicative of lithic soils (continuous, shallow soils, usually bedrock). Sediment beds form local aquifers and are seen on the hillsides as light colored bands of soil, or bands of trees and brush running along the open grassy slopes.

According to the Salmon and Steelhead Habitat Limiting Factors for Water Resource Inventory Area 31: The streams in this subbasin appear to have similar geomorphic characteristics. Headwater tributaries flow out of the mountains and across the relatively flat basalt plateau at gradients of generally less than 1 %. This area is above known anadromous use. Coming off the plateau, streams enter steep-walled canyons where gradients increase to 2-4% or more (Lautz 2000).

In steep-walled canyons, substrate is characterized by a mix of cobbles and boulders. Little suitable spawning gravel occurs (Lautz 2000), and rearing areas (pools) are minimal in extent and quality and are limited to protected areas behind boulders and along stream margins. Below the canyon reaches, streams enter alluvial valleys; gradients range between 1% and 2% near the upper end, diminishing to less than 1% as streams approach the Columbia River (Lautz 2000). Substrate is variable, with particle sizes ranging from cobble to silt. Near the mouth of Rock Creek, flatlands that existed along the Columbia before inundation have formed shallow wetlands and embayments that now serve as holding or resting areas for migrating adults and juveniles.

Elevations range from 200 feet at the confluence of Rock Creek and the Columbia River to 4,721 feet at Lone Pine Butte.

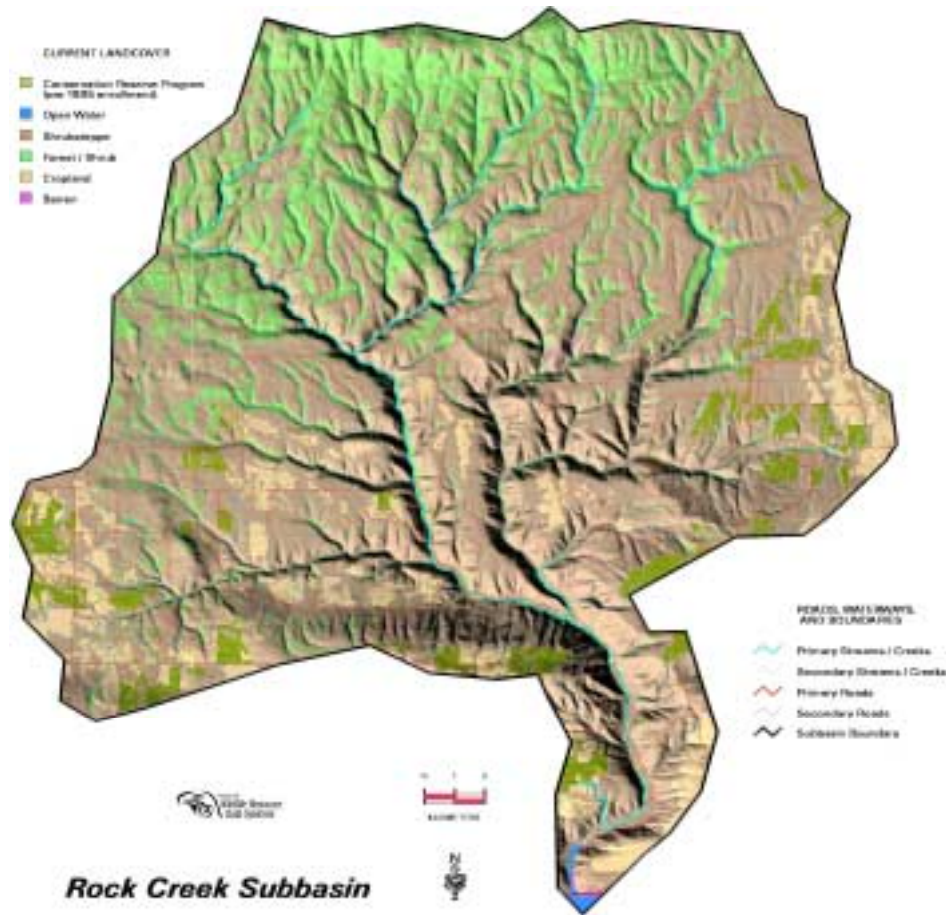


Figure 2. Current landcover in the Rock Creek subbasin

Vegetation

The subbasin lies within a vegetation zone in transition from arid shrub-steppe to the south and forest vegetation to the north. Within the zone, there is a mosaic of meadow-steppe communities and forest communities dominated by Oregon white oak and ponderosa pine (WDNR 1998). The forest communities are generally found on north-facing slopes and in riparian zones, while the steppe communities populate drier areas. The meadow steppe communities also occupy drier areas in the subbasin. Bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg's bluegrass (*Poa suandbergii*) generally dominate this plant community type (WDNR 1998). Also present are a variety of forbs indicative of lithic soils. In the south central Klickitat area, heavily grazed stands are dominated by cheatgrass (*Bromus tectorum*), gray rabbitbrush (*Chrysothamnus nauseosus*), broom snakeweed (*Gutierrezia sarothrae*), and/or lupines (*Lupinus sp.*).



Figure 3. Historic landcover in the Rock Creek subbasin.

In headwaters, land cover is primarily coniferous forest. (This area is mostly above known anadromous fish use, although rainbow trout and non-salmonids such as dace use available fish habitat.) Coming off the plateau, land cover is conifer forest or mixed conifer-deciduous forest in the vicinity of streams, transitioning to shrub-steppe in the uplands. Below the canyon reaches, land cover is primarily shrub-steppe in the uplands, with riparian areas transitioning downstream from mixed conifer-deciduous forest to deciduous forest to shrub-grassland.

The riparian zones are made up of primarily the white alder plant community. The subbasin contains some of the few known high-quality occurrences of the white alder community type within Washington, where it is limited to riparian zones in the eastern portion of the state. Most of the riparian zone community has an overstory of Oregon white oak (*Quercus garryana*), bigleaf maple (*Acer macrophyllum*), white alder (*Alnus rhombifolia*), black cottonwood (*Populus trichocarpa*), and water birch (*Betula occidentalis*), while shrubs are dense in places and include mock orange (*Philadelphus lewisii*), ocean spray (*Holodiscus discolor*), currant (*Ribes aureum*), and occasionally willow (*Salix sp.*) (WDNR 1998).

Hydrology and Geomorphology

From the mountain headwaters across the relatively flat basalt plateau, channels are moderately confined to unconfined (although there may be locally confined reaches caused by channel incision).

As streams enter steep-walled canyons, channels become highly confined. Fish habitat quality is generally fair to poor, due mostly or entirely to the higher stream power in these reaches (Lautz 2000). The subbasin contains a number of springs or seeps including some located in small depressions close to stream channels in the bottom of canyons. In the alluvial valleys below the canyon reaches, channels are moderately confined to unconfined (although there may be locally confined reaches caused by channel incision).

No flow regulation occurs within the subbasin. Some minor diversions occur for irrigation and stock watering. The streams in this subbasin are considered “flashy” (i.e. flows rise and fall rapidly in response to precipitation and/or snowmelt) in the canyon and alluvial reaches. It is likely that road construction in the headwaters has increased drainage density and intensified any natural flashiness. Degradation in riparian areas and wetlands has also likely decreased retention capacity. These impacts are most likely to have altered the natural regimen. Streamflow data is very limited for the Rock Creek subbasin. The USGS maintained a gage near Roosevelt, WA (Gage # 14036600) for water years (WY; October 1 through September 30) 1963-1968. Mean streamflow over the period of record was 45.8 cfs. The maximum mean annual discharge was 113 cfs and occurred in water year 1965, which encompassed the Christmas floods of 1964 when Rock Creek peaked at 4800 cfs on December 22 and 23. The minimum mean annual flow of 25 cfs occurred during water year 1964. However, annual and even monthly streamflow values (Figure 4) do not adequately communicate the seasonally episodic flow distribution pattern. Much of the runoff generally occurred in two or three discrete events while the gage station was dry an average of 77 days per year, ranging from 40 days for WY 1965 to 109 days for WY 1964 (Figure 5).

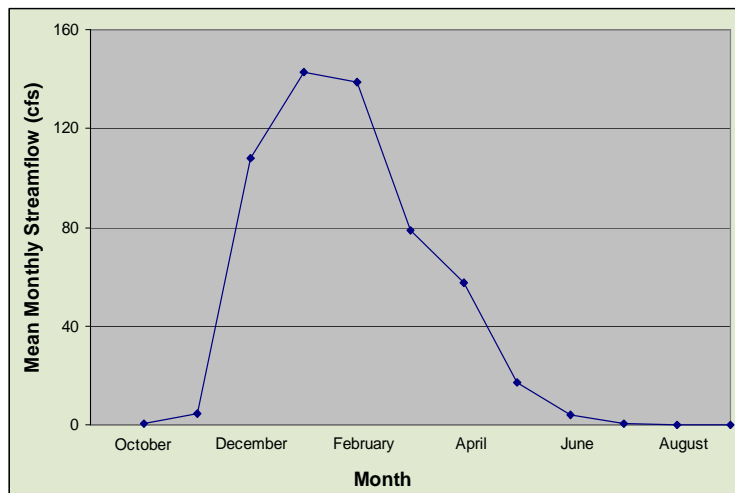


Figure 4. Mean monthly streamflow for Rock Cr. at USGS gage 14036600 (near the mouth at Roosevelt, WA) for entire period of record (Oct. 1962 – Sept. 1968)

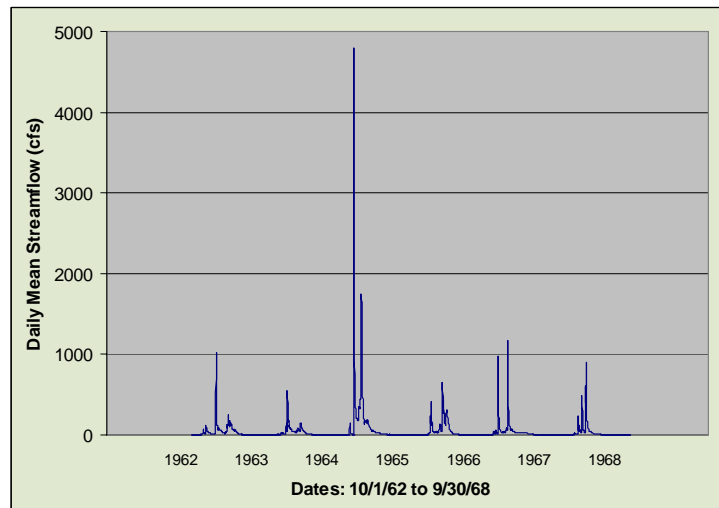


Figure 5. Daily mean streamflows for Rock Cr. at USGS gage14036600 (near the mouth at Roosevelt, WA) for entire period of record (Oct. 1962 – Sept. 1968)

Major flood events occur when winter rains (or rain-on-snow) falls on frozen soils. Flood damage to channels and riparian areas from such a storm in early 1996 is evident. Below the plateau, upland soils are thin and rocky; relatively narrow floodplain areas limit storage of runoff during the winter for later release in the summer. These landscape factors, combined with the virtual lack of precipitation from July through September, cause summer flows to go subsurface in some portions of the stream network. This situation is exacerbated in areas where channel widening has occurred, channel downcutting is taking place or flow is distributed over several smaller, shallower channels. Channel dewatering has obvious impacts to fish, including reduction in juvenile mobility, limiting or precluding access for spawning, and mortality due to stranding.

Water Quality

All streams in this subbasin are classified as Class A streams, that is, overall excellent water quality for human consumption, but not necessarily for aquatic life. High water temperatures recorded during the summer have been identified as a water quality-limiting factor.

Rock Creek was identified as a candidate for the state 303(d) (water quality impaired) list for temperature based on multiple excursions of the standard (18° C/64.4° F) measured in 1990 and 1991 (WDOE 1998). Further monitoring and stream survey work indicated that while stream temperatures may be naturally high during summer months, human activities in the upper and lower areas appear to be contributing to the high temperatures.

Based on this assessment, the Washington State Department of Ecology and Eastern Klickitat Conservation District signed a memorandum of agreement on July 9, 1996, excluding Rock Creek from the Clean Water Act Section 303(d) listing, subject to certain conditions (see Existing and Past Efforts).

Based on temperature data through 1997, exceedances of the standard at higher elevations (plateau and upper canyon reaches) appear to be relatively minor and of short duration. Some thermal stressing of juvenile salmonids may occur, but may be avoided if there is access to cool water refuges (areas of spring outflow or groundwater upwelling).

In lower canyon and alluvial reaches, exceedances extend well into the sub-lethal or lethal ranges for salmonids and are of long duration. It is unknown to what extent cool water refuges exist in these reaches.

Land Use and Ownership

About 88% of the Rock Creek subbasin is privately owned (Figure 6). Federal and state lands comprise just over 11%. The Yakama Nation and its members own about 749 acres in trust allotments, located mostly in the lower and eastern portions of the Rock Creek watershed. Non-forested rangeland, about 47 % of basin, is found in the canyons and other areas unsuitable for agriculture (Figure 7). The rangeland is used for livestock grazing. Most of the land in agricultural and only 4% is cropland. Forestlands comprise about 47% of the subbasin and are mostly in private ownership. Many of these forestlands also have active grazing allotments. This sparsely populated subbasin is located in eastern Klickitat County.

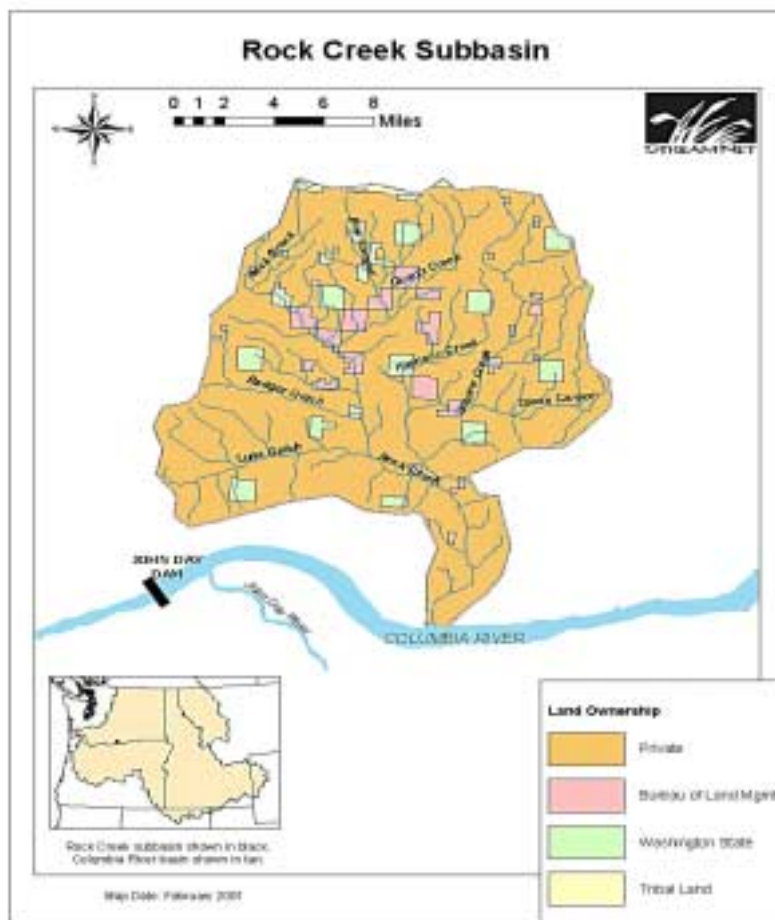


Figure 6. Land ownership in the Rock Creek subbasin

Impoundments and Irrigation Projects

There are no known natural barriers, such as falls or cascades, that block anadromous fish access within the Rock Creek subbasin. Such barriers may exist in unsurveyed canyon reaches of the area.

Protected Areas

Badger Gulch Natural Area Preserve

The Washington Department of Natural Resources (WDNR) established the 180-acre Badger Gulch Natural Area Preserve in 1982 to protect four important native plant communities and three rare plants. The Natural Area Preserve (NAP) lies within Klickitat County and includes a 2-mile long portion of Badger Gulch, a tributary of Rock Creek.

Klickitat Oaks Preserve

Adjoining the Badger Gulch NAP is The Nature Conservancy of Washington's Klickitat Oaks Preserve. The currently 414-acre site is preserving native habitats and significant plant and animal species as a functional ecosystem within the upper Rock Creek watershed.

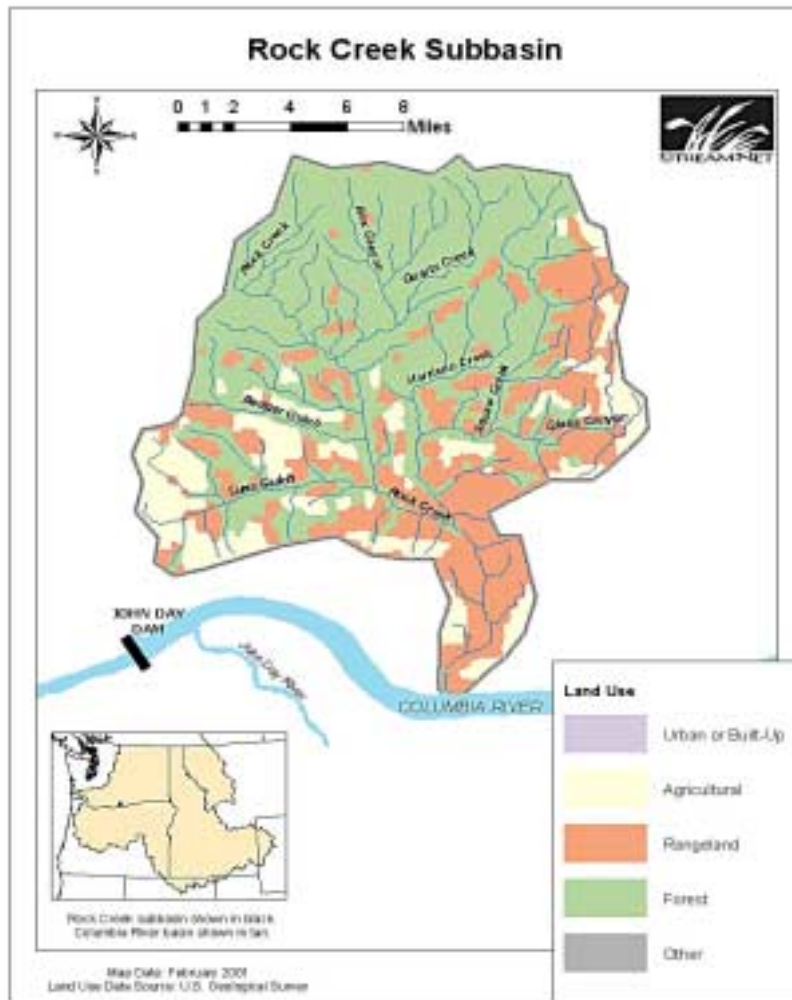


Figure 7. Current land use in the Rock Creek subbasin.

Fish and Wildlife Status

Fish

Three species of anadromous salmon, fall chinook (*Onchorynchus tshawytscha*), coho (*Onchorynchus kisutch*), and summer steelhead (*Onchorynchus mykiss*), use streams in this subbasin. Pacific lamprey (*Entosphenus tridentatus*), suckers (*Catostomus spp*), dace (*Rhinicthys spp*) and other non-game fish species have also been observed in Rock Creek (Jim Matthews, YN, pers. communication 2001). One distinct stock, summer steelhead, has been identified as indigenous to the subbasin. The remaining anadromous use is believed to be a result of straying of other mid-Columbia stocks, or is incidental use associated with upriver migration of adults or downriver migration of juveniles.

Steelhead (*Onchorynchus mykiss*)

Summer steelhead are indigenous to the subbasin. This stock is considered part of the Mid-Columbia Evolutionarily Significant Unit (ESU) for steelhead, which has been listed as “threatened” under the Endangered Species Act. This ESU includes all steelhead stocks in the Columbia River basin from Mosier Creek to the Yakima River. (NMFS, 1996) Rock Creek summer steelhead are considered to be of native origin and are sustained by natural production. The 1992 SASSI report (WDF and WDW 1993) indicated that the stock status for summer steelhead is unknown.

Adults enter the Columbia from May to November, and hold in the Columbia until fall and winter rains allow them to enter subbasin streams. The adults will continue to hold in Rock Creek and its tributaries until the spawning period, which occurs from February through April.

Little information is available on juvenile life histories specific to this watershed; life stage timing is inferred from those of nearby stocks and smolt sampling on the mainstem conducted by WDW in 1990. Fry are believed to emerge from April through mid-June, and will rear for up to two years. Smoltification and out-migration occur in April and May, peaking in early May.

Steelhead are known to occur in Rock Creek up to a point 1/4 mile above the confluence with Quartz Creek (BLM 1985; BLM 1986); additional potential utilization may occur above this point. Steelhead have also been found in lower Quartz Creek (BLM 1985; BLM 1986). Steelhead are known to occur in Squaw Creek up to the confluence with Harrison Creek, and have occurred historically as far as the confluence with Spring Creek (C. Dugger, WDFW, pers. comm. 1999).

In general, spawning may occur anywhere in the identified areas that suitable substrate material is found; rearing may be similarly widespread during most of the year, but may be restricted to spring-fed or groundwater upwelling areas during the summer and early fall. Known utilization includes the lower and middle portions of Rock Creek, lower Quartz Creek and Squaw Creek.

Fall Chinook (*Onchorynchus tshawytscha*)

Fall chinook found in this subbasin are believed to be stray upriver brights belonging to either the wild Hanford Reach stock or the Bonneville Pool Hatchery stock. No specific life history information exists for fall chinook using subbasin streams; the information below is inferred from that of the Columbia River upriver bright (Hanford Reach) stock (WDFW 1990).

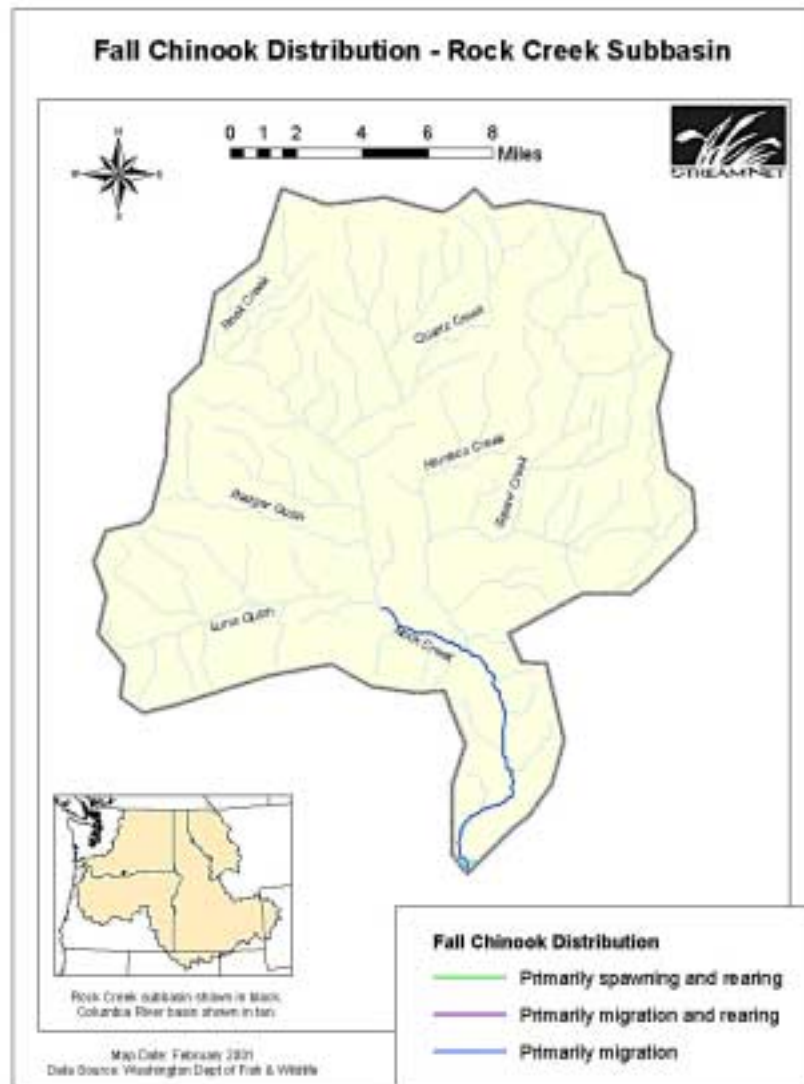


Figure 8. Fall chinook distribution

Upriver bright chinook adults begin entering the Columbia in August, and will reside in freshwater for up to two months while they mature sexually. Utilization of Rock Creek for spawning may not occur until there are sufficient flows brought about by fall rains, generally, in October or November. Fry emerge from mid-March through Mid-May, and may utilize stream habitat through early- to mid-spring, but probably move out to Lake Umatilla before flows diminish and temperatures increase in June or July. Emigrating smolts occupy near-shore habitat in Lake Umatilla in late July and August (Lautz 2000).

Distribution appears to be limited to the lower portions of Rock Creek and along the shore of Lake Umatilla (Lautz 2000). Spawning has been observed in Rock Creek up to the confluence with Luna Gulch (WDF, 1990), and juveniles use lower portions of Rock Creek (Lautz 2000; C. Dugger, WDFW, pers. comm. 1999). There is incidental use associated with upriver migration of adults or downriver migration of juveniles from other

Columbia River stocks; this use would generally be restricted to the shore of Lake Umatilla or the pool areas at the stream mouths (Lautz 2000).

No utilization by spring chinook has been observed (Lautz 2000). There is incidental use associated with upriver migration of adults or downriver migration of juveniles from other Columbia River stocks. This use would generally be restricted to the shore of Lake Umatilla or pool areas near stream mouths (Figure 8).

Coho (*Onchorynchus kisutch*)

Coho found in this subbasin are believed to be stray hatchery fish, although a small number also appear to be spawning naturally. No specific life history information exists for coho that utilize subbasin streams; the information below is inferred from that of Columbia River hatchery stocks (Lautz 2000).

Adults begin entering the Columbia in July and migrate past Bonneville Dam from July through November, with a peak in September. Adults will remain in the mainstem until there are sufficient flows brought about by fall rains, generally, in October or November. Spawning occurs shortly after stream entry, and continues until mid-December. Fry emerge in March and early April, and will rear in available stream habitat through the following winter. Smolting and emigration occurs in April through mid-May. Emigrating smolts occupy near-shore habitat in Lake Umatilla at this time.

Some utilization by juveniles has been noted along the shore of Lake Umatilla. There is incidental use associated with upriver migration of adults or downriver migration of juveniles from other Columbia River stocks; this use would generally be restricted to the shore of Lake Umatilla or pool areas near stream mouths.

Resident Fish

Resident rainbow trout have been found in many of the streams in the subbasin, particularly in the headwaters. Resident rainbow have been observed in upper Rock Creek, Quartz Creek, Squaw Creek and Box Canyon. Other streams may have resident fish, but have not been surveyed at this point. Historically, subbasin streams supported several species of suckers, scuplin, dace, crayfish and fresh water mussels among other species (J. Meninick, pers. communication 2001; Hunn 1990).

Wildlife

Rock Creek subbasin may have one of the most diverse animal (and plant) assemblages in southeastern Washington. Some 200 vertebrate and a profusion of invertebrate species use the subbasin's oak woodlands.

Oregon white oak habitat, which is considered a state priority habitat, is used by an abundance of mammals, birds, reptiles, and amphibians. Oak woodland habitats and grasslands support not only the threatened western gray squirrel (*Sciurus griseus griseus*), but also wild turkey, prairie falcon, chukar, and other wildlife populations. Many invertebrates, including various moths, butterflies, gall wasps, and spiders are found exclusively in association with this oak species.

Avian species such as the bald and golden eagles were historically more common along the riparian sections of the Columbia River. Although numbers of bald eagles have increased in the Columbia River Gorge in the past 10 years, current numbers are considered a small remnant of past population levels. In Rock Creek, there are currently two known golden eagle nests found in the central and lower subbasin. One golden eagle

nest site was used as a nest site by prairie falcons as well, and was a release site for the federally listed peregrine falcon in the early 1980s. Peregrine falcons have recently been seen at the mouth of Rock Creek during the breeding season but no nest sites have been located to date.

Before inundation by hydroelectric dams, the natural hydrological flooding and seasonal drying of lowland backwater areas along the Columbia created environments that would have been especially rich in amphibian species, such as spotted frog and western toady. Now these species are primarily missing from the Columbia River lowlands.

Among Rock Creek fauna of particular concern are the state-threatened western gray squirrel; black-tailed/mule deer (*Odocoileus hemionus hemionus/columbianus*), an important game and subsistence animal; and the declining neotropical bird species. Neotropical birds are considered indicators of forest health, as they require wintering habitat in Central and South America. Many of these species are experiencing significant declines throughout their respective ranges prompting an international effort for their recovery.

Table 1. Vertebrate terrestrial species that may occur in Rock Creek subbasin based on habitat types

Mammals

Masked Shrew	Northern Grasshopper Mouse	House Mouse	Norway Rat
Vagrant Shrew	Townsend's Big-eared Bat	Pacific Jumping Mouse	Common Porcupine
Montane Shrew	Pallid Bat	Bushy-tailed Woodrat	Nutria
Water Shrew	Eastern Cottontail	Southern Red-backed Vole	Coyote
Pacific Water Shrew	Nuttall's (Mountain) Cottontail	Heather Vole	Red Fox
Trowbridge's Shrew	Snowshoe Hare	Montane Vole	Black Bear
Shrew-mole	White-tailed Jackrabbit	Long-tailed Vole	Raccoon
California Myotis	Black-tailed Jackrabbit	Creeping Vole	American Marten
Western Small-footed Myotis	Least Chipmunk	Water Vole	Fisher
Yuma Myotis	Yellow-pine Chipmunk	Sagebrush Vole	Ermine
Little Brown Myotis	Townsend's Chipmunk	Great Basin Pocket Mouse	Long-tailed Weasel
Long-legged Myotis	Yellow-bellied Marmot	American Beaver	Mink
Fringed Myotis	Townsend's Ground Squirrel	Western Harvest Mouse	Wolverine
Long-eared Myotis	California Ground Squirrel	Bobcat	American Badger
Silver-haired Bat	Cascade Golden-mantled	Roosevelt Elk	Striped Skunk
Western Pipistrelle	Ground Squirrel	Rocky Mountain Elk	Northern River Otter
Big Brown Bat	Western Gray Squirrel	Black-tailed/Mule Deer	
Hoary Bat	Douglas' Squirrel	Mountain Lion	
Deer Mouse	Northern Flying Squirrel	Muskrat	
	Northern Pocket Gopher		

Amphibians

Long-toed Salamander
Rough-skinned Newt
Larch Mountain Salamander

Tailed Frog
Great Basin Spadefoot
Western Toad

Woodhouse's Toad
Pacific Treefrog
Cascades Frog

Oregon Spotted Frog
Bullfrog

Reptiles

Painted Turtle
Western Pond Turtle
Red-eared Slider Turtle
Northern Alligator Lizard
Southern Alligator Lizard

Short-horned Lizard
Sagebrush Lizard
Western Fence Lizard
Side-blotched Lizard
Western Skink

Rubber Boa
Racer
Sharptail Snake
Ringneck Snake
Night Snake

California Mountain Kingsnake
Striped Whipsnake
Gopher Snake
Western Terrestrial Garter Snake
Common Garter Snake

Birds

Pied-billed Grebe
American Bittern
Great Blue Heron
Black-crowned Night-heron
Turkey Vulture
Western Canada Goose
Taverner's Canada Goose
Cackling Canada Goose
Lesser Canada Goose
Tundra Swan
Wood Duck
Mallard
Cinnamon Teal
Green-winged Teal
Ring-necked Duck
Greater Scaup
Harlequin Duck
Barrow's Goldeneye
Hooded Merganser
Common Merganser
Osprey
Northern Harrier
Sharp-shinned Hawk
Cooper's Hawk
Northern Goshawk
Swainson's Hawk
Red-tailed Hawk
Ferruginous Hawk
Rough-legged Hawk
Golden Eagle
American Kestrel
Gyr Falcon
Prairie Falcon
Chukar
Gray Partridge
Ring-necked Pheasant
Ruffed Grouse
Blue Grouse
Wild Turkey
Mountain Quail
California Quail
Virginia Rail

Spotted Sandpiper
Long-billed Curlew
Semipalmated Sandpiper
Western Sandpiper
Least Sandpiper
Baird's Sandpiper
Pectoral Sandpiper
Stilt Sandpiper
Long-billed Dowitcher
Common Snipe
Red-necked Phalarope
Ring-billed Gull
California Gull
Herring Gull
Thayer's Gull
Glaucous Gull
Caspian Tern
Forster's Tern
Black Tern
Rock Dove
Mourning Dove
Barn Owl
Flammulated Owl
Western Screech-owl
Great Horned Owl
Northern Pygmy-owl
Burrowing Owl
Spotted Owl
Barred Owl
Long-eared Owl
Short-eared Owl
Northern Saw-whet Owl
Common Nighthawk
Common Poorwill
Vaux's Swift
Calliope Hummingbird
Rufous Hummingbird
Belted Kingfisher
Lewis's Woodpecker
Williamson's Sapsucker
Red-naped Sapsucker
Downy Woodpecker

Hammond's Flycatcher
Gray Flycatcher
Dusky Flycatcher
Pacific-slope Flycatcher
Cordilleran Flycatcher
Say's Phoebe
Ash-throated Flycatcher
Western Kingbird
Eastern Kingbird
Loggerhead Shrike
Northern Shrike
Cassin's Vireo
Warbling Vireo
Red-eyed Vireo
Gray Jay
Steller's Jay
Western Scrub-Jay
Black-billed Magpie
American Crow
Northwestern Crow
Common Raven
Horned Lark
Tree Swallow
Violet-green Swallow
No. Rough-winged Swallow
Bank Swallow
Cliff Swallow
Barn Swallow
Black-capped Chickadee
Mountain Chickadee
Chestnut-backed Chickadee
Red-breasted Nuthatch
White-breasted Nuthatch
Pygmy Nuthatch
Brown Creeper
Rock Wren
Canyon Wren
House Wren
Winter Wren
Marsh Wren
American Dipper
Golden-crowned Kinglet

Varied Thrush
Gray Catbird
Sage Thrasher
European Starling
Bohemian Waxwing
Cedar Waxwing
Orange-crowned Warbler
Nashville Warbler
Yellow Warbler
Yellow-rumped Warbler
Black-throated Gray Warbler
Townsend's Warbler
Hermit Warbler
Macgillivray's Warbler
Common Yellowthroat
Wilson's Warbler
Yellow-breasted Chat
Western Tanager
Spotted Towhee
American Tree Sparrow
Chipping Sparrow
Brewer's Sparrow
Vesper Sparrow
Lark Sparrow
Black-throated Sparrow
Sage Sparrow
Savannah Sparrow
Grasshopper Sparrow
Fox Sparrow
Song Sparrow
White-crowned Sparrow
Dark-eyed Junco
Lapland Longspur
Black-headed Grosbeak
Lazuli Bunting
Red-winged Blackbird
Western Meadowlark
Yellow-headed Blackbird
Brewer's Blackbird
Brown-headed Cowbird
Bullock's Oriole
Cassin's Finch

Birds

Sora	Hairy Woodpecker	Ruby-crowned Kinglet	House Finch
American Coot	White-headed Woodpecker	Western Bluebird	Red Crossbill
Sandhill Crane	Black-backed Woodpecker	Mountain Bluebird	Pine Siskin
Killdeer	Northern Flicker	Townsend's Solitaire	Lesser Goldfinch
Greater Yellowlegs	Pileated Woodpecker	Veery	American Goldfinch
Lesser Yellowlegs	Olive-sided Flycatcher	Swainson's Thrush	Evening Grosbeak
Solitary Sandpiper	Western Wood-pewee	Hermit Thrush	House Sparrow
	Willow Flycatcher	American Robin	

Western Gray Squirrel (*Sciurus griseus*)

The western gray squirrel was listed as a state threatened species in Washington in 1993, when surveys indicated that the species' distribution was becoming increasingly patchy and separated. Small, isolated, populations remain in south Puget Sound, the Lake Chelan area, the southeast slope Cascade region, and the Columbia River Gorge, the latter being the largest in the state. The exact reasons for this decline are unknown; however, changes in the landscape likely play a key role. Many years of fire suppression and selective logging practices have altered Washington's oak-conifer communities and the habitat of the western gray squirrel. On sites with sufficient moisture, invading Douglas fir overtops the slow-growing, fire-adapted oak. In drier areas, drought and insects further stress overstocked forests.

The Rock Creek subbasin provides important habitat for maintaining the population of western gray squirrels in the eastern portion of Klickitat County. Rock Creek provides a dispersal corridor from population areas in the Klickitat River drainage to those riparian habitats in the eastern portion of the county. Pockets of Ponderosa pine in oak woodlands, which frequently contain clusters of gray squirrel nests, have been subjected to logging at an increased rate in Southeast Washington, including in the Rock Creek area.

The core population of the western gray squirrel is currently found from the Rock Creek drainage west through central Klickitat County to Underwood near the Little White Salmon drainage. A recent report from the Vancouver area suggests that historically the Columbia River offered a dispersal corridor through the Columbia River Gorge between Klickitat and Clark counties. Current threats include loss of habitat from logging, residential development and invasion of the eastern gray squirrel.

No hunting of western gray squirrels is allowed in Washington; they are listed as threatened. Hunting did not substantially contribute to the decline of western gray squirrels in Washington; however, there is concern that in Klickitat County many local people like to shoot "gray diggers" (California ground squirrel) for recreation. With this in mind there is need for public education to protect western gray squirrels from being mistaken for ground squirrels. Although the two species look different up close, they can be easily confused at a distance by the trained eye. Recently, habitat overlap has increased between the species.

Black-tailed/Mule Deer (*Odocoileus hemionus hemionus/columbianus*)

Black-tailed/mule deer inhabit the Rock Creek watershed. This drainage represents the transition in range from west side black-tailed populations with east side mule deer populations. There is no doubt genetic mixing of the two deer subspecies in the Rock

Creek drainage. This area is a significant wintering area for deer that move from the Klickitat drainage and the Yakama Nation Reservation.

Timber harvest, land conversion to residential uses and loss of riparian habitat to hydro inundation are the primary reasons for the decline of resident black-tailed/mule deer populations along the mainstem Columbia. Since construction of John Day Dam in 1968, winter carrying capacity was reduced in areas immediately bordering the Columbia River. During years of heavy snow accumulation (i.e. 1996) deer are frequently seen congregating in the lower elevations adjacent to the Columbia River.

Riparian Avian Guild

A great number of bird species are associated with or require riparian habitats along the mainstem Columbia River. As a subset of this guild, the neotropical migrants (e.g., willow flycatcher, yellow warbler, yellow-breasted chat, red-eyed vireo, Vaux's swift) continue to exhibit declining population trends in this region. Lewis woodpeckers are closely associated with large cottonwood stands.

Historically they were common in the cottonwood habitats of the Columbia River but declines were noted after 1965 and they are now considered extirpated from Columbia River riparian habitat. The yellow-billed cuckoo is a riparian obligate species that was once common along the Columbia River but has not been reported in this area since 1977.

The yellow warbler was a target species selected for the John Day habitat evaluation procedure. The habitat evaluation procedure (HEP) has become a standard approach for impact assessment and evaluation of measures and management activities causing changes in the environmental conditions of wildlife habitats. It represented similar species that reproduce in riparian shrub habitat and make extensive use of adjacent wetlands. The formation of the John Day pool resulted in the loss of 1,085 acres of yellow warbler habitat (Rasmussen and Wright 1989).

Forested riparian areas also contain marshes and ponds, which provide habitat for a number of water dependent species, such as Virginia rail, sora rail, and marsh wren. Loss of riparian and marsh habitat for these birds resulted from the inundation and alteration of habitats along the mainstem of the Columbia River.

In a 1995/96 study of neotropical bird communities in Klickitat County, 63 species of neotropical migrants and 27 permanent residents were detected in 20 study sites. The mean number of bird species detected in upland sites was 21.2. In riparian sites, the mean number of species detected was 24.2. The number of species detected per site was higher in riparian areas than in the upland sites surveyed. Neotropical species comprised 83% of all birds detected in upland sites and 85% in riparian sites. Of the 5 riparian sites, 79 species were recorded. The highest species richness was found at Rock Creek and Catherine Creek (Manual 1997).

Beaver (*Castor canadensis*)

Beaver provide many functional benefits to the ecosystems in which they are (or were) found. Beaver ponds provide rearing and over-wintering habitat for salmon, catch and store sediment, store water that enhances summer flows, enriches nutrient content, improves primary and secondary stream productivity, and increases the size and productivity of riparian habitats, among other benefits (Cederholm et al. 2000). Although beavers are occasionally found in the Rock Creek subbasin, their numbers and ecological influence are greatly reduced in comparison to historic levels.

Amphibians

Amphibians are important components in many ecosystems as both aquatic and terrestrial species, and in some systems, comprise a major component of vertebrate biomass. For instance, tailed frog tadpoles constitute 90% of herbivore biomass in some small streams (Hawkins et al. 1988). Their predators include fish species such as cutthroat trout (Daugherty and Sheldon 1982). Additionally, amphibians can serve the function of biological indicators of ecosystem health (Blaustein et al. 1995). Tailed frogs may be particularly valuable as independent indicators of habitat quality for fish as well as amphibians, as they have the lowest thermal tolerance of North American frogs (Washington State Gap Analysis: <http://salmo.cqs.washington.edu/~wagap/herps>), and are very sensitive to sedimentation. While present in Rock Creek subbasin, little is known of the distribution, abundance and life histories of amphibians in the subbasin.

Bats

Although it is speculated that relationships between bats and salmon may exist, it is unclear at this time what those relationships may be (Cederholm et al. 2000). However, bats depend on many of the same resources, being exclusively insectivorous in this region. Little is known of the distribution, abundance and life histories of bats in the subbasin.

Table 2. A Listed and Proposed Endangered and Threatened Species, Critical Habitat and Candidate Species that may occur in Klickitat County as Listed by the U.S. Fish and Wildlife Service (January 4, 2001, FWS Reference: 1-9-01-SP-008) and/or by National Marine Fisheries Service.

KLICKITAT COUNTY

	<u>Endangered</u>	<u>Threatened</u>	<u>Designated</u>
LISTED	Gray wolf (<i>Canis lupus</i>) Steelhead (<i>O. mykiss</i>)	Bald eagle (<i>Haliaeetus leucocephalus</i>) Bull trout (<i>Salvelinus confluentus</i>) Canada lynx (<i>Lynx canadensis</i>) Northern spotted owl (<i>Strix occidentalis caurina</i>) ¹ Ute ladies'-tresses (<i>Spiranthes diluvialis</i>) Steelhead (<i>Oncorhynchus mykiss</i>)	Critical habitat for the northern spotted owl
PROPOSED	Coastal Cutthroat Trout (<i>Oncorhynchus clarki clarki</i>)		
CANDIDATE	Mardon Skipper (butterfly) (<i>Polites mardon</i>) Oregon spotted frog (<i>Rana pretiosa</i>) Northern wormwood (<i>Artemisia campestris</i> var. <i>wormskioldii</i>)		
ANIMAL SPECIES OF CONCERN	Black tern (<i>Chlidonias niger</i>) California floater (mussel) (<i>Anodonta californiensis</i>) Cascades frog (<i>Rana cascadae</i>) Columbia pebblesnail (<i>Fluminicola (=Lithoglyphus) columbianus</i>) [great Columbia River spire snail] Columbia spotted frog (<i>Rana luteiventris</i>) (= <i>Rana pretiosa</i> , eastern population)		
MORE ANIMAL SPECIES OF CONCERN	Ferruginous hawk (<i>Buteo regalis</i>) Fringed myotis (bat) (<i>Myotis thysanodes</i>) Harlequin duck (<i>Histrionicus histrionicus</i>) Interior redband trout (<i>Oncorhynchus mykiss gairdneri</i>) Larch Mountain salamander (<i>Plethodon larselli</i>) Little willow flycatcher (<i>Empidonax traillii brewsteri</i>) Loggerhead shrike (<i>Lanius ludovicianus</i>)		

<p>MORE ANIMAL SPECIES OF CONCERN, Cont...</p>	<p>Long-eared myotis (bat) (<i>Myotis evotis</i>) Long-legged myotis (bat) (<i>Myotis Volans</i>) Northern goshawk (<i>Accipiter gentilis</i>) Northern sagebrush lizard (<i>Sceloporus graciosus graciosus</i>) Northwestern pond turtle (<i>Clemmys marmorata marmorata</i>) Olive-sided flycatcher (<i>Contopus borealis</i>) Pacific lamprey (<i>Lampetra tridentata</i>) Pacific Townsend's (= western) big-eared bat (<i>Corynorhinus (=Plecotus) townsendii townsendii</i>) Pale Townsend's (= western) big-eared bat (<i>Corynorhinus (=Plecotus) townsendii pallescens</i>) Red-legged frog (<i>Rana aurora</i>) River lamprey (<i>Lampetra ayresi</i>) Small-footed myotis (bat) (<i>Myotis ciliolabrum</i>) Tailed frog (<i>Ascaphus truei</i>) Western burrowing owl (<i>Athene cunicularia hypugea</i>) Western gray squirrel (<i>Sciurus griseus griseus</i>) Westslope cutthroat trout (<i>Oncorhynchus clarki lewisi</i>) Yuma myotis (bat) (<i>Myotis yumanensis</i>)</p>
<p>PLANT SPECIES OF CONCERN</p>	<p>Ames' milk-vetch (<i>Astragalus pulsiferae</i> var. <i>suksdorfii</i>) Barett's beardtongue (<i>Penstemon barrettiae</i>) Clustered lady's-slipper (<i>Cypripedium fasciculatum</i>) Columbia yellow cress(<i>Rorippa columbiae</i>) Long-bearded sego lily (<i>Calochortus longebarbatus</i> var. <i>longebarbatus</i>) Obscure buttercup (<i>Ranunculus reconditus</i>) Pale blue-eyed grass (<i>Sisyrinchium sarmentosum</i>) Suksdorf s desert-parsley (<i>Lomatium suksdorfii</i>) White meconella (<i>Meconella oregana</i>) Woven spore lichen (<i>Texosporium sancti-jacobi</i>)</p>

¹This orchid is known to inhabit wetland and riparian areas, including spring habitats, and mesic to wet meadows, river meanders and floodplains. Recently, this species has been found at about 700 feet in elevation in Washington. Future surveys may document its occurrence at lower elevations. In other parts of its range it is found up to about 6,000 feet, below the lower margin of montane forests, generally in moist areas in open shrub or grassland, or in the transitional zone. This species may be adversely affected by modifications of its habitat associated with livestock grazing, vegetation removal, excavation, construction, stream channelization, and other actions that alter hydrology.

Habitat Areas and Quality

Geomorphic features of the Rock Creek subbasin have a significant impact on habitat availability and quality. The principal streams of the subbasin share similar features, allowing discussion of three general habitat sub-areas: (1) headwaters and upstream plateau, (2) mid-stream canyons and (3) lower stream alluvial reaches.

Fish

Headwaters and Upper Plateau

Headwater tributaries flow out of the mountains and across a relatively flat basalt plateau. Channels are moderately confined to unconfined (although there may be locally confined reached caused by channel incision) with gradients generally less than 1% on the plateau. Land cover is primarily coniferous forest. This area is above currently known anadromous

fish use. Further surveys are needed to define the full extent of anadromous use and potential habitat. Rainbow trout and non-salmonids such as dace use the available fish habitat.

In-channel fine sediment is a problem in some areas of the subbasin, particularly in the headwaters and lower alluvial areas. Primary contributors of fine sediment in the subbasin include roads, riparian grazing, timber harvest activities, and recent wildfires. A number of roads in the headwaters are primarily built of native material with a high fine sediment component. Some of these roads parallel or are in close proximity to streams. Additionally, the roads typically have had infrequent maintenance. Where these roads are poorly maintained and near streams they deliver substantial sediment to the stream system. Grazing practices in riparian areas have also elevated fine sediment in some areas. Heavy livestock use in springs, seeps and on stream banks has caused erosion and channel downcutting. Loss of vegetation from grazing in these areas has also contributed to bank erosion through a reduction in rooting strength. Other timber harvest activities such as skid trails, landings and tree skidding near streams have caused ground disturbance and erosion. Finally, the recent forest and range fire on the east side of the Rock Creek drainage has removed substantial vegetation and escalated the erosion process.

Riparian grazing, timber harvest near streams and the recent wildfire have also reduced vegetation needed for stream temperature moderation. Loss of riparian vegetation has opened the stream channel to greater summer heating and winter cooling. Additionally, reductions in vegetation across the watershed may also be increasing peak flow discharges and reducing ground water storage. Further evaluation of the effects of vegetation loss on stream flows and ground water is needed.

Loss of riparian vegetation has also limited future recruitment of woody debris to the stream channel. Woody debris is a key element for forming pool habitat, providing overhead cover, sorting spawning gravels, and maintaining channel and bank stability. Where riparian vegetation has been substantially reduced by management practices or natural events, efforts are needed to reestablish vegetation and protect the sites from further vegetation loss.

Fish habitat quality in the headwaters is generally considered fair to poor due to effects from past grazing and riparian harvest activities, recent fires on the east side of Rock Creek, and the extensive road network. Watershed assessment and field investigations should further pinpoint the impact and magnitude of these activities, as well as restoration opportunities and benefits.

Canyon Reaches

Coming off of the plateau, streams enter steep-walled canyons. Channels are highly confined, gradients increase to 2-4%, and substrate is characterized by a mix of cobbles and boulders. Riparian vegetation consists primarily of white alder, willows and water birch. Although limited by the narrow floodplain area, existing riparian vegetation is of relatively good quality and is less effected by grazing and forest management activities as the steep terrain limits accessibility. There are some areas at the lower end of the Rock Creek canyon reach where flooding and resulting channel widening has damaged or obliterated riparian vegetation. Much of the observed disruption occurred as a result of the 100-year flood event that occurred in 1996.

Water temperature in the upper canyon reaches is not a significant problem as

temperatures exceeding the standard (18° C/64.4°F) are infrequent and of short duration (Lautz 2000). Some thermal stressing of juvenile salmonids may occur, but may be avoided if there is access to cool water refuges (areas of spring outflow or groundwater upwelling).

Stream flows in the canyons currently rise and fall rapidly in response to precipitation and/or snow. Historically, peak flows may have been somewhat moderated due to greater infiltration and groundwater storage from beaver ponds and vegetation in the headwaters. Further evaluation of historic conditions is needed. The relatively narrow floodplain in the canyon area limits storage of runoff during the winter for later release in the summer when precipitation is negligible. During normal or drier-than-normal years some areas may go dry during the summer. At the same time, heavy rains and snowmelt can result in extremely high stream flows and flooding conditions. The floods of 1996 further reduced habitat quality in some areas of the watershed. Fish habitat quality is generally fair due primarily to the higher stream power that can be experienced in these reaches. Spawning gravel and rearing areas are typically associated with boulders and limited woody debris in the canyon reach.

Alluvial Valleys

Below the canyon reaches, streams enter alluvial valleys. Channels are moderately confined to unconfined (although there may be locally confined reaches caused by channel incision), with gradients generally between 1% and 2% near the upper end, diminishing to less than 1% near the Columbia River (Lautz 2000).

In these lower elevation reaches, riparian forest stand development is limited by the lack of precipitation and runoff. Riparian areas transition downstream from mixed conifer-deciduous forest to deciduous forest and shrub-grassland. Riparian quality is highly variable; the riparian zone is non-existent over significant portion of the alluvial reaches, while elsewhere, it occurs as a strip varying in width from 15 feet to over 150 feet.

Grazing activities, which tend to be concentrated along streams, appear to have caused accelerated riparian vegetation quantity and quality (Lautz 2000). These impacts are both direct (browsing, trampling, soil compaction) and indirect (channel incision, bank instability and resulting channel widening). Historically, intensive land uses such as overgrazing adversely altered riparian species composition and habitat characteristics. Continued use of degraded areas in conjunction with greater storm flow intensity is likely impeding natural recovery mechanisms. In incised channels, habitat quality is reduced due to several factors, including high fine sediment levels (associated with bed and bank erosion, runoff from agricultural lands) In incised channels, habitat quality is reduced due to several factors, including high fine sediment levels (associated with bed and bank erosion), reduced shade from riparian vegetation, and higher storm flows. In all areas where incision has been reported, grazing is prevalent and is likely a primary accelerating factor. Stream-adjacent roads exist along portions of Rock Creek. Generally, the road occurs either along the edge of the floodplain or on a terrace immediately above the floodplain; observed impacts of these roads on floodplain connectivity appears to be minimal.

Current channel conditions have been significantly impacted by a 100-year flood event, which occurred in early 1996 (Lautz 2000). A number of reaches exhibit extensive bank erosion, migration, widening, deposition, braiding and uprooting of riparian vegetation. While these large flood events are commonly viewed as destructive to habitat,

their occasional occurrences can produce long-term habitat benefits through increases in habitat quantity and complexity. Potential benefits can be enhanced if complemented by channel and riparian restoration activities that serve to create habitat, cover, and bank and channel stability against smaller, more frequent flood events.

Subbasin streams are classified as Class A streams. Water temperature is, however, a problem affecting habitat quality in the alluvial and lower canyon reaches. In these areas, temperatures above the standard extend well into the sublethal or lethal ranges for salmonids for extended periods. Some springs and seeps exist in these reaches and can provide critical cool water refuges. These sites need to be further identified and protected from degradation. Dewatering is also a problem, particularly in areas where channel widening has occurred and flow is distributed over several small, shallower channels. Channel dewatering has obvious impacts on fish, including reduction in juvenile mobility, limiting or precluding access for spawning, and mortality due to stranding. Reestablishment of riparian vegetation and control of management activities can help improve channel conditions and surface flows.

Overall, fish habitat quality is highly variable, ranging from poor where degraded riparian zones and channel widening and incision occurs, to excellent where complex habitat elements (deep pools, suitable spawning gravel, large wood debris, riparian cove) exist in the vicinity of spring inflow or groundwater upwelling areas. The locations and relative importance of springs and groundwater are not well known in this watershed and need further investigation.

Wetlands

Flatlands that existed prior to inundation by John Day Dam are now shallow wetlands and embayments along the shore near the mouth of Rock Creek. These wetlands and embayments serve as holding or resting areas of migrating adults and juveniles. Other identified wetland areas are associated with springs occurring further upstream. Many of the spring areas also serve as cattle watering areas, to the detriment or exclusion of wetland vegetation and water quality. Fish habitat with these spring-related wetland areas is unlikely, owing to their small size. However, spring outflow in the immediate vicinity of fish-bearing waters may provide important cool-water refuges during the summer and early fall. Wetlands help capture runoff waters and augment water infiltration to aquifers for release later in the season as springs and groundwater upwelling.

Wildlife Habitat

The subbasin contains a variety of habitats, including mixed coniferous, deciduous, grassland/meadow, cliff/canyon, riparian/wetland, riverine, alpine and agricultural types. Habitat quality varies, but many habitats have been lost or degraded by past or present land use activities such as logging, agriculture, road building, hydropower development, invasion of non-native plants, and expansion of human development.

Oregon White Oak (*Quercus garryana*)

Oregon white oak is Washington's only native oak. Although limited and declining, oaks and their associated floras comprise distinct woodland ecosystems. The various plant communities and stand age mixtures within oak forests provide valuable habitat that contributes to wildlife diversity statewide. In conjunction with other forest types, oak woodlands provide a mix of feeding, resting, and breeding habitat for many wildlife

species. More than 200 vertebrate (**Table 1**) and a profusion of invertebrate species use Washington's oak woodlands. Some species occur in especially high densities, whereas others are not typically found in Washington.

The Rock Creek drainage is the easternmost extent of the largest assemblage of white oak habitat remaining in the state of Washington. Oregon white oak is considered a state priority habitat that is determined to be of significance because it is used by an abundance of mammals, birds, reptiles and amphibians. Many invertebrates, including a variety of moths, butterflies, gall wasps and spiders are found exclusively in association with this oak species. Oak/conifer associations provide contiguous aerial pathways for animals such as the state-threatened western gray squirrel, and they provide important roosting, nesting and feeding habitat for wild turkeys and other birds and mammals. Dead oaks and dead portions of live oaks harbor insect populations and provide nesting cavities. Acorns, oak leaves, fungi and insects provide food. Some birds, such as the Nashville warbler, exhibit unusually high breeding densities in oak. Oaks in Washington may play a critical role in the conservation of neotropical migrant birds that migrate through or nest in Oregon.

Riparian

The majority of terrestrial vertebrate species use riparian habitat for essential life activities, and the density of wildlife in riparian areas is higher when compared to other habitat types. This is especially true in Eastern Washington regions such as Rock Creek, where riparian habitats support species that could not survive in dry-land vegetation. Riparian hardwood, dominated by cottonwood, alder and willow, is the most common riparian habitat type in the Rock Creek subbasin. This forested habitat has an abundance of snags and downed logs that are critical to many cavity birds, mammals, reptiles and amphibians. This habitat is often characterized by relatively dense understory and overstory vegetation. Riparian habitats, while often forested, may also contain important subcomponents such as marshes and ponds that provide critical habitat for a number of species (e.g., Virginia rail, sora rail, marsh wren). Riparian habitats also function as travel corridors between and connecting essential habitats (e.g., breeding, feeding, seasonal ranges).

Riparian habitat along the mainstem Columbia was the critical link between drainages for a number of species (i.e., black-tailed/mule deer, western gray squirrels, neotropical birds). Creation of the John Day pool flooded 1,086 acres of riparian tree habitat. This reduction of riparian habitat along the mainstem Columbia, effectively cut off riparian habitat connectivity that linked rich upland areas, isolating and limiting riparian dependant species. This is evident by species extirpation (yellow-billed cuckoo) and current fragmented populations of threatened, endangered and sensitive species in watersheds along the Columbia River. Other species such as the bald eagle were undoubtedly common along the riparian sections of the Columbia River. Inundation of the lower reaches of the subbasin, while a relatively small number of acres, resulted in the loss of critical riparian habitat, and the connectivity it provided to upland habitats and other subbasins.

Rock Creek's riparian areas, which are in a semi-arid region, are subject to overgrazing. In riparian ecosystems, overgrazing is one of the most destructive forces (Davis 1982) and is usually the result of inappropriate livestock management (Oregon-Washington Interagency Wildlife Council 1979, Platts 1979). The major reason for the

continued decline in riparian habitat quality in the Rock Creek subbasin is that riparian areas are managed in the same way as upland areas. Because of greater forage production, cover and water availability relative to surrounding uplands, riparian areas are often subjected to levels of livestock use disproportionately high to their limited area extent (Platts 1990). Because livestock concentrate in riparian areas, and because riparian areas are more sensitive to overuse, upland management practices have resulted in significant degradation. Grazing can affect all characteristics of riparian and associated aquatic systems, including vegetative cover, soil stability, bank and channel structure, instream structure, and water quantity and quality.

Late-successional Forest

Little forestland occurs in the Rock Creek drainage. However logging practices have altered the late successional habitats that do occur within the subbasin. In the past, timber harvest removed important components of older forests, such as large diameter trees, snags, multi-layered canopies and dead, downed wood. Components of these habitats are important to the viability of species such as spotted owls, white-headed woodpeckers, black-backed woodpeckers, pileated woodpeckers, and pine marten. Large, intact tracts of closed canopy and late succession forest habitat are in short supply within the forest stands of the basin.

Meadows

Meadow habitats provide for a unique assemblage of plant and wildlife species. Fire suppression has allowed trees to encroach into meadows, resulting in a decrease in size or total loss of meadows. Over-grazing has changed species composition of grasses and herbs, introduced non-native plants that out-compete native vegetation, and reduced species diversity. The construction of roads through meadows has altered water flow patterns, effectively draining them and drastically changing the species composition.

Wetlands

Wetlands provide another unique and important habitat for wildlife and fish. Some species, such as great blue herons and amphibians, depend on this habitat, while many others use these habitats when available. A reduction in the number of beaver in the subbasin has resulted in the drying and loss of many wetland and riparian habitats.

The inundation of wetlands from hydropower development also resulted in the loss of this habitat type. The creation of the John Day pool resulted in the loss of 511 acres of emergent wetland (Rasmussen and Wright 1989). These connected wetland habitats would have provided for more widely distributed populations of western pond turtle, among other species, along the Columbia River than now exist.

Deer Winter Range

The Rock Creek drainage lies within the eastside Cascades ecological province. Winter conditions in this area tend to be colder with more frequent snow accumulation. Therefore the importance of low elevation winter range has importance disproportionate to its size. Development of hydropower reduced available big game winter range from historic levels, limiting carrying capacity for big game.

Research has indicated that the low elevation oak woodland and oak/pine mixed forest found in Rock Creek are important wintering habitats, especially where these cover types occur in a mosaic with openings and topographically diverse terrain with abundant

south-facing slopes. Such areas are most commonly found associated with the breaks in the upper Rock Creek canyon.

Meadow Steppe

The meadow steppe community is found in the “transition area” between forested uplands and true shrub-steppe. In the subbasin, the meadow steppe community is found in drier areas. Bluebunch wheatgrass and Sandberg's bluegrass generally dominate. Also present are a variety of forbs indicative of lithic soils. In the south central Klickitat area, heavily grazed stands are dominated by cheatgrass, gray rabbitbrush, broom snakeweed, and/or lupines (WDNR 1998).

Areas in the uplands that produce the best herbaceous forage are the riparian habitats that are consequently heavily used by cattle. Bitterbrush (*Purshia tridentata*) stands on south-facing slopes are heavily browsed by deer and many are decadent and under-productive. Grazing management, particularly in the upper riparian zones and deer winter ranges, is a primary concern.

Watershed Assessment

The Washington State Conservation Commission conducted a limiting habitat factors analysis of the Rock Creek subbasin, designated as Water Resource Inventory Area (WRIA) 31 pursuant to Chapter 75.46 Revised Code of Washington (Salmon Recovery). Water Resource Inventory Area 31 includes a larger area than the Rock Creek drainage—WRIA 31 extends east to the confluence of the Columbia and Yakima rivers. The assessment, “Salmon and Steelhead Habitat Limiting Factors” was published in January 2000. Its purpose was “to identify the limiting factors for salmonids,” where “limiting factors” are defined as “conditions that limit the ability of habitat to fully sustain populations of salmon.”

The findings of the analysis, which was limited to consideration of anadromous fish, are to be used by a locally based habitat project selection committee to prioritize appropriate projects for funding under Washington's salmon recovery program, as well as assist potential project sponsors in identifying projects. As part of the adaptive management process defined in 75.46 RCW, the “Salmon and Steelhead Habitat Limiting Factors” document will be revised as necessary when more information becomes available. Its findings serve as an important source for this subbasin summary.

The Yakama Nation will be conducting a Rock Creek watershed assessment, which will be contracted through the Columbia River Basin Fish and Wildlife Authority.

Limiting Factors

Fish

The primary limiting factors affecting fish productivity are seasonally low to non-existent stream flows and high summer temperatures. These conditions are most prevalent in the lower portions of the watersheds, but also occur in some sections of the headwaters and canyon reaches. Low or non-existent flows in all streams during the late summer, fall, and early winter will limit or preclude utilization by fall spawning adults (chinook, coho), and limit mobility of juveniles of all species and may result in mortality due to stranding. High stream temperatures during the summer and early fall limit mobility of juveniles of all salmonid species and may result in mortality due to thermal stress. The high stream

temperatures can also restrict or delay upstream migration and access for fall spawning fish.

The secondary limiting factors are channel incision and channel widening which have resulted in a reduction in the quality and amount of available fish habitat. In the headwaters and alluvial reaches of the watershed, the combined effects of overgrazing on soils, vegetation and hydrology is the principal contributor to downcutting and channel widening. Channel incision and channel widening may also be causing a reduction or loss of summer base flows. Cattle watering at, or in the vicinity of, spring areas can also have an adverse impact on water quality and riparian function. Spring outflow into fish-bearing waters may provide important cool water refuges for juvenile salmonids during the summer and early fall, even when stream temperatures are high.

Forest practices including logging and roads have also adversely impacted functional quality of riparian areas in some portions of the headwater and canyon reaches (e.g. upper Rock Creek, Box Canyon, Quartz Creek). Types of impacts include removal of or damage to riparian vegetation, fine sediment delivery from roads and ground disturbance, and compaction and erosion of stream banks and adjacent floodplain areas. Roads and timber harvest may also be elevating the efficiency of storm and snowmelt runoff; thereby affecting peak flows in the drainage.

Wildlife

Limiting factors vary for each species of wildlife. However, the degradation and loss of habitat is a common theme for all species. Degradation and loss of habitat has been the result of land use activities such as logging, agriculture, road building, hydropower development, invasion of non-native plants, and expansion of human activities.

Western Gray Squirrel (*Sciurus griseus*)

Loss of habitat is the single most important limiting factor for the western gray squirrel. The trees in squirrel habitat must be of sufficient size to produce and interconnected canopy for arboreal travel. In addition habitat must provide mast, either seeds or fruit, for food. The lack of mature pine and oak are limiting factors because smaller trees do not produce sufficient mast or maternal nest cavities to support a western gray squirrel population. Factors, such as grazing, which inhibit reproduction of oak and ponderosa pine also limit western gray squirrels. In addition, western gray squirrel drink free water and need access to water without leaving the cover of tree canopy. The arboreal nature of the western gray squirrel requires continuous corridors of trees connecting feeding, nesting and water sites. It does not have to be a permanent water body, seeps and deep pools in intermittent streams may be adequate, but it must be connected to suitable habitat .

Black-tailed/Mule Deer (*Odocoileus hemionus hemionus/columbianus*)

Protection of key wintering habitat in the Rock Creek subbasin is an important element in the maintenance of a stable deer population in east Klickitat County. In many big game areas, federal lands provide much of the summer or winter range needed to support deer herds. In contrast, most of the winter habitat mosaic here is under private ownership. Key wintering habitats for black-tailed deer are currently under development pressure in other parts of Klickitat County, where forest, grasslands and agricultural areas are currently being converted to small-scale residential developments. A large number of developments have

occurred within the core winter range for the Klickitat herd since the beginning of the Yakama Nation research effort in 1988.

Competing interests of private landowners, who control most of the land base, limit management of black-tailed deer in the Rock Creek drainage. A cooperative study between WDFW and the YN provides important data on deer movement patterns of Klickitat County deer (McCorquodale 1998). Future protection of the Rock Creek drainage deer herd depends on resolving depredation concerns and protecting habitat now controlled by private landowners.

Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles are vulnerable to loss of nesting and winter roost habitat and are sensitive to human disturbance from residential development and timber harvest along shorelines.

Riparian Avian Guild

Hydro development and resulting inundation directly reduced riparian and riparian-marsh habitat for riparian birds in the Rock Creek subbasin and along the nearby mainstem of the Columbia River. In addition, livestock grazing in the Rock Creek vegetation wetted zone has contributed to changes in riparian vegetation and limited habitat for the yellow warbler and other similar species.

Amphibians

Studies of abundance, density and life history of amphibian species have not been conducted in this subbasin. Thus, factors limiting their populations are not yet known. The loss and degradation of riparian and wetland habitats from over-grazing likely contribute to limiting amphibian populations in the Rock Creek subbasin.

Bats

Studies of abundance, density and life history of bat species have not been conducted in this subbasin, so factors limiting Rock Creek bat populations are not yet known. Contributing factors may be the loss and degradation of habitats and habitat components such as riparian/ wetland vegetation and snags for roosting, and the reduction of prey species from such factors as use of insecticides.

Artificial Production

Anadromous fish production within the subbasin is almost exclusively natural. There are no fish production hatcheries or other facilities located in the subbasin. However, to mitigate for the loss of fall chinook spawning and rearing habitat, the U.S. Fish and Wildlife Service tested net pen rearing of bright fall chinook near the mouth of Rock Creek from 1984 through 1987 (Nelson 1987; Beeman 1994). The program was discontinued because of exposure to infectious hemetopietic necrosis among the source populations from the Little White Salmon hatchery (Nelson 1987).

Existing and Past Efforts

Summary of Past Efforts

Badger Gulch Natural Area Preserve

The Washington Department of Natural Resources established the 180-acre Badger Gulch Natural Area Preserve in 1982 to protect four important native plant communities and three rare plants. The Natural Area Preserve lies within Klickitat County about 6.8 miles north of the Columbia River and 13 miles east of Goldendale on the Goldendale-Bickleton road.

The preserve includes a 2-mile long portion of Badger Gulch, a narrow, steep-walled canyon. Running west to east through the canyon bottom, Badger Creek empties into Rock Creek near river mile 15.

The four protected native plant communities are Idaho fescue-houndstongue hawkweed, Oregon white oak-ponderosa pine, bluebunch wheatgrass-Sandberg's bluegrass and white alder riparian. The three rare plant species are porcupine sedge, shining flatsedge, and beaked cryptantha. These plant communities play an important ecological role in protecting the subbasin's water quality and many vertebrate and invertebrate species.

The Badger Gulch NAP serves as an educational laboratory that provides opportunities for outdoor research and provides baselines for comparison against the effects of human manipulations in similar ecosystems. Additionally, this Natural Area Preserve is valuable as gene pools for native organisms, including species designated as sensitive, threatened or endangered in region.

In 1998 Washington Department of Natural Resources' Southeast Region developed the "Badger Gulch Natural Area Preserve Management Plan." The purpose of the management plan is "to permit natural ecological and physical processes to predominate, while controlling activities that directly or indirectly modify these processes" on the preserve. The plan defines all aspects of management for the site from public use to monitoring and research activities.

Klickitat Oaks Preserve

Adjoining the Badger Gulch NAP is The Nature Conservancy of Washington's Klickitat Oaks Preserve. The site is currently 414 acres and is located north of the Goldendale-Bickleton road crossing of Rock Creek. This area has been a major conservation site for the Conservancy since the ecological significance of the area was identified in the 1980s. The Conservancy is currently negotiating the purchase of an additional 120-acres and, with another private landowner, a 1500-acre limited development conservation easement. Working with federal, state and private adjoining landowners, the Conservancy's purpose is to protect all of the native habitats and significant plant and animal species of the site as a functional ecosystem within the upper Rock Creek watershed.

The Nature Conservancy has developed an initial preserve design and an in-depth Site Conservation Plan for the area. It is a cooperative management strategy for the upper Rock Creek watershed involving a U.S. Bureau of Land Management, WDNR, and resident private landowners. The Nature Conservancy has made a long-term commitment to the site and is currently involved in restoration and management work on the ground, including exotic species control, plant and animal inventory and assessment, and long-term restoration planning.

Memorandum of Agreement on 303 (d)

Rock Creek became a candidate for the state 303(d) (water quality impaired) list for temperature based on multiple excursions of the standard (18° C/64.4° F) measured in 1990 and 1991 (WDOE, 1998). Further monitoring and stream survey work by Ehinger in 1996 concluded that Rock Creek showed "impacts from past grazing activity and episodic flood events, including lack of riparian cover and a shallow, braided stream channel." He also suggested that high stream temperatures observed in upper Rock Creek "may be natural for a small creek in a hot, sunny summer climate," while temperatures in lower

Rock Creek were “affected by the exposed rocky substrate (channel bed) and lack of riparian cover.”

Based on this assessment, a Memorandum of Agreement between the Washington State Department of Ecology and Eastern Klickitat Conservation District regarding the delisting of Rock Creek from Section 303(d) list of the Clean Water Act was signed on July 9, 1996. The exclusion of Rock Creek from the 303(d) list was subject to the following conditions, to be implemented jointly by the two agencies in cooperation with landowners:

- (1) Identify riparian zones that can be successfully revegetated. Assist landowners to implement Best Management Practices that would enhance canopy cover and encourage channel rehabilitation.
- (2) Monitor grazing and forestry practices.
- (3) Advise landowners in the upper watershed of Best Management Practices for road stability and riparian corridor harvesting.
- (4) Continue water quality monitoring to obtain data for long range planning and for landowners participation with Best Management Practices (Figure 9).
- (5) Seek funds to assist with monitoring and rehabilitation efforts.
- (6) Submit a yearly progress report. Implementation of this agreement is ongoing and will continue at least through 2001.

The benefits and/or results of these voluntary activities are unknown.



Figure 9. Water temperature sampling sites

Land Exchange

To create more solid blocks of contiguous ownership, the Bureau of Land Management is currently working on several land exchanges. One exchange is with WDNR to acquire a few parcels in the upper watershed near the Box Canyon Road. The BLM is also trading out of several small, scattered parcels east of the Goldendale-Bickleton Highway.

PRESENT SUBBASIN MANAGEMENT

Existing Management

Federal, tribal, state, and local governments manage and, to a lesser extent, own lands in the Rock Creek subbasin. Most of these entities have regulations and guidelines to protect fish and wildlife and their habitats. However, over 90% of the land base in the subbasin is privately owned, making ranchers and other landowners in the subbasin important potential participants in the restoration and protection of subbasin fish, wildlife and water resources.

Federal Government

Bureau of Land Management

The Bureau of Land Management (BLM) manages 7,307 acres (2,957 hectares) in the Rock Creek subbasin. Most of the land is forest/shrub habitat; the agency manages grazing leases on some of those acres. The BLM has about 4.5 miles of contiguous stream in Rock Creek, starting at the Nature Conservancy property just upstream from the Bickleton Highway crossing. It also has smaller sections of Quartz and Squaw Creek both tributaries to Rock Creek.

Environmental Protection Agency

The Environmental Protection Agency (EPA) and Washington Department of Ecology are responsible for carrying out the Clean Water Act, including overseeing the development and implementation of Total Maximum Daily Load (TMDL) plans.

Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS), a federal agency within the U.S. Department of Agriculture (USDA), works in cooperation with the Washington Conservation Commission and aids conservation districts in the three counties that make up the Rock Creek subbasin. NRCS manages a variety of programs that provide financial and technical assistance to implement conservation practices on privately owned land. Using this help, farmers and ranchers apply practices that reduce soil erosion and improve water quality; enhance forest and grazing land and wildlife habitat; and maintain riparian areas along streams containing salmonids fish.

National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) administers the federal Endangered Species Act as it pertains to anadromous fish. NMFS reviews and comments on fill/removal permit applications on streams with anadromous salmonids and on any hydroelectric project proceedings where anadromous fish are involved. Rock Creek summer steelhead are listed as threatened under the ESA.

Tribes

Yakama Nation

The Yakama Nation, also known as the Confederated Tribes and Bands of the Yakama Indian Nation, is a fish and wildlife co-manager of this subbasin. The Yakama Nation is responsible for protecting and enhancing treaty fish, wildlife and other natural resources for present and future generations.

The Yakama Nation ceded the Rock Creek area in the June 9, 1855 treaty with the United States, reserving fishing, hunting and gathering rights among other rights and responsibilities. Federal court decisions in 1969 and 1974, in *U.S. v. Oregon* and *U.S. v. Washington*, respectively, ruled that the Yakama tribe had retained “the exclusive right of taking fish in streams running through and bordering the reservation...and at all other usual and accustomed places....”

In the Rock Creek subbasin, the Yakama Nation and its members own Vancouver allotments held in trust by the United States government in the names of individual Yakama tribal members. Many of the allotment are the original homes of deceased and current tribal members. The Yakama people have used the resources in the subbasin for thousands of years and continue to use an array of the area’s cultural resources. Past and

current oral history validates the traditional uses of this important area. In addition, Yakama Nation tribal members are pursuing restoration of some traditional areas for their future use.

Tribal members lived in the Rock Creek subbasin until the John Day Dam inundated the majority of traditional fishing places in 1968. Although many tribal members were moved to the Yakama Reservation, to Goldendale and various locations in the Northwest, they continue to own trust allotments there and to live, fish, hunt and gather in the area. The tribe and the Rock Creek Band, the area's traditional inhabitants, maintain a cemetery and longhouse there.

The Yakama Nation reviews proposed management on public lands within the subbasin and provides comments relative to protection of fish and wildlife resources. Tribal range managers establish and monitor use of livestock grazing leases on tribal allotments within the subbasin.

State

State of Washington

The *Statewide Strategy to Recover Salmon* was released in September 1999, following the Salmon Recovery Planning Act, passed by the legislature in 1998. The Strategy was designed as the state's long-term vision or guide "to restore salmon, steelhead, and trout populations to healthy and harvestable levels and improve the habitats on which fish rely." In December 2000, the Governor and his Joint Natural Resources Cabinet, issued a status report on the Salmon Strategy.

Washington Conservation Commission

The Washington Conservation Commission (WCC) assists and guides local conservation districts. Washington State Conservation Commission has several salmon recovery initiatives including the Salmon Habitat Limiting Factors Program and the Conservation Reserve Enhancement Program. The Salmon Habitat Limiting Factors Program involves the identification of habitat factors that limit the success of salmon as the first step in restoring healthy salmon runs. In January 2000, the limiting habitat factors for salmonids were identified for the Rock Creek subbasin or Water Resource Inventory Area 31 as it known under the act.

Administered by WCC, the USDA's Conservation Reserve Enhancement Program provides technical and financial assistance to qualifying landowners to install and maintain streamside buffers along waters that are spawning areas for salmon and steelhead stocks. The Conservation Reserve Enhancement Program fits into the Governor's Salmon Recovery Plan by helping protect habitat on agricultural land. The Commission makes a variety of water quality grants to conservation districts.

Washington Department of Natural Resources

The Washington Department of Natural Resources administers the Natural Areas Program (NAP) including Badger Gulch NAP. Located in a steep, narrow canyon, this 180-acre preserve within the Rock Creek subbasin protects excellent examples of native grasslands and oak savannas unique to south-central Washington. The WDNR has other lands in the drainage that are managed for economic return to the school lands trust. Activities on these other lands can include timber harvest, grazing and mining. The WDNR also has the

regulatory authority on other private lands in the subbasin to ensure that they are in compliance with the State Forest Practices Act.

Washington Department of Fish and Wildlife

The mission of the Washington Department of Fish and Wildlife (WDFW) is to provide sound stewardship of fish and wildlife resources. The WDFW and treaty Indian tribes co-manage the state's salmon populations and are joining with the National Marine Fisheries Service and U.S. Fish and Wildlife Service to define recovery goals for listed species. In addition to the protection and enhancement of these resources, the department is charged with providing fishing, hunting and other opportunities for public recreation. The Rock Creek subbasin lies within the agency's south-central district.

Through its Priority Habitats and Species Program, WDFW also provides important fish, wildlife, and habitat information to local governments, state and federal agencies, private landowners and consultants, and tribal biologists for land use planning purposes. PHS information indicates which species and habitat types are priorities for management and conservation; where these habitats and species are located; and what should be done to protect these resources. In the Rock Creek subbasin, the oak woodland habitat, riparian habitats and the western gray squirrel are designated as needing protection.

Washington Department of Ecology

The mission of the Department of Ecology (WDOE) is to protect, preserve and enhance Washington's environment, and promote the wise management of our air, land and water for the benefit of current and future generations. Its goals are to prevent pollution, clean up pollution and support sustainable communities and natural resources (Figure 9).

WDOE is responsible for implementing the federal Clean Water Act and enforcing the water quality standards. In accordance with Section 303(d) of the federal Clean Water Act, every two years the state must identify its polluted water bodies and what type of pollution they suffer from and submit this list to Environmental Protection Agency. The Rock Creek watershed was not listed under 303 (d) because with a water management plan in place-the MOA between WDOE and Eastern Klickitat Conservation District-Rock Creek was likely to improve its water quality sufficiently to meet standards.

WDOE also manages of the Watershed Planning Act, passed in 1998 to set a framework to address the state's water resources, water quality and salmon habitat needs and to establish instream flows. However, there are currently no planned activities for the Rock Creek Subbasin under the Watershed Planning Act.

Local Government

Eastern and Central Klickitat Conservation Districts

The Eastern Klickitat Conservation District works with farmers and ranchers in the eastern portion of the subbasin to develop conservation plans and administers grants to encourage basic conservation work on private lands. Under a 1996 agreement, the Washington State Department of Ecology and Eastern Klickitat Conservation District are working with landowners to improve water quality under the state's 303 (d) Clean Water Act provisions. The Central Klickitat Conservation District also has some responsibility for agricultural issues in the subbasin.

Other

Oregon-Washington Partners in Flight

Partners in Flight was launched in 1990 in response to growing concerns about declines in the populations of many landbirds, and in order to emphasize the conservation of birds not covered by existing conservation initiatives. Partners in Flight is a cooperative effort involving partnerships among federal, state and local governmental agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals. The Steering Committee for the Oregon-Washington chapter of Partners in Flight includes representatives from Bureau of Land Management, US Fish and Wildlife Service, US Forest Service, and Washington Department of Fish and Wildlife. The efforts of Partners In Flight focuses on improvement of monitoring and inventory, research and educational programs involving birds and their habitats.

The Nature Conservancy

The Nature Conservancy of Washington is a private non-profit organization committed to preserving plants, animals, and natural communities that represent the diversity of life by protecting the lands and waters they need to survive. The Conservancy owns and manages the 414-acre Klickitat Oaks Preserve.

Existing Goals, Objectives, and Strategies

Note: All of these goals, objectives and strategies are not necessarily shared by the resource managers or other subbasin entities. It should also be noted that Strategies indicate potential options for meeting the stated objectives.

Fish

Yakama Nation and Washington Department of Fish and Wildlife

Goal: Restore and enhance available spawning, migratory, adult holding and rearing habitat and flow conditions for resident and anadromous fish species.

- Objective 1. Gain a better understanding of the causative factors of high stream temperatures needed to identify the types and location of restoration activities that will provide the greatest benefit.
- Strategy 1. Conduct a stream temperature study as part of the Watershed Assessment that has been funded by the Columbia River Fish and Wildlife Authority and will be administered by the Yakama Nation.
 - Strategy 2. Determine and implement actions needed to achieve acceptable stream temperature conditions needed for anadromous and resident fish use.
- Objective 2. Improve floodplain connectivity, natural hydrological regime and riparian area functionality.
- Strategy 1. Protect and restore of habitats capable of attenuating high flows and subsequently releasing base flows.
 - Strategy 2. Establish and maintain streamflow monitoring stations throughout the basin.
 - Strategy 3. Control fine sediment delivery to the stream system from roads, grazing and forestry practices. Conduct further evaluations of fine sediment sources through the Watershed Assessment and other monitoring.

- Prioritize and develop plans to prevent fine sediment delivery to the stream system.
- Strategy 4. Manage livestock grazing in or near riparian areas and stream banks to reduce channel incision (entrenchment, downcutting) and promote fully functioning floodplains and riparian conditions.
- Strategy 5. Manage livestock grazing near type 3 streams to maintain a 200-foot buffer on each side of the stream
- Strategy 6. Encourage land use practices consistent with sound watershed management, such as agricultural practices that increase infiltration and residual surface cover (instead of, e.g., direct seeding/no-till); elimination of riparian timber harvest; and improved riparian/wetland livestock management (e.g. spring/fall flash grazing, exclusion from seep and spring areas, etc.).
- Strategy 7. Conduct more detailed evaluations of the condition of channels, floodplains, wetlands and riparian areas, which may then be used to identify priority areas for protect and restoration. These evaluations should be conducted as part of the Watershed Assessment that has been funded by the Columbia River Fish and Wildlife Authority and will be administered by the Yakama Nation.
- Strategy 8. Restore oak/pine woodland and grassland habitats on canyon slopes immediately adjacent to riparian floodplain to filter and buffer upstream land uses impacts.
- Objective 3. Improve summer and early fall flow conditions in the subbasin.
- Strategy 1. Evaluate management factors and their effect on stream flows. Through the Watershed Assessment and other monitoring work identify and determine factors negatively affecting stream flows.
- Strategy 2. Determine and implement actions needed to restore stream flows.
- Objective 4. Identify and secure adequate protection of critical habitat areas.
- Strategy 1. Identify critical areas and habitat for anadromous fish through the Watershed Assessment and other monitoring.
- Strategy 2. Secure protection of these areas through landowner agreements, conservation easements, and/or land purchase.
- Strategy 3. Acquire and/or restore upland (oak/pine woodland and grassland) habitats on canyon slopes immediately adjacent to riparian floodplain to maintain riparian/upland transition and buffer upstream land uses impacts.
- Objective 5. Identify and remove, where appropriate, any potential barriers to spawning and rearing habitat.
- Strategy 1. Conduct investigation of potential barriers on all fish bearing streams, using the assessment and inventory protocol described in WDFW (1998). This activity could be conducted in conjunction with the Watershed Assessment that has been funded by the Columbia River

Fish and Wildlife Authority and will be administered by the Yakama Nation.

Objective 6. Where possible, identify type and extent of historic wetland and riparian habitats.

Objective 7. Restore fish populations to sustainable and harvestable levels.

Wildlife

Oregon-Washington Partners in Flight/Columbia Plateau Bird Conservation Plan

Goal 1: Maintain existing and increase the amount of diverse moderate to high quality native riparian habitat in the Rock Creek subbasin.

Objective 1. Increase riparian shrub patch size (width and length) by 50% along Rock Creek by 2009.

Strategy 1. Reduce habitat fragmentation in the Rock Creek subbasin through restoration and acquisition efforts

Strategy 2. Institutionalize a policy of "no net loss" of riparian habitat in Rock Creek (i.e., discourage loss and conversion of habitat, but when unavoidable, mitigate with equal or greater restoration efforts).

Strategy 3. Initiate actions to increase high quality riparian habitat through restoration of degraded riparian habitat in Rock Creek.

Strategy 4. Maintain all tracts of contiguous cottonwood gallery forest >50 acres in Rock Creek, regardless of understory composition.

Strategy 5. Maintain multiple vegetation layers and all age classes (e.g., seedlings, saplings, mature, and decadent plants) in Rock Creek riparian woodlands.

Strategy 6. Acquire/Restore upland (oak/pine woodland and grassland) habitats on canyon slopes immediately adjacent to riparian floodplain to maintain riparian/upland transition, and to provide buffer/filter from land uses in watershed above.

Objective 2. Limit exotic vegetation infestations to 2001 levels or below.

Strategy 1. Actively manage Rock Creek (and adjoining uplands) to sustain quality riparian habitat and to prevent infestations of exotic vegetation

Strategy 2. Reduce the presence of Russian olive trees in Rock Creek where native vegetation (e.g., willows) is ecologically appropriate through a long-term restoration strategy that considers timing of actions (outside breeding season) and the need to maintain some areas of existing habitat until native vegetation can provide suitable habitat.

Goal 2: Maintain existing, and increase the quantity and quality of neotropical bird habitat in the Rock Creek subbasin.

Objective 1. Determine the current baseline population of landbirds using the riparian habitats in the Rock Creek subbasin.

Strategy 1. Inventory and map existing riparian neotropical bird habitat in the Rock Creek subbasin.

- Strategy 2. Establish permanent roadside and off-road census stations to monitor bird population and habitat changes.

- Objective 2. Increase contiguous areas of riparian neotropical bird habitat and reduce fragmentation by gaining compliance to the RHA widths by 2020.
 - Strategy 1. Support partnerships that seek to acquire/restore riparian habitat in Rock Creek.
 - Strategy 2. Develop conservation agreements with private landowners in the Rock Creek Subbasin to enhance the quality of riparian habitat.
 - Strategy 3. Leave upland buffer zones of uncultivated and unharvested areas adjacent to riparian habitats to protect the stream and increase habitat for area-sensitive bird species.

- Objective 3. Implement HB 1309 Ecosystem Standard B14A: Riparian Management Zone – Undeveloped Land, to create or maintain vegetation adjacent to water in a condition which approximates site potential in terms of vigor, composition and other relevant attributes for a distance far enough from the water body edge to adequately meet the needs of neotropical birds.
 - Strategy 1. Implement HB 1309 Ecosystem Standard B15A: Plant community Status/Condition - Riparian, to create or maintain the plant community within the Riparian Management Zone in structural complexity, vegetative cover and plant species diversity which approximates site potential for native plant species. Non-native plants may be substituted if they bring equivalent benefits to neotropical birds.
 - Strategy 2. Implement HB 1309 Ecosystem Standard B21: Plant community Status/Condition - Uplands to create or maintain the upland plant community in structural complexity, vegetative cover and plant species diversity which approximates site potential for native plant species. Non-native plants may be substituted if they bring equivalent benefits to neotropical birds.
 - Strategy 3. Develop a site specific management plan to provide an adequate level of protection. In all cases special attention should be given and steps should be taken to address departures within 100 feet of the edge of type 1-4 waters and within 50 feet of type 5 waters.
 - Strategy 4. The Riparian Management Zone may be extended up to 325 feet to address specific needs of neotropical migrants.

- Objective 4. Protect all existing neotropical habitat and resident birds from disturbance and from a decrease in the insect food base.
 - Strategy 1. Discourage cowbird use with habitat modifications - e.g., higher grass heights.
 - Strategy 2. Conduct removal of exotic species (e.g., Russian olive, reed canary grass) at appropriate times (i.e., outside breeding season).

- Strategy 3. Use Integrated Pest Management (IPM) practices or non-spraying in low human use areas (e.g., mosquito spraying).
 - Strategy 4. Encourage biological controls rather than chemical controls wherever possible.
 - Strategy 5. Use hand application of chemical controls, if practical, to target appropriate species (e.g., noxious weeds).
 - Strategy 6. Limit the application of fertilizers, pesticides and herbicides in the riparian zone to invasive non-native species (e.g., reed canary grass) in conjunction with habitat enhancement projects that include long-term solutions such as planting trees and shrubs to eventually shade-out future infestations.
- Objective 5. Return the Rock Creek Subbasin to a naturally functioning system by 2020.
- Strategy 1. Restore natural hydrological regimes where possible or initiate actions to mimic natural flood events (e.g., dam releases to flood according to natural hydrologic periods).
 - Strategy 2. Avoid or reverse stream and bank channelization that results in the loss of floodplain vegetation.
 - Strategy 3. Where restoration of natural hydrologic regimes is not possible, establish horticultural restoration projects (plantings) of multiple species of shrubs and trees to mimic natural plant diversity and structure.
 - Strategy 4. Restore native grassland and oak/pine woodland habitat on canyon slopes immediately adjoining riparian floodplain to filter/buffer system impacts from above watershed land uses.
- Objective 6. Reduce neo-tropical bird habitat disturbance caused by human recreation.
- Strategy 1. Limit extent of human recreation in important riparian bird habitat in Rock Creek during the nesting season.
 - Strategy 2. Develop brochures or other educational materials for private landowners describing riparian values and management strategies to provide habitat for landbirds and other wildlife.
- Goal 3: Maintain existing, and increase the quantity and quality of yellow warbler subcanopy foliage in riparian woodland habitat in the Rock Creek subbasin.
- Objective 1. Increase and protect contiguous areas of subcanopy foliage in riparian woodland habitat and reduce fragmentation by gaining compliance to the RHA widths by 2020.
- Strategy 1. Achieve >70% cover in the shrub and subcanopy layer with subcanopy layer contributing >40% of the total
 - Strategy 2. Achieve >70% of the cover in the shrub and subcanopy layer comprised of native species
 - Strategy 3. At the landscape level, provide aforementioned habitat conditions within sites that contain: high degree of deciduous riparian

- heterogeneity within or among wetland, shrub, and woodland patches, <10% hostile habitat (agricultural lands with moderate to heavy grazing pressure or other areas supporting cowbird populations)
- Strategy 4. Eliminate willow cutting and herbicide spraying in riparian zone.
- Strategy 5. Manage at the landscape level to discourage cowbird use of riparian areas (i.e., discourage short-grass areas, maintain taller grass heights).
- Objective 2 Manage livestock grazing in yellow warbler habitat to ensure complete development of all vegetation layers. (See Goal 2, Objectives 3 and 6.)
- Goal 4: Maintain existing and increase the quantity and quality of yellow-breasted chat habitat, which is the dense shrub understory in riparian woodland areas.
- Objective 1. Increase and protect contiguous areas of dense shrub understory in riparian woodland habitat and reduce fragmentation by gaining compliance to the RHA widths by 2020.
- Strategy 1. Where ecologically appropriate, initiate actions in riparian woodland to maintain or provide the following conditions: Achieve patchy shrub layer (i.e. woody vegetation 1-4 m [3-12 ft] tall) with cover 30-80% throughout territory and several scattered herbaceous openings, achieve canopy tree (i.e., woody vegetation >4 m [12 ft] tall) cover <20%
- Strategy 2. At the landscape-level, provide the aforementioned habitat conditions at sites that are: >1 km (0.6 mi) from urban/residential areas, >5 km (3 mi) from high-use cowbird areas (e.g., feed lots, stables)
- Strategy 3. Create riparian habitat with dense shrub layer and increase width of existing riparian zones through alteration of hydrological regimes, willow and other plantings, etc.
- Strategy 4. Eliminate willow cutting and herbicide spraying in riparian zone.
- Strategy 5. Reduce potential impacts of cowbird parasitism by discouraging activities and management that results in attracting cowbirds (e.g., aggregations of livestock).
- Goal 5: Maintain existing, and increase the quantity and quality of willow flycatcher riparian shrub habitat in the Rock Creek subbasin.
- Objective 1. Increase and protect contiguous areas riparian habitat and reduce fragmentation by gaining compliance to the RHA widths by 2020.
- Strategy 1. Where ecologically appropriate, initiate actions in riparian habitat to maintain or provide the following conditions: Achieve dense patches of native vegetation in the shrub layer >10 m sq in size and interspersed with openings of herbaceous vegetation, achieve a shrub layer cover 40-80% across the area of suitable habitat and achieve a shrub layer height >1 m (3 ft) high and tree cover <30%
- Strategy 2. Provide site conditions as described above: in areas of suitable habitat >2 ha (5 ac), but preferably in patches >8 ha (20 ac), within a landscape matrix with <10% hostile habitat (agricultural lands with moderate to heavy grazing pressure or other areas supporting cowbird populations).

- Strategy 3. At the landscape-level, provide the aforementioned habitat conditions at sites that are: >1 km (0.6 mi) from urban/residential areas, >5 km (3 mi) from high-use cowbird areas.
- Strategy 4. Avoid or reverse stream and bank channelization that results in the loss of riparian floodplain vegetation and shrub habitat.
- Strategy 5. Where herbicide control of riparian exotic shrubs and trees (e.g., Russian olive) is occurring within known nesting habitat, consider the following actions: Conduct treatment outside the breeding season, treat patches on a staggered rotation; treat remaining patches when treated patches approach habitat suitability, let treated areas decompose naturally without mechanical assistance, and use mechanical removal in smaller areas of treated patches to assist in recolonization by desired species through planting/seedings.
- Strategy 6. Reduce cattle grazing in riparian zones within appropriate timing and duration guidelines. (See Goal 2, Objectives 3 and 6.)
- Strategy 7. Also see Goal 4, Objective 1, Strategies 3, 4, 5.

U.S. Fish and Wildlife Service

Goal 6: Contribute to the recovery of the western gray squirrel in Washington by maintaining existing populations and increasing the amount of western gray squirrel oak woodlands habitat.

- Objective 1. Maintain “no net loss” of WGS the population in the Rock Creek drainage.
- Objective 2. Maintain and increase connectivity of suitable habitat between Rock Creek and Little Klickitat River.
 - Strategy 1. Complete survey and mapping of suitable WGS habitat in Rock Creek.
 - Strategy 2. Identify and map nest clusters.
 - Strategy 3. Identify habitat linkages that need to be enhanced or restored.
 - Strategy 4. Protect WGS habitat and corridors through acquisition, easements and/or cooperative agreements.

Yakama Nation and Washington Department of Fish and Wildlife

Goal 7: Maintain long-term viability of the east Klickitat County deer herd to meet the traditional needs of tribal members and the recreational demands of sport hunters.

- Objective 1. Restore and increase winter habitats
 - Strategy 1. Acquire appropriate lands and conservation easements

The Nature Conservancy

Goal 8: To protect all of the native habitats and significant plant and animal species together as a functional ecosystem within the upper Rock creek watershed.

- Objective 1. To expand the Klickitat Oaks Preserve and manage comprehensively in cooperation with other landowners in the upper Rock Creek watershed
 - Strategy 1. Purchase other adjacent properties as possible to expand the Klickitat Oaks Preserve. Currently negotiating to purchase an additional 120

- acres (to enlarge present 414 acre preserve) , as well as a 1500 acre limited development conservation easement with another private landowner.
- Strategy 2. Conduct on-site restoration activities and management activities such as exotic species control, plant and animal inventory and assessments and long-term restoration planning.
- Strategy 3. Work with US Bureau of Land Management, WDNR, WDFW and resident private landowners towards a cooperative management strategy for the upper Rock Creek watershed.

Washington Department of Natural Resources

Goal 9: Manage Badger Gulch Natural Area Preserve to permit natural ecological and physical processes to predominate, while controlling activities that directly or indirectly modify these processes.

Goal 10: Maintain ecological integrity of Badger Gulch Natural Area

Objective 1. Expand Rock Creek/Badger Gulch Natural Area

- Strategy 1. Purchase adjacent properties and conservation easements with willing landowners

Research, Monitoring, and Evaluation Activities

The limiting factors analysis states that the following types of research, monitoring and evaluation activities should be part of the Watershed Assessment that has been funded by the Columbia River Fish and Wildlife Authority and is to be administered by the Yakama Nation:

- Further investigation of fish utilization and habitat availability and quality to be conducted on all accessible or potentially accessible streams.
- Further investigation of potential barriers conducted on all fish bearing streams, using an approved assessment and inventory protocol.
- More detailed evaluations of the condition of channels, floodplains, wetlands, and riparian areas.
- Identification of sediment sources, sinks and sediment related impacts to habitat
- Stream temperature study to provide a better understanding of the causative factor of high stream temperatures.

The Management Plan for Badger Gulch Natural Area Preserve list the following activities as activities that should be ongoing:

- Monitoring of Oregon white oak-ponderosa pine woodland and Idaho fescue-houndstongue hawkweed community using methods detailed in monitoring plan which was to be developed in 1998. Monitoring was to occur in 1998 and continue every five years.
- Monitoring of porcupine sedge and shining flatsedge populations by conducting complete counts and populations, estimates of watercress (*Rorippa nasturtium-aquaticum*) cover and habitat photographs every 2 years.

- Identification and monitoring of the following was also to begin in 1998 and occur during routine site visits: deer activity, fences, weed species, public use, culture resource sites, insects and disease and water quality

Memorandum of Agreement between the Washington State Department of Ecology and Eastern Klickitat Conservation District regarding the delisting of Rock Creek from Section 303(d) list of the Clean Water Act:

- Monitor grazing and forestry practices.
- Monitor water quality to obtain data for long range planning and for landowners participation with Best Management Practices.

Statement of Fish and Wildlife Needs

- Protection and restoration of native fish populations
- Reduction in water temperatures in Rock Creek and its tributaries
- Restoration of incised and widened stream channels
- Restoration of lost and degraded riparian shrub and understory habitats
- Additional winter range habitat for black-tailed/mule deer
- Protection for yellow warbler, yellow-breasted chat and willow flycatcher from parasitism by brown-headed cowbird

Information needs:

- Monitor and evaluate the magnitude and extent of sediment delivery and siltation.
- Baseline data are needed on all aspects of willow flycatcher, yellow-breasted chat and yellow warbler nesting ecology and habitat relationships. Determine the impact of cowbird parasitism on yellow warbler in different landscapes. Determine the significance of landscape components or adjacent land-uses significant to willow flycatcher nesting success.
- In agricultural landscapes, determine what factor cowbirds play in willow flycatcher productivity. Determine whether riparian shrub habitat within an agricultural landscape (i.e., a landscape with suitable cowbird habitat) can support viable populations of yellow-breasted chat. If so, how important are habitat or anthropogenic factors.

References

- Ammon, E. M., and P. B. Stacey. 1997. Avian nest success in relation to past grazing regimes in a montane riparian system. *Condor* 99:7-13.
- Beeman, J.W. and J. F. Novotny 1994. Pen Rearing and Imprinting of Fall Chinook Salmon. Final Report. A 137 13084-6 Bonneville Power Administration, Portland, OR.
- Blaustein, A.R., J.J. Beatty, D.H. Olson, and R.M. Storm. 1995. The biology of amphibians and reptiles in old-growth forests in the Pacific Northwest. Gen. Tech. Rep. PNW-GTR-337. Portland, OR: USDA, Forest Service, Pacific Northwest Research Station. 98 p.
- Bock, C. E., V. A. Saab, T. D. Rich, and D. S. Dobkin. 1993. Effects of livestock grazing on neotropical migratory landbirds in western North America. Pages 296-309 *in* Proc. national workshop on status and management of neotropical migratory birds. U.S. For. Serv. Gen. Tech. Rep. RM-229.
- Bureau of Land Management. 1985. Field exam of Rock Creek, Klickitat County. Memorandum to Wenatchee Area Manager. November 4, 1985. 2pp (plus attachments).
- Bureau of Land Management. 1986. Summary of Rock Creek Stream Survey, May 20 1, 1986 by Art Oakley, State Office Fishery Biologist.
- Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J., Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status Review of West Coast Steelhead from Washington, Idaho, Oregon and California. U.S. Dept. of Commerce. NOAA Tech Memo. NMFS-NWFSC-27. 261pp.
- Buttery, R. F., and P. W. Shields 1975. Range management practices and bird habitat values. Pages 183-189 *in* D. R. Smith, ed., *Symp. on management of forest and range habitats for non-game birds*. U.S. For. Serv. Gen. Tech. Rep. WO-1.
- Cederholm, C.J., D.H. Johnson, R.E. Bilby, L.G. Dominguez, A.M. Garrett, W.H. Graeber, E.L. Greda, M.D. Kunze, B.G. Marcot, J.F. Palmisano, R.W. Plotnikoff, W.G. Pearcy, C.A. Simenstad, and P.C. Trotter. 2000. Pacific salmon and wildlife-ecological contexts, relationships, and implications for management. Special Edition Technical Report, Prepared for D.H. Johnson and T. A. O'Neil (Manag. Dirs.), Wildlife-Habitat Relationships in Oregon and Washington. Washington Department of Fish and Wildlife, Olympia.
- Colorado. Pages 186-197 *in* Proc. of the wildlife livestock relationships symposium. For. Wildl. Range Exp. Stn., Univ. Idaho, Moscow.
- Crouch, G. L. 1978. Effects of protection from livestock grazing on a bottomland wildlife habitat in northeastern Colorado. Pages 118-125 *in* Proc. lowland river and stream habitat in Colorado. Univ. North Colorado, Greeley.

- Crouch, G. L. 1981. Wildlife on ungrazed and grazed bottom lands on the South Platte River in northeastern
- Daugherty, C. H. and A. L. Sheldon. 1982. Age-determination, growth, and life history of a Montana population of the tailed frog (*ascaphus truei*). *Herpetologica* 38 (4): 461-468.
- Davis, J. W. 1982. Livestock vs. riparian habitat management--there are solutions. Pages 175-183 *in Proc. Of the wildlife livestock relationships symposium. For. Wildl. Range Exp. Stn., Univ. Idaho, Moscow.*
- Duff, D. A. 1979. Riparian habitat recovery on Big Creek, Rich County, Utah. Pages 91-92 *in Proc. of the forum--grazing and riparian/stream ecosystems. Trout Unlimited, Inc. Vienna, Va.*
- Dugger, Carl, Washington Department of Fish and Wildlife, 1999. Personal communication to Kevin Lautz.
- Ecosystem Standards Advisory Board and the Washington Conservation Commission, 1994. Ecosystem standards for state-owned agricultural and grazing land (HB 1309), Olympia, Washington.
- Evans, K. E., and R. R. Krebs. 1977. Avian use of livestock watering ponds in western South Dakota. U.S. For. Serv. Gen Tech. Rep. RM-35.
- Franklin, Jerry F., and C.T. Dyrness. 1984. Natural Vegetation of Oregon and Washington. Oregon State University Press. Oregon.
- Hallock, Lisa A., 1998. Herpetofauna inventory of Bureau of Land Management sites in Douglas, Franklin, Grant, Lincoln, Klickitat, Washington. Bureau of Land Management, Spokane, Washington.
- Hawkins, C. P., L. J. Gottschalk and S. S. Brown. 1988. Densities and habitat of tailed frog tadpoles in small streams near Mt. St. Helens following the 1980 eruption. *J. N. Am. Benthol. Soc.* 7 (3): 246-252.
- Hunn, E. S., 1990. Nch'i Wana "The Big River": Mid-Columbia Indians and Their Land, University of Washington Press, Seattle and London.
- Lautz, Kevin. 2000. Salmon and Steelhead Habitat Limiting Factors: Water Resource Inventory Area 31. Washington State Conservation Commission. 43 pp
- Manual, D.A, 1997. Neotropical bird communities in oak woodland of South-central Washington. Final report to Washington Department of Fish and Wildlife, Olympia. WA. and US Fish and Wildlife Service, Portland OR.
- Matthews, Jim, Yakama Nation Fisheries Resource Management, 2001. Personal communication to Laura Berg.
- Meninick, JoAnna, Yakama Nation Cultural Committee, 2001. Personal communication to Thomas Backman.
- Nelson, W. R. and four others. 1987. Pen Rearing and Imprinting of Fall Chinook Salmon. Annual Report. A43 13084-4. Bonneville Power Administration, Portland, OR.

- NW Ecosystem Alliance and Tahoma Audubon Society. 2000. Petition for an emergency rule to list the Washington populations of western gray squirrel, *Sciurus griseus griseus*, as threatened or endangered under the Endangered Species Act, 16 U.S.C., 1531 et seq. (1973 as amended). Unpublished report, NW Ecosystem Alliance, 1421 Cornwall Ave., Ste. 201, Bellingham, WA 98225.
- Oregon-Washington Interagency Wildlife Committee. 1979. Managing riparian ecosystems (zones) for fish and wildlife in eastern Oregon and eastern Washington. Prepared by Riparian Habitat Subcomm. of the Oreg./Wash. Interagency Wildlife Comm. Portland, Oreg. 44pp.
- Overmire, T. G. 1963. The effects of grazing upon habitat utilization of the dickcissel (*Spiza americana*) and Bell's vireo (*Vireo bellii*) in northcentral Oklahoma. Ph.D. Thesis, Oklahoma State Univ., Stillwater.
- Platts, W. S. 1979. Livestock grazing and riparian/stream ecosystems. Pages 39-45 in Proc., forum-grazing and riparian/stream ecosystems. Trout Unlimited, Inc.
- Platts, W. S. 1990. Managing fisheries and wildlife on rangelands grazed by livestock: a guidance and reference document for biologists. Nev. Dept. Wildl. (Irr. Pag.).
- Rasmussen, L., P. Wright. 1989. Wildlife Impact Assessment, John Day Project, Oregon and Washington. Annual Report 1989, Project No. 88-12. U.S. Dept of Energy, BPA Division of Fish and Wildlife Portland OR.
- Reynolds, T. D., and C. H. Trost. 1980. The response of native vertebrate populations to crested wheatgrass planting and grazing by sheep. *J. Range Manage.* 33:122-125.
- Roderick, Elizabeth and Rugh Milner (Eds). 1991. Management Recommendations for Washington's Priority Habitats and Species. Washington Department of Wildlife. Olympia, Washington.
- Ryan, L. A. and A. B. Carey. 1995. Biology and management of the western gray squirrel and Oregon white oak woodlands: with emphasis on the Puget Trough. Gen. Tech. Rep. PNW-GRT-348. Portland, OR: U.S. Dept. of Agric., For. Serv., PNW Research Station. 36 p.
- Van Velson, R. 1979. Effects of livestock grazing upon rainbow trout in Otter Creek, Nebraska. Pages 53-55 in O. B. Cope, ed. Proc. of the forum--grazing and riparian/stream ecosystems. Trout Unlimited, Inc., Vienna, Va. 94pp.
- Washington Department of Ecology. 1998. Impaired and Threatened Surface Waters Requiring Additional Pollution Controls (Proposed 1998 Section 303(d) List). Publication No. 97-14.
- Washington Department of Fisheries and Washington Department of Wildlife. 1993. Washington State Salmon and Steelhead Stock Inventory. Appendix Three: Columbia River Stocks. 580 pp.
- Washington Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State Salmon and Steelhead Stock Inventory (SASSI). March. 1993, 212 pp.

Washington Department of Natural Resources. 1998. Management Plan for Badger Gulch Natural Area Preserve. 55pp.

Winegar, H. H. 1977. Camp Creek channel fencing--plant, wildlife, soil, and water response. Rangenman's J. 4:10-12.

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