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KITTITAS COUNTY CRITICAL AREA ORDINANCE – FISH AND WILDLIFE HABITAT CONSERVATION AREAS

BEST AVAILABLE SCIENCE REVIEW AND CONSIDERATIONS FOR CODE UPDATE

Prepared for: **June 2012**

Kittitas County

ESA

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1.0 FISH AND WILDLIFE HABITAT CONSERVATION AREAS[1]

Washington State's Growth Management Act (GMA) (RCW 36.70A.060) requires counties and cities to adopt development regulations that protect the functions and values of critical areas, including fish and wildlife habitat conservation areas (FWHCAs). Fish and wildlife habitat conservation means land management for maintaining species in suitable habitats within their natural geographic distribution so that isolated subpopulations are not created; it does not mean maintaining all individuals at all times (WAC 365-190-080(5)). Kittitas County is undertaking an update of its critical areas ordinance, along with concurrent updates to its shoreline master program. These two efforts overlap and are being closely coordinated. The Washington State Shoreline Management Act (RCW 90.58) requires shoreline master programs to "provide a level of protection to critical areas within the shoreline area that assures no net loss of shoreline ecological functions necessary to sustain shoreline natural resources" (WAC 173-26-221(2)).

State GMA guidelines (Ousley et al., 2003) suggest the following habitat types should be designated as FWHCAs in accordance with the GMA procedural criteria for adopting comprehensive plans and development regulations (WAC 365-190):

1. **Areas with which state or federally listed species (endangered, threatened, candidate, or sensitive) have a primary association.**

   The U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS) are responsible for designating federal special status species and should be consulted for current listing status. The Washington Department of Fish and Wildlife (WDFW) is responsible for designating state special status species and maintains the current list of these species (Ousley et al., 2003).

2. **State priority habitats and areas associated with state priority species.**

   The Priority Habitats and Species (PHS) database is updated on a regular basis with input from WDFW field biologists and other scientists and represents the best available science on the distribution of special status wildlife species and habitats in Washington. The PHS habitats identified by WDFW are considered a priority for conservation and management due to their high fish and wildlife species density and/or diversity, important habitat functions, importance to priority species, limited distribution or rarity, vulnerability, or their cultural value (e.g., commercial or recreational) (Ousley et al., 2003; WDFW 2008). WDFW (2008) has designated 20 priority habitats statewide, 14 of which occur in Kittitas County, Washington (Table 1).

Table 1. WDFW Designated Priority Habitats that Occur in Kittitas County.

Priority Habitats		
Terrestrial	**Aquatic**	**Habitat Features**
Aspen Stands	Freshwater Wetlands & Deepwater	Caves
Biodiversity Areas and Corridors	Instream	Snags/Logs
Inland Dunes	-	Cliffs
Juniper Savannah	-	Talus
Old Growth/Mature Forest	-	
Oregon White Oak Woodlands	-	
Riparian	-	
Shrub-steppe	-	

SOURCE: WDFW, 2008; WDFW, 2012

3. **Habitats and species of local importance.**

   These could include a seasonal range or habitat elements with which a given species has a primary association, and which, if altered, may reduce the likelihood that the species will maintain and reproduce over the long-term. Examples are areas of high relative density or species richness, breeding habitats, winter ranges, movement corridors, and habitats that are of limited availability or high vulnerability to alteration, such as cliffs, talus, and wetlands. Local jurisdictions may designate habitats and species of local importance because of their value to the local environment (Ousley et al., 2003).

4. **Commercial and recreational shellfish areas.**

   Commercial and recreational shellfish areas include public and private tidelands that support shellfish harvest (Ousley et al., 2003).

5. **Kelp and eelgrass beds, and herring and smelt spawning areas.**

   Kelp and eelgrass beds are highly productive ecosystems that provide essential rearing and foraging habitat for a variety of important food and forage fish including rockfish, salmon, smelt and herring as well as Dungeness crab (WAC 365-190-080; WAC 220-110-250; Murphy et al., 2000).

6. **Naturally occurring ponds under twenty (20) acres.**

   Naturally occurring ponds and ponds created for wetland/critical areas mitigation may provide fish and wildlife habitat and other wetland functions. These ponds do not include other manmade ponds (farm ponds, detention ponds) (Ousley et al., 2003).

7. **Waters of the state.**

   Waters of the state include surface waters and watercourses within state jurisdiction under the Shoreline Management Act as defined in WAC 222-16-030 or WAC 222-16-031 (Ousley et al., 2003).

8. **Lakes, ponds, streams, and rivers planted with game fish by a government or tribal entity.**

   These waters provide a valuable public recreational and commercial resource.

9. **State natural area preserves and natural resource conservation areas.**

   Natural area preserves and natural resource conservation areas, owned and administered by the Washington State Department of Natural Resources (WDNR), represent unique or high quality undisturbed ecosystems and habitats (WDNR, 2012).

10. **Land essential for preserving connections between habitat blocks and open space.**

    Maintaining habitat connectivity for fish and wildlife species is necessary to sustain population viability. Habitat connectivity enables individuals to move between habitat patches to obtain needed resources, the dispersal of individuals, and genetic exchange between populations. Isolated populations are at greater risk of extinction due to natural population fluctuations, random events, and inbreeding (Morrison et al., 1998; Lemkuhl et al., 2001).

Of the above listed FWHCAs, numbers 4 and 5 do not apply to Kittitas County due to the lack of marine water and the habitat to support species that use these environments.

For the most part, Kittitas County Code (KCC) is inconsistent with the GMA guidance with respect to designation of FWHCAs. The waterbody classification in the current KCC differs slightly from the organization of the GMA water types, but KCC 17A.07.10 protects many of the same water features. Lands that provide habitat connectivity are not specifically designated as FWHCAs in the current KCC, nor are state natural areas preserves and natural resource conservation areas or streams, lakes and ponds planted with game fish. To date, Kittitas County has not formally identified or designated locally important habitat types or species.

The WDFW and the Washington Natural Heritage Program (WNHP) compile and map fish and wildlife habitats throughout the state. There are also numerous studies for specific species and habitat types that apply to the County. Kittitas County has traditionally relied on the information provided by WDFW as well as other resource managers for protection of fish and wildlife habitat. For most priority habitats and wildlife species, the PHS database offers the best available information on their presence and distribution, including site-specific data. Once disseminated, WDFW recommends that PHS data should be updated every six months for site-specific evaluations (WDFW, 2008).

1.1 Overview of Inventory

1.1.1 Species and Habitats

Listed Species Habitat

Table 2 presents the species in Kittitas Count y that are listed as threatened or endangered or are candidates for listing under the federal or state Endangered Species Act, state species of concern, and sensitive species (definitions for each status category are provided in WAC 232-12-297 and 16 U.S.C. § 1532). The table also includes notes about the species habitat requirements and distribution.

Table 2. Listed, Sensitive, and Candidate Species Known or Suspected to Occur in Kittitas County.

Species	Status (State/Federal)	Habitat Requirements and Distribution
Columbia spotted frog	Candidate/None	Aquatic habitat, especially emergent vegetation in wetlands, ponds, and streams in the Cascade Mountains and in eastern Washington (Nordstrom and Milner, 1997).
Western toad	Candidate/Species of Concern	Found near emergent wetlands and small lakes from 0 to 6,530 ft elevation (Leonard et al., 1993).
Sharptail snake	Candidate/Species of Concern	Habitat includes moist situations in pastures, meadows, oak woodlands, broken chaparral, and the edges of coniferous or hardwood forests (Stebbins, 2003); also shrubby rabbitbrush-sagebrush (Weaver, 2004). This snake generally is found under logs, rocks, fallen branches, or other cover. It retreats underground during dry periods
Striped whipsnake	Candidate/None	In Washington, striped whipsnakes inhabit relatively undisturbed native grasslands, sagebrush flats, and dry, rocky canyons with elevations up to 1,985 ft (Storm and Leonard, 1995). They require shrubs for cover, and rock crevices or rodent burrows for egg-laying and hibernation. In Washington, this snake occurs in the Columbia Basin, along the Columbia River border of Walla Walla, Benton, Franklin, Kittitas, and Grant counties.
Sagebrush lizard	Candidate/Species of Concern	Habitats include sagebrush and other types of shrublands (e.g., manzanita and ceanothus brushland), also pinyon-juniper woodland and openly wooded areas of ponderosa pine or Douglas-fir; occupied areas have with open ground and some low bushes (Degenhardt et al., 1996, Hammerson, 1999, Stebbins, 2003). This is a ground dweller that regularly perches on rocks, logs, or snags; it uses rodent burrows, shrubs, logs, etc., for cover.
American white pelican	Endangered/None	Non-breeding and wintering populations occur in eastern Washington throughout the year. Regular concentrations along Columbia River corridor.
Western grebe	Candidate/None	Summer resident and breeding along Columbia River.
Bald eagle	Sensitive/Species of Concern	Numerous nest territories and foraging areas in major drainages and along the Yakima and Columbia Rivers (Rodrick and Milner, 1991).
Ferruginous hawk	Threatened/Species of Concern	Associated with open country including prairies, grasslands, and shrublands. Nest in trees, bushes or often on rocky slopes. In Kittitas County, the species is often associated with open shrub-steppe and grassland habitats between the Columbia River and foothills of the east Cascades (Udvardy and Ferrand, 1995).

Species	Status (State/Federal)	Habitat Requirements and Distribution
Golden eagle	Candidate/None	Common raptor in eastern WA along Columbia River plateau associated with open country. Nests on cliffs or large trees (Rodrick and Milner, 1991).
Northern goshawk	Candidate/Species of Concern	Raptor that nests in relatively dense mature conifer and mixed forests. Sensitive to clear-cut timber harvest in nest and foraging stands (Larsen et al., 2004).
Peregrine falcon	Sensitive/Species of Concern	Year-round resident; nests in cliffs (> 150 ft in height); and feeds on birds, especially shorebirds and waterfowl (Larsen et al., 2004). Occurrences primarily along Columbia River.
Yellow-billed cuckoo	Candidate/Candidate	Typically associated with mature cottonwood stands in riparian areas in Washington. Requires fairly large undisturbed tracts of mature cottonwood for breeding. Rare in Washington.
Burrowing owl	Candidate/Species of Concern	Typically associated with plains, deserts, fields (shrublands and shrub-steppe communities). Requires burrows dug by ground squirrels or badgers for nesting (Udvardy and Ferrand, 1995).
Flammulated owl	Candidate/None	Typically found in coniferous forest and forest edges in the Pacific Northwest. Also prefers dry ponderosa pine forest (Udvardy and Ferrand, 1995).
Northern spotted owl	Endangered/Threatened	Resident in coniferous forests below 5,000 ft elevation. Closely associated with late-successional forests (King County, 2003).
Vaux's swift	Candidate/None	A summer resident and breeder of eastern Washington closely associated with late-successional conifer forests. Requires hollow, large-diameter snags for nesting and roosting (Larsen et al., 2004).
Black-backed woodpecker	Candidate/None	Typically associated with coniferous forests in the boreal zone (Udvardy and Ferrand, 1995).
Lewis's woodpecker	Candidate/None	Typically found in pine-oak woodlands, oak or cottonwood groves in grasslands, or in ponderosa pine dominated forest (Udvardy and Ferrand, 1995).
Pileated woodpecker	Candidate/None	Large resident woodpecker of mature forests requiring trees > 17-inch diameter for nesting and roosting. Important primary excavator providing cavities for a number of species (Larsen et al., 2004).
White-headed woodpecker	Candidate/None	Typically associated with ponderosa pine forest and subalpine fir forest habitats (Udvardy and Ferrand, 1995).

Species	Status (State/Federal)	Habitat Requirements and Distribution
Loggerhead shrike	Candidate/None	Typically occupies open country habitat with scattered trees and shrubs including grasslands, shrublands, agricultural fields, and, occasionally, open woodland; often perches on poles, wires or fenceposts (Udvardy and Ferrand, 1995).
Greater sage grouse	Candidate/Candidate	Large upland game bird. This species uses a wide variety of sagebrush mosaic habitats, including (1) tall sagebrush types such as big sagebrush, three-tip sagebrush, and silver sagebrush; (2) low sagebrush types, such as low sagebrush and black sagebrush; (3) mixes of low and tall sagebrush with abundant forbs; (4) riparian and wet meadows; (5) steppe dominated by native forbs and bunchgrasses; (6) scrub-willow; and (7) sagebrush/woodland mixes with juniper, ponderosa pine, or quaking aspen (Schroeder et al., 1999).
Sage sparrow	Candidate/None	Found from sea level to 6,500 ft; strongly associated with sagebrush for breeding. Prefers semi-open habitats, shrubs 3-7 feet tall (Martin and Carlson, 1998). Positively correlated with big sagebrush, shrub cover, bare ground, above-average shrub height, and horizontal patchiness; negatively correlated with grass cover (Rotenberry and Wiens, 1980; Wiens and Rotenberry, 1981).
Sage thrasher	Candidate/None	Sagebrush plains, primarily in arid or semi-arid situations, rarely around towns (AOU, 1998). Usually breeds between 4,000 and 6,500 ft above sea level (Reynolds and Rich, 1978). In eastern Washington, showed strongest correlation to amount of sagebrush cover of all shrub-steppe birds; most abundant where sagebrush percent cover was 11% which is similar to estimated historic sagebrush cover (Dobler, 1992, Dobler et al., 1996).

Species	Status (State/Federal)	Habitat Requirements and Distribution
Merriam's shrew	Candidate/None	Merriam's shrews are estimated to occur at elevations ranging between 1200-3000 ft in elevation in the Columbia Basin. The most commonly reported habitat of this species is sagebrush-steppe, but it also has been found in semi-arid grasslands, pinyon-juniper woodlands, high elevation brushlands, and even mixed woodlands of ponderosa pine, Douglas-fir, and cottonwood (Wilson and Ruff, 1999). Big sagebrush, rabbitbrush, and bitterbrush (*Purshia tridentata*) are commonly found in areas where Merriam's shrews are present (MacCracken et al., 1985, Ports and McAdoo, 1986, Kirkland et al., 1997, Nagorsen et al., 2001). In the Pacific Northwest, Merriam's shrews are found primarily in the arid portions of the region (Verts and Carraway, 1998). Their Washington range includes portions of central and southeastern Washington (Hudson and Bacon, 1956; Johnson and Cassidy, 1997).
Preble's shrew	Candidate/Species of Concern	Recorded habitats include arid and semiarid shrub-grass associations, openings in montane coniferous forests dominated by sagebrush in Washington (Hoffman et al., 1969).
Townsend's Big-eared Bat	Candidate/Species of Concern	A year-round resident that inhabits caves and abandoned mines and buildings. Extremely sensitive to human disturbance (Graham, 1966; Barbour and Davis, 1969; Humphrey and Kunz, 1976; Perkins and Levesque, 1987; Pierson and Rainey, 1998; Ellison et al., 2003).
Black-tailed Jackrabbit	Candidate/None	Inhabits open plains, fields and deserts; open country with scattered thickets or patches of shrubs (Caire et al., 1989). Rests by day in shallow depression.
White-tailed Jackrabbit	Candidate/None	Open grasslands and sagebrush plains. At higher elevations found in open areas adjacent to pine forests and in alpine tundra. Rests by day usually in shallow depressions at base of bush or beside or in cavity in snow. Young are born in a well concealed depression in the ground or in burrows abandoned by other animals (NatureServe, 2012).
Townsend's Ground Squirrel	Candidate/Species of Concern	Common at times in sagebrush, low sagebrush, and alkali scrub. Less common in bitterbrush, and least common in pinyon-juniper habitat. May invade croplands of alfalfa and grain in winter and spring. Occurs in these habitats from Nevada north through Washington

Species	Status (State/Federal)	Habitat Requirements and Distribution
Western Gray Squirrel	Threatened/Species of Concern	In Washington, pine and oak are especially important for their ability to produce an abundance of large-seeds. Seeds and nuts from other trees like hazelnut are also consumed. Trees >38 cm (15 in diameter at breast height (dbh) may be important for reproductive fitness, given larger trees offer greater food and cover, as reported for the closely related Abert's squirrel. Western Gray Squirrel habitat requires the presence of diverse foods such as nuts, seeds, and fungi. Higher quality habitat also has an interconnected canopy that can be used for arboreal travel (Linders et al., 2010). Historically, Washington's Western Gray Squirrels were found along the entire length of the East Cascades from southern Klickitat County up through Chelan and southern Okanogan Counties. The range of the Western Gray Squirrel has contracted significantly, leaving three isolated populations (Klickitat, Okanogan, and Puget Trough). Presence in Kittitas County is historical (Linders et al., 2010).
Cascade Red Fox	Candidate/None	The Cascade red fox is a rare, possibly extremely rare, isolated Washington endemic subspecies. It is known to occur in alpine and subalpine habitats on Mt. Rainier and Mt. Adams and may possess physiological adaptations that other populations lack (Aubry, 1984; Swanson et al., 2005). There is some verifiable evidence of their presence in the central Cascades.
Fisher	Endangered/Candidate	Very rare forest carnivore closely associated with late-successional coniferous and mixed forests of Olympic and North Cascade Mountains (Larsen et al., 2004).
Gray Wolf	Endangered/Endangered	Rare carnivore of forested and open habitat requiring adequate ungulate prey. Recent sightings have been documented near Cle Elum in the Teanaway River area.
Grizzly Bear	Endangered/Threatened	Rare omnivore of wilderness areas. Occasional recent records from North Cascades National Park (King County, 2003).
Wolverine	Candidate/Candidate	A wide-ranging scavenger that requires large tracts of remote boreal or montane habitat. Rare in Washington, but records in Kittitas County.

Species	Status (State/Federal)	Habitat Requirements and Distribution
Juniper Hairstreak	Candidate/None	The range is broadly defined as western North America, however, there are fewer than six stations known. The Washington distribution is in the Columbia Basin, and Franklin and Kittitas counties. As the name suggests this butterfly is found among junipers -- both in juniper/shrub-steppe composite, and in juniper covered hills and dunes. Host plants are Rocky Mountain juniper and western or Sierra juniper (Larsen et al., 1995).
Silver-bordered Fritillary	Candidate/None	The silver-bordered bog fritillary inhabits boggy meadows and true bogs which support violets (Pyle, 1974), usually located within low- to mid-elevation forests. Several colonies occur in wetlands located within xeric steppe habitat. Violets, most importantly the northern bog violet, are the only known larval host plants of the silver-bordered bog fritillary in Washington. Adults collect nectar from a variety of other flowering plants (Pyle, 1974). In Washington, this butterfly occurs east of the Cascade Mountains in the Columbia Basin, and in Okanogan and Pend Oreille counties. Though numerous where it occurs, the distribution of this species is disjunct, with fewer than 20 sites known (Larsen et al., 1995).

1.1.2 State Priority Habitats and Species

State priority habitats and habitats associated with state priority species include areas associated with high recreational value (e.g., waterfowl, deer, Rocky Mountain elk, bighorn sheep) or relatively rare species (e.g., marten, dusky grouse) (Table 3) (WDFW, 2008). The polygons mapped as priority habitat by WDFW include elk, deer, mountain goat and bighorn sheep wintering calving, and summer ranges and breeding territories for peregrine falcons and sage grouse (leks) (WDFW, 2012). Mapped priority habitat polygons are found throughout the County in varying habitat types from the mountainous west side of the County to the shrub-steppe and grassland habitats above the Columbia River to the east. The KCC does not explicitly designate priority habitats or identify priority species as a separate class of protected wildlife outside of regulated riparian, floodplain, and wetlands; however, protection is afforded by designated the mapped location of a endangered, threatened, or sensitive priority species as priority species habitat. Priority habitats are identified in Table 1.

Table 3. Priority Species Known or Suspected to Occur in Kittitas County

Species/Sites	Criteria[1]
Eastern Washington breeding concentrations of Grebes and Cormorants	VA
Eastern Washington breeding terns	VA
Black-crowned night heron	VA
Great blue heron	VA
Cavity-nesting ducks: Wood Duck, Barrow’s Goldeneye, Common Goldeneye,	RCT

Species/Sites	Criteria[1]
Bufflehead, Hooded Merganser	
Harlequin Duck	VA/RCT
Tundra Swan	VA/RCT
Waterfowl Concentrations	VA/RCT
Prairie Falcon	RCT
Chukar	RCT
Dusky Grouse	RCT
Sooty Grouse	RCT
Wild Turkey	RCT
E WA breeding occurrences of: Phalaropes, Stilts and Avocets	VA
Roosting Concentrations of: Big-brown Bat, Myotis bats, Pallid Bat	VA
Marten	RCT
Bighorn Sheep	RCT
Mountain Goat	RCT
Northwest White-tailed Deer	RCT
Elk	RCT
Rocky Mountain Mule Deer	RCT

[1] VA = vulnerable aggregations, RCT = recreational, commercial, or tribal importance vulnerable to habitat loss or degradation (WDFW, 2008).

1.1.3 Habitats and Species of Local Importance

The KCC does not identify any species of local importance or particular habitats types or locations of habitats of local importance. Currently, KCC identifies the procedures for nominating a species or habitat of local importance, but to date, none have been identified for the County. The species and habitats identified above in Table 3 could be included as species and habitats of local importance under the existing KCC.

1.1.4 Naturally Occurring Ponds

Naturally occurring ponds less than 20 acres are found throughout the lowlands of the western portion of the County. In Kittitas County, naturally occurring ponds are currently protected as wetlands and are not specifically called out for protection as a FWHCA. Ponds provide critical breeding habitat for a number of Pacific Northwest amphibians (Leonard et al. 1993).

1.1.5 Waters of the State

Waters of the state within Kittitas County include the Yakima River and its tributaries, independent tributaries to the Columbia River, the Columbia River, and the lakes found throughout the County.

1.1.6 Waters Planted with Game Fish

Refer to subsection 2.1.1 in the Fish and Other Aquatic Species section for a discussion of waters planted with game fish.

1.1.7 State Natural Areas

Currently, there are no natural area preserves and natural resource conservation areas owned and administered by WDNR in Kittitas County (WDNR, 2011). Typically, these areas represent unique or high quality undisturbed ecosystems and habitats (WDNR 2011).

1.1.8 Lands Essential for Habitat Connectivity

Kittitas County has not designated any lands essential for habitat connectivity; however, WDFW PHS data have identified Biodiversity Areas and Corridors as a priority habitat in Kittitas County (WDFW, 2012). As part of improvements to Interstate 90 between Hyak and Lake Easton, the Washington State Department of Transportation (WSDOT) is constructing "connectivity emphasis areas" or CEAs at several locations. The purpose of the CEAs is to restore or enhance connections between habitats on both sides of I-90 to benefit fish, wildlife, and hydrologic functions. CEAs are planned along Keechelus Lake at several stream crossings: Gold Creek, Rocky Run Creek, Wolf Creek, Resort Creek, Townsend Creek, and Price/Noble Creeks (WSDOT 2011).

1.2 Habitat Evaluation of Kittitas County

This evaluation addresses upland habitat for terrestrial species only. Fish habitat is considered in Section 2.

The ultimate aim of planning for habitat protection is the conservation of associated wildlife species. Three main elements determine whether species are conserved:

- Availability of habitat,
- Behavior of individual animal species, and
- Dynamics of populations.

Availability of habitat determines what resources and environments are accessible. Behavior establishes how animals select their resources and interact with the environment. Population dynamics dictate how the habitats are occupied. To maintain viable populations of wildlife species, there must be adequate environmental conditions for reproduction, foraging, resting, cover, and dispersal of animals at a variety of scales across the landscape.

One important aspect of habitat that has a significant effect on species persistence is fragmentation, or the increase in isolation and decrease in the size of habitat areas. Arguably, no other single factor has been a greater cause of wildlife population declines than loss of habitat, and no one aspect of habitat change has been more insidious than fragmentation. Fragmentation affects quality of habitat of a given species in numerous ways. It alters the quality and type of the food base. Fragmentation changes microclimates by altering temperature and moisture regimes. It alters the availability of cover and brings species together that normally would have little interaction, and thus may increase the rate of nest parasitism, competition, and predation. Fragmentation can also increase contact with and exploitation by humans. The size of a habitat area, however, is not the only important factor. Other key factors affecting habitat quality include the presence of essential resources such as food, water, nest building materials, the complexity of the environment, and the presence or absence of predator species and diseases. These factors are often influenced by elements outside the habitat area (Kagen et al., 2000; Morrison et al., 1992).

As a method of linking large habitat areas, migration corridors offer a means to connect publicly protected lands and other intact habitat areas. Riparian corridors offer a natural system of linkages between these large habitat areas. The value of riparian corridors varies from species to species, and also varies depending on the width of the riparian corridor. Large mammals require widths of several hundred feet for migration whereas amphibian and reptile species may require widths less than 50 feet. In semi-arid regions such as Kittitas County, riparian corridors not only offer migratory linkages between large habitat areas, but also offer important refuge and habitat for numerous species that rely on the riparian areas for their existence. Of the numerous vertebrate species that are known to occur within Kittitas County, over half use the riparian corridors as their primary habitat. Species that use riparian areas for some portion of their life cycle represent up to 80 percent of all species (Kagen et al., 2000; Morrison et al., 1992).

In addition to riparian corridors, cliffs, steep slope areas, and ravines can add potential corridors for species movement and in some cases can also effectively add to the width of relatively narrow riparian areas adjacent to them. These non-riparian corridors are essential to connecting some of the shrub-steppe habitat areas in the eastern portion of the county (Morrison et al., 1992).

In providing for adequate distribution of habitat within and across landscapes, a clear understanding of the elements that change the landscape is necessary. Some of these elements include loss of vegetative cover, erosion, and the alteration or disruption of a water supply, to name just a few. Managing a natural landscape for both human presence and ecological objectives depends on keeping human activity inversely proportional to the sensitivity of landscape elements, protecting the areas of major animal movement, and maintaining natural disturbance regimes. Managing a remnant of a natural landscape focuses on these same three objectives, plus two more: minimizing isolation and minimizing human impacts on the surrounding matrix (Morrison et al., 1992).

1.2.1 Kittitas County Vegetative Matrix

The available vegetative habitat within Kittitas County is extremely diverse and offers habitat for a wide variety of vertebrate species. This habitat ranges from the permanent snow and alpine areas in the upper Cascades to the arid steppe regions in the eastern half of the County. Although much of this varying landscape and its wide range of species habitat still survive to a significant degree, much is threatened by nonnative plant species or by incompatible land uses. Johnson and O'Neil (2003) provide detailed information regarding the description, extent, condition, and species of major habitat vegetation classifications in this area. Habitat vegetation for Kittitas County includes the following.

Alpine Grasslands and Shrublands

Alpine grassland and shrubland habitat occurs above the upper tree line in the mountains, or a short distance below it. Typically, it occurs adjacent to or in a mosaic with subalpine parkland. The vegetation classifications within this habitat include alpine and permanent snow/ice. This habitat is naturally very limited in extent. Most of this habitat is still in good condition and is dominated by native species. Some vertebrate species that are known to occur within this vegetation class include:

Mammals		
broad-footed mole	northern pocket gopher	coyote
American pika	deer mouse	red fox
yellow-pine chipmunk	bushy-tailed woodrat	black bear
yellow-bellied marmot	southern red-backed	American marten
hoary marmot	vole	long-tailed weasel
Olympic marmot	heather vole	mountain lion
Belding's ground squirrel	long-tailed vole	bobcat
Columbian ground squirrel	creeping vole	black-tailed deer
Cascade goldenmantled ground	water vole	mule deer
Douglas' squirrel	western jumping mouse	mountain goat
	Pacific jumping mouse	bighorn sheep
Amphibians and Reptiles		
long-toed salamander	Pacific chorus (tree) frog	common garter snake
western toad		
Birds		
turkey vulture	horned lark	Nashville warbler
mallard	violet-green swallow	yellow-rumped warbler
green-winged teal	black-capped	MacGillivray's warbler
Barrow's goldeneye	chickadee	Wilson's warbler
northern harrier	mountain chickadee	chipping sparrow
sharp-shinned hawk	chestnut-back	vesper sparrow
Cooper's hawk	chickadee	savannah sparrow
golden eagle	red-breasted nuthatch	fox sparrow
American kestrel	canyon wren	song sparrow
prairie falcon	winter wren	white-crowned
white-tailed ptarmigan	golden-crowned	sparrow
dusky grouse	kinglet	dark-eyed junco
spotted sandpiper	ruby-crowned kinglet	brewer's blackbird
great horned owl	hermit thrush	pine grosbeak
rufous hummingbird	varied thrush	red crossbill
gray jay	European starling	pine siskin
Clark's nutcracker	American pipit	evening grosbeak
common raven	cedar waxwing	

Subalpine Parkland

The subalpine parkland habitat lies above the mixed montane conifer forest or lodgepole pine forest habitats and below the alpine grassland and shrubland habitats, between 5,000 and 8,000 feet elevation. The vegetation zones that fall within this category include alpine parkland and subalpine fir. Wind blasting by ice and snow plays a critical role in this zone. Shifts in climate factors, such as drought, snow pack depth, or duration either allows tree invasions into meadows and shrublands or retard tree growth. Land uses within this zone include recreation and grazing. This habitat is generally considered fairly stable with some possible future impacts associated with global warming. Some species that are known to occur within this vegetation class include:

Mammals		
masked shrew	American pika	bushy-tailed woodrat
Trowbridge's shrew	snowshoe hare	heather vole
shrew-mole	Townsend's chipmunk	long-tailed vole
Yuma myotis	yellow-bellied marmot	creeping vole
little brown myotis	hoary marmot	Pacific jumping
long-legged myotis	golden-mantled ground squirrel	mouse
long-eared myotis	northern pocket gopher	common porcupine
Townsend's big-eared bat	American beaver	coyote
American marten	deer mouse	red fox

ermine long-tailed weasel mule deer	mountain lion bobcat	mountain goat bighorn sheep
Amphibians and Reptiles		
common garter snake northwestern salamander long-toed salamander	Cope's giant salamander Pacific giant salamander rough-skinned newt western toad	Pacific chorus (tree) frog Cascades frog Columbia spotted frog
Birds		
turkey vulture mallard Barrow's goldeneye osprey northern harrier sharp-shinned hawk Cooper's hawk northern goshawk golden eagle American kestrel prairie falcon ruffed grouse spruce grouse dusky grouse spotted sandpiper band-tailed pigeon great horned owl northern pygmy owl vaux's swift black-chinned hummingbird calliope hummingbird rufous hummingbird Lewis's woodpecker Williamson's sapsucker red-naped sapsucker three-toed woodpecker black-backed woodpecker	northern flicker olive-sided flycatcher dusky flycatcher gray jay Steller's jay Clark's nutcracker black-billed magpie American crow common raven horned lark violet-green swallow barn swallow black-capped chickadee mountain chickadee red-breasted nuthatch canyon wren winter wren American dipper golden-crowned kinglet ruby-crowned kinglet western bluebird Townsend's solitaire Swainson's thrush hermit thrush American robin varied thrush	American pipit cedar waxwing orange-crowned warbler Nashville warbler yellow-rumped warbler Townsend's warbler hermit warbler MacGillivray's warbler western tanager chipping sparrow vesper sparrow savannah sparrow fox sparrow song sparrow Lincoln's sparrow golden-crowned sparrow dark-eyed junco brown-headed cowbird pine grosbeak purple finch Cassin's finch white-winged crossbill pine siskin evening grosbeak European starling

Montane Mixed Conifer Forest

The montane mixed conifer forest habitat is typified by a moderate-to-deep winter snow pack that persists for 3 to 9 months. On the east side of the Cascade Range it occupies a narrow zone of about 1,500 vertical feet. The topography is generally mountainous. The vegetation classifications within this habitat include mountain hemlock, interior Douglas fir, grand fir and subalpine fir. The typical land use is forestry or recreation. Most of this vegetation type is found on public lands managed for timber, and much of it has been harvested in a dispersed-patch pattern. There has probably been little or no decline in the extent of this type over time. Large areas of this habitat are relatively undisturbed by humans and include significant old-growth stands, while other areas have been extensively affected by logging, especially clear-cut areas. Some species that are known to occur within this vegetation class include:

Mammals		
masked shrew vagrant shrew montane shrew Trowbridge's shrew shrew-mole coast mole	American pika snowshoe hare mountain beaver yellow-pine chipmunk Townsend's chipmunk golden-mantled	long-tailed vole creeping vole Pacific jumping mouse common porcupine coyote black bear

California myotis	ground squirrel	American marten
Yuma myotis	Douglas' squirrel	ermine
little brown myotis	northern flying squirrel	long-tailed weasel
long-legged myotis	northern pocket	mink
fringed myotis	gopher	mountain lion
long-eared myotis	American beaver	bobcat
silver-haired bat	deer mouse	mule deer
big brown bat	bushy-tailed woodrat	white-tailed deer
hoary bat	heather vole	mountain goat
Townsend's big-eared bat	montane vole	
Amphibians and Reptiles		
northwestern salamander	Cascade torrent salamander	ensatina
long-toed salamander	rough-skinned newt	California slender
Pacific giant salamander	Dunn's salamander	Cascades frog
Olympic torrent salamander	Larch Mountain salamander	salamander
Columbia torrent salamander	Van Dyke's salamander	tailed frog
southern torrent salamander	western red-backed salamander	western toad
clouded salamander	red-legged frog	Pacific chorus (tree)
Siskiyou mountains salamander	Del Norte salamander	Oregon spotted frog
common garter snake	rubber boa	Columbia spotted frog
western skink	northern alligator lizard	
Birds		
turkey vulture	black-backed woodpecker	varied thrush
Barrow's goldeneye	northern flicker	European starling
osprey	pileated woodpecker	cedar waxwing
bald eagle	olive-sided flycatcher	orange-crowned warbler
sharp-shinned hawk	western wood-pewee	Nashville warbler
Cooper's hawk	willow flycatcher	yellow-rumped warbler
northern goshawk	Hammond's flycatcher	Townsend's warbler
red-tailed hawk	dusky flycatcher	hermit warbler
golden eagle	Pacific-slope flycatcher	MacGillivray's warbler
American kestrel	warbling vireo	Wilson's warbler
prairie falcon	gray jay	western tanager
ruffed grouse	Steller's jay	chipping sparrow
dusky grouse	Clark's nutcracker	fox sparrow
killdeer	common raven	song sparrow
band-tailed pigeon	tree swallow	white-crowned
flammulated owl	violet-green swallow	sparrow
great horned owl	northern winged swallow	dark-eyed junco
northern pygmy-owl	barn swallow	brown-headed cowbird
northern spotted owl	mountain chickadee	pine grosbeak
long-eared owl	chestnut-backed chickadee	purple finch
northern saw-whet owl	red-breasted nuthatch	Cassin's finch
common nighthawk	brown creeper	red crossbill
Vaux's swift	canyon wren	pine siskin
rufous hummingbird	house wren	evening grosbeak
Lewis's woodpecker	mountain bluebird	American robin
Williamson's sapsucker	Townsend's solitaire	
red-naped sapsucker	Swainson's thrush	
red-breasted sapsucker	hermit thrush	
hairy woodpecker	golden-crowned kinglet	
three-toed woodpecker	ruby-crowned kinglet	

Eastside Mixed Conifer Forest

The eastside mixed conifer forest habitat is primarily mid-montane, with an elevation range between 3,000 and 5,500 feet. Eastside mixed conifer habitats are montane forests and woodlands. This habitat contains various vegetation classifications including interior Douglas fir, ponderosa pine, whitebark pine, grand fir, western hemlock and subalpine fir. Stand canopy structure is generally diverse, although single-layer forest canopies are currently more common than multilayered forests with snags and large woody debris. The tree layer varies from closed forests to more open-canopy forests or woodlands. This habitat may include very open stands. The undergrowth is complex and diverse. Tall shrubs, low shrubs, forbs, or any combination may dominate stands. Deciduous shrubs typify shrub layers. Prolonged canopy closure may lead to development of sparsely vegetated undergrowth. Roads, timber harvest, periodic grazing, and fire suppression have compromised these forests. Even though this habitat is more extensive than it was prior to 1900, natural processes and functions have been modified enough to alter its natural status as functional habitat for many species. Some species known to occur within this vegetation class include:

Mammals		
masked shrew	snowshoe hare	Pacific jumping mouse
vagrant shrew	yellow-pine chipmunk	common porcupine
montane shrew	Townsend's chipmunk	coyote
Trowbridge's shrew	yellow-bellied marmot	black bear
shrew-mole	golden-mantled ground squirrel	American marten
coast mole	Douglas' squirrel	ermine
California myotis	northern flying squirrel	long-tailed weasel
Yuma myotis	northern pocket	mink
little brown myotis	gopher	American badger
long-legged myotis	American beaver	striped skunk
long-eared myotis	deer mouse	mountain lion
silver-haired bat	bushy-tailed woodrat	bobcat
big brown bat	heather vole	mule deer
hoary bat	montane vole	white-tailed deer
Townsend's big-eared bat	long-tailed vole	bighorn sheep
Amphibians and Reptiles		
northwestern salamander	tailed frog	red-legged frog
long-toed salamander	great basin spadefoot	Cascades frog
Pacific giant salamander	western toad	Columbia spotted frog
rough-skinned newt	Pacific chorus (tree) frog	
Birds		
turkey vulture	northern rough-winged swallow	Nashville warbler
osprey	American kestrel	yellow-rumped warbler
bald eagle	prairie falcon	western screech-owl
sharp-shinned hawk	ruffed grouse	great horned owl
Cooper's hawk	dusky grouse	northern pygmy-owl
northern goshawk	wild turkey	*spotted owl
red-tailed hawk	killdeer	barred owl
golden eagle	band-tailed pigeon	long-eared owl
white-throated swift	flammulated owl	northern saw-whet owl
rufous hummingbird	bank swallow	common nighthawk
Lewis's woodpecker	cliff swallow	black-throated gray warbler
Williamson's sapsucker	barn swallow	Townsend's warbler
red-naped sapsucker	mountain chickadee	hermit warbler
hairy woodpecker	chestnut-backed	MacGillivray's warbler
white-headed	chickadee	Wilson's warbler
woodpecker	red-breasted nuthatch	western tanager
three-toed woodpecker	brown creeper	spotted towhee
black-backed woodpecker	canyon wren	chipping sparrow
northern flicker	house wren	fox sparrow
pileated woodpecker	winter wren	song sparrow
olive-sided flycatcher	golden-crowned kinglet	white-crowned sparrow
western wood-pewee	ruby-crowned kinglet	dark-eyed junco
willow flycatcher	western bluebird	black-headed grosbeak
Hammond's flycatcher	mountain bluebird	pine grosbeak
dusky flycatcher	Townsend's solitaire	purple finch

warbling vireo	Swainson's thrush	Cassin's finch
gray jay	hermit thrush	red crossbill
Steller's jay	American robin	pine siskin
Clark's nutcracker	varied thrush	American goldfinch
common raven	European starling	evening grosbeak
violet-green swallow	orange-crowned warbler	

Ponderosa Pine Forest and Woodlands

The ponderosa pine forest habitat generally occurs on the driest sites supporting conifers. It is widespread and variable, appearing on moderate-to-steep slopes in canyons, foothills, and on plateaus or plains near mountains. This habitat represents the lower tree line zone, forming a transition with the eastside mixed conifer forest habitat. Tall ponderosa pine over Oregon white oak trees form stands along part of the east Cascades. Oregon white oak dominates limited areas of open woodlands. This habitat generally is degraded because of increased numbers of exotic plants and decreased native bunchgrasses. One third of Pacific Northwest Oregon white oak, ponderosa pine, and dry Douglas fir or grand fir community types listed in the National Vegetation Classification are considered imperiled or critically imperiled. Some species known to occur within this vegetation class include:

Mammals		
masked shrew	snowshoe hare	common porcupine
vagrant shrew	least chipmunk	coyote
Trowbridge's shrew	yellow-pine chipmunk	black bear
coast mole	yellow-bellied marmot	ermine
California myotis	golden-mantled ground squirrel	long-tailed weasel
Yuma myotis	*western gray squirrel	mink
little brown myotis	Douglas' squirrel	American badger
long-legged myotis	northern flying squirrel	striped skunk
long-eared myotis	northern pocket	mountain lion
silver-haired bat	gopher	bobcat
big brown bat	American beaver	mule deer
hoary bat	deer mouse	white-tailed deer
spotted bat	montane vole	bighorn sheep
Townsend's big-eared bat	long-tailed vole	
pallid bat	Pacific jumping mouse	
Amphibians and Reptiles		
long-toed salamander	painted turtle	sharptail snake
rough-skinned newt	northern alligator lizard	ringneck snake
Larch Mountain salamander	southern alligator	night snake
ensatina	lizard	striped whipsnake
tailed frog	short-horned lizard	western terrestrial garter snake
Great Basin spadefoot	sagebrush lizard	northwestern garter snake
western toad	western fence lizard	common garter snake
Pacific tree frog	western skink	western rattlesnake
Columbia spotted frog	rubber boa	
bullfrog	racer	
Birds		
turkey vulture	California quail	red-naped sapsucker
osprey	killdeer	hairy woodpecker
bald eagle	band-tailed pigeon	white-headed
sharp-shinned hawk	mourning dove	woodpecker
Cooper's hawk	flammulated owl	three-toed woodpecker
northern goshawk	western screech-owl	black-backed
red-tailed hawk	great horned owl	woodpecker
golden eagle	northern pygmy-owl	northern flicker
American kestrel	*spotted owl	pileated woodpecker

merlin	barred owl	olive-sided flycatcher
prairie falcon	long-eared owl	western wood-pewee
ring-necked pheasant	northern saw-whet owl	willow flycatcher
ruffed grouse	common nighthawk	Hammond's flycatcher
dusky grouse	rufous hummingbird	gray flycatcher
wild turkey	Lewis's woodpecker	Townsend's warbler
dusky flycatcher	brown creeper	Macgillivray's warbler
say's phoebe	rock wren	Wilson's warbler
ash-throated flycatcher	canyon wren	western tanager
western kingbird	house wren	spotted towhee
eastern kingbird	golden-crowned kinglet	chipping sparrow
warbling vireo	ruby-crowned kinglet	lark sparrow
gray jay	western bluebird	fox sparrow
Steller's jay	mountain bluebird	song sparrow
Clark's nutcracker	Townsend's solitaire	white-crowned sparrow
black-billed magpie	hermit thrush	dark-eyed junco
common raven	American robin	black-headed grosbeak
violet-green swallow	varied thrush	lazuli bunting
northern rough-winged swallow	European starling	purple finch
cliff swallow	cedar waxwing	Cassin's finch
barn swallow	orange-crowned warbler	house finch
mountain chickadee	Nashville warbler	red crossbill
red-breasted nuthatch	yellow-rumped warbler	pine siskin
white-breasted nuthatch	black-throated gray warbler	American goldfinch
pygmy nuthatch	Williamson's sapsucker	Evening grosbeak

Eastside Riparian – Wetlands

Riparian habitats appear along perennial and intermittent rivers and streams. This habitat also appears in impounded wetlands and along lakes and ponds. The riparian and wetland areas usually are in fairly narrow bands along valley streams. The most typical stand is limited to 100 to 200 feet from streams. Approximately 40 percent of riparian shrublands occurred above 3,280 feet in elevation prior to 1900; now nearly 80 percent is found above that elevation. This change reflects losses to agricultural development, roads, and dams. Riparian habitat is located within all vegetation zones. Some species known to occur within the riparian areas include:

Mammals		
masked shrew	long-eared myotis	yellow-pine chipmunk
vagrant shrew	silver-haired bat	yellow-bellied marmot
montane shrew	western pipistrelle	northern flying squirrel
Trowbridge's shrew	big brown bat	northern pocket gopher
shrew-mole	hoary bat	American beaver
coast mole	spotted bat	western harvest mouse
California myotis	Townsend's big-eared bat	deer mouse
Uuma myotis	pallid bat	American badger
little brown myotis	snowshoe hare	mountain lion
long-legged myotis	common porcupine	bobcat
bushy-tailed woodrat	coyote	mule deer
heather vole	black bear	white-tailed deer
montane vole	raccoon	
long-tailed vole	American marten	
creeping vole	long-tailed weasel	
muskrat	mink	
Pacific jumping mouse	white-tailed jackrabbit	
Amphibians and Reptiles		
northwestern salamander	Pacific tree frog	rubber boa
long-toed salamander	red-legged frog	racer

rough-skinned newt	Cascades frog	sharptail snake
tailed frog	Columbia spotted frog	western terrestrial garter snake
Great Basin spadefoot	bullfrog	common garter snake
western toad	painted turtle	western rattlesnake
Woodhouse's toad	northern alligator lizard	
Birds		
pied-billed grebe	California quail	Lincoln's sparrow
great blue heron	sandhill crane	white-crowned sparrow
black-crowned night heron	killdeer	golden-crowned sparrow
wood duck	spotted sandpiper	olive-sided flycatcher
mallard	band-tailed pigeon	western wood-pewee
green-winged teal	mourning dove	willow flycatcher
ring-necked duck	barn owl	dusky flycatcher
harlequin duck	flammulated owl	Say's phoebe
hooded merganser	western screech-owl	eastern kingbird
common merganser	great horned owl	Cassin's vireo
osprey	northern pygmy-owl	warbling vireo
bald eagle	barred owl	gray jay
northern harrier	long-eared owl	Steller's jay
Cooper's hawk	northern saw-whet owl	black-billed magpie
northern goshawk	common nighthawk	common raven
Swainson's hawk	calliope hummingbird	tree swallow
red-tailed hawk	rufous hummingbird	violet-green swallow
golden eagle	belted kingfisher	northern roughwinged swallow
American kestrel	Lewis's woodpecker	bank swallow
prairie falcon	red-naped sapsucker	cliff swallow
chukar	red-breasted sapsucker	barn swallow
ring-necked pheasant	downy woodpecker	black-capped
ruffed grouse	hairy woodpecker	chickadee
dusky grouse	three-toed woodpecker	mountain chickadee
wild turkey	black-backed woodpecker	red-breasted nuthatch
brown creeper	northern flicker	white-breasted nuthatch
canyon wren	pileated woodpecker	pygmy nuthatch
house wren	orange-crowned warbler	dark-eyed junco
winter wren	Nashville warbler	black-headed
American dipper	yellow warbler	grosbeak
golden-crowned kinglet	yellow-rumped warbler	lazuli bunting
ruby-crowned kinglet	MacGillivray's warbler	bobolink
western bluebird	common yellowthroat	red-winged blackbird
mountain bluebird	Wilson's warbler	brewer's blackbird
Townsend's solitaire	yellow-breasted chat	brown-headed
veery	western tanager	cowbird
Swainson's thrush	spotted towhee	Bullock's oriole
hermit thrush	American tree sparrow	Cassin's finch
American robin	chipping sparrow	house finch
gray catbird	savannah sparrow	pine siskin
European starling	fox sparrow	American goldfinch
cedar waxwing	song sparrow	evening grosbeak

Shrub-Steppe

Shrub-steppe habitat can appear in large landscape patches. Three-tip sage, bitterbrush, and central arid steppe are three vegetation classifications that fall into this broad vegetation class. Livestock grazing is the primary land use in the shrub-steppe, although much has been converted to irrigation or dryland agriculture. Large areas also occur within the Department of Defense’s Yakima Training Center. Burrowing animals and their predators likely play important roles in creating small scale patch patterns. The shrub-steppe habitat has seen an increase in exotic plants and a decrease in native bunchgrasses.

More than half of the Pacific Northwest shrub-steppe habitat community types listed in the National Vegetation Classification are considered imperiled or critically imperiled. Some species that are known to occur within this vegetation class include:

Mammals		
California myotis	pallid bat	bushy-tailed woodrat
Yuma myotis	black-tailed jackrabbit	montane vole
little brown myotis	least chipmunk	sagebrush vole
long-legged myotis	Townsend's ground squirrel	coyote
long-eared myotis	Great Basin pocket mouse	mule deer
big brown bat	western harvest mouse	
spotted bat	deer mouse	
Townsend's big-eared bat	northern grasshopper mouse	
Amphibians and Reptiles		
rough-skinned newt	short-horned lizard	ringneck snake
Great Basin spadefoot	sagebrush lizard	night snake
western toad	western fence lizard	striped whipsnake
Woodhouse's toad	side-blotched lizard	western terrestrial garter snake
Columbia spotted frog	western skink	common garter snake
bullfrog	rubber boa	western rattlesnake
painted turtle	racer	
Birds		
turkey vulture	long-billed curlew	rock wren
mallard	rock dove	canyon wren
Barrow's goldeneye	mourning dove	Townsend's solitaire
osprey	barn owl	American robin
bald eagle	great horned owl	sage thrasher
northern harrier	burrowing owl	European starling
sharp-shinned hawk	long-eared owl	Nashville warbler
Cooper's hawk	short-eared owl	chipping sparrow
northern goshawk	common nighthawk	Brewer's sparrow
Swainson's hawk	common poorwill	vesper sparrow
red-tailed hawk	white-throated swift	lark sparrow
ferruginous hawk	black-chinned hummingbird	sage sparrow
golden eagle	northern flicker	savannah sparrow
American kestrel	gray flycatcher	grasshopper sparrow
prairie falcon	Say's phoebe	white-crowned
chukar	western kingbird	sparrow
gray partridge	eastern kingbird	western meadowlark
ring-necked pheasant	loggerhead shrike	Brewer's blackbird
greater sage grouse	black-billed magpie	brown-headed cowbird
dusky grouse	common raven	American goldfinch
California quail	horned lark	
killdeer	northern rough-winged swallow	
black-necked stilt	bank swallow	
American avocet	cliff swallow	
spotted sandpiper	barn swallow	

Upland Aspen Forest Habitat

This habitat generally occurs on well-drained mountain slopes or canyon walls that have moisture. Rockfalls, talus slopes, or stony north slopes are often typical sites. These sites may occur in steppe habitat on moist microsites; however, they are not associated with streams, ponds, or wetlands. The habitats are generally found from 2,000 to 9,500 feet in elevation. With fire suppression and change in fire regime, aspen forest habitat is less common than prior to 1900. None of the five Pacific Northwest upland quaking aspen community types in the National Vegetation Classification are considered imperiled. Some species that are known to occur within this vegetation class include:

Mammals		
Preble's shrew	white-tailed jackrabbit	white-tailed deer
vagrant shrew	Nuttall's mountain cottontail	bushy-tailed woodrat
montane shrew	snowshoe hare	Belding's ground squirrel
Trowbridge's shrew	coyote	Pacific jumping mouse
shrew-mole	gray wolf	deer mouse
coast mole	grizzly bear	yellow-bellied marmot
California myotis	ermine	northern flying squirrel
little brown myotis	long-tailed weasel	northern pocket gopher
big brown bat	mink	American beaver
hoary bat	American badger	western harvest mouse
creeping vole	mountain lion	common porcupine
montane vole	bobcat	least chipmunk
long-tailed vole	Rocky Mountain elk	
southern red-backed vole	mule deer	
Amphibians and Reptiles		
Columbia spotted frog	Pacific tree frog	western terrestrial garter snake
long-toed salamander	northern alligator lizard	common garter snake
western toad	rubber boa	western rattlesnake
Birds		
Turkey vulture	flammulated owl	chipping sparrow
Sharp-shinned hawk	western screech-owl	song sparrow
Cooper's hawk	great horned owl	White-crowned sparrow
northern goshawk	long-eared owl	dark-eyed junco
red-tailed hawk	northern saw-whet owl	Cassin's vireo
golden eagle	common nighthawk	warbling vireo
American kestrel	Williamson's sapsucker	mountain chickadee
peregrine falcon	red-naped sapsucker	white-breasted nuthatch
prairie falcon	downy woodpecker	black-headed grosbeak
ruffed grouse	hairy woodpecker	brewer's blackbird
dusky grouse	three-toed woodpecker	brown-headed cowbird
spruce grouse	black-backed woodpecker	Cassin's finch
wild turkey	northern flicker	house finch
brown creeper	pileated woodpecker	pine siskin
house wren	tree swallow	American goldfinch
ruby-crowned kinglet	violet-green swallow	red crossbill
mountain bluebird	bank swallow	Vaux's swift
Townsend's solitaire	cliff swallow	lazuli bunting
Swainson's thrush	barn swallow	orange-crowned warbler
American robin	American crow	Nashville warbler
European starling	common raven	yellow warbler
cedar waxwing	Clark's nutcracker	yellow-rumped warbler
calliope hummingbird	dusky flycatcher	MacGillivray's warbler
rufous hummingbird	western wood-pewee	Townsend's warbler
		Western tanager

Lodgepole Pine Forest and Woodland Habitat

This habitat is located mostly at mid- to higher elevations (3,000 to 9,000 feet). These environments can be cold and relatively dry with regular and persistent snow-pack. The tree layer is typically dominated by lodgepole pine; however, other associated montane species such as grand fir, western larch, Douglas fir, mountain hemlock, Engelmann spruce, and ponderosa pine can also be found in these habitats. The extent of lodgepole pine cover type in Washington has changed little since 1900 and may have even expanded its historical extent. Only 5 percent of the Pacific Northwest lodgepole pine associations, listed in the National Vegetation Classification, are considered imperiled. Some species that are known to occur within this vegetation class include:

Mammals		
masked shrew	golden-mantled ground squirrel	black bear
vagrant shrew	Columbia ground squirrel	grizzly bear
montane shrew	red squirrel	ermine
Trowbridge's shrew	Douglas' squirrel	long-tailed weasel
coast mole	northern flying squirrel	American marten
broad-footed mole	northern pocket gopher	American badger
California myotis	American beaver	gray wolf
Yuma myotis	deer mouse	Canada lynx
little brown myotis	bushy-tailed woodrat	mountain lion
long-legged myotis	southern red-bellied vole	bobcat
long-eared myotis	western red-bellied vole	mule deer
silver-haired bat	heather vole	white-tailed deer
big brown bat	long-tailed vole	bighorn sheep
hoary bat	creeping vole	mink
Townsend's big-eared bat	northern bog lemming	pronghorn antelope
snowshoe hare	Pacific jumping mouse	black-tailed deer
yellow-pine chipmunk	common porcupine	Rocky Mountain elk
yellow-bellied marmot	coyote	
Amphibians and Reptiles		
long-toed salamander	Oregon spotted frog	racer
rough-skinned newt	northern alligator lizard	night snake
tailed frog	short-horned lizard	gopher
Great Basin spadefoot	sagebrush lizard	western terrestrial garter snake
western toad	western fence lizard	common garter snake
Pacific tree frog	western skink	western rattlesnake
Columbia spotted frog	rubber boa	
Birds		
turkey vulture	rufous hummingbird	hermit thrush
osprey	calliope hummingbird	American robin
bald eagle	Vaux’s swift	European starling
sharp-shinned hawk	black swift	cedar waxwing
Cooper's hawk	tree swallow	orange-crowned warbler
northern goshawk	violet-green swallow	Nashville warbler
red-tailed hawk	bank swallow	yellow-rumped warbler
golden eagle	cliff swallow	MacGillivray's warbler
American kestrel	barn swallow	Townsend’s warbler
merlin	northern rough-legged swallow	western tanager
peregrine falcon	gray jay	white-headed woodpecker
prairie falcon	Steller’s jay	three-toed woodpecker
ruffed grouse	Clark’s nutcracker	black-backed
dusky grouse	American crow	woodpecker
spruce grouse	common raven	northern flicker
wild turkey	mountain chickadee	pileated woodpecker
flammulated owl	red-breasted nuthatch	Williamson’s woodpecker
western screech-owl	brown creeper	chipping sparrow
great horned owl	canyon wren	fox sparrow
northern pygmy-owl	golden-crowned kinglet	white-crowned sparrow
northern spotted owl	ruby-crowned kinglet	dark-eyed junco
barred owl	mountain bluebird	brown-headed cowbird
long-eared owl	Townsend’s solitaire	pine grosbeak
northern saw-whet owl	olive-sided flycatcher	Cassin’s finch
great gray owl	gray flycatcher	red crossbill

mourning dove	dusky flycatcher	white-winged crossbill
common nighthawk	red-naped sapsucker	pine siskin
common poorwill	hairy woodpecker	evening grosbeak

Dwarf Shrub-steppe

This habitat appears on sites with little soil development that often has extensive areas of exposed rock, gravel, or compacted soil and is often associated with flats, plateaus, or gentle slopes. This habitat is found across a wide range of elevations from 500 feet to 7,000 feet. Vegetative communities include low sagebrush, shrubby buckwheat species, and Sandberg bluegrass with higher productive sites containing taller bluebunch wheatgrass or Idaho fescue. Low sagebrush cover types are as abundant now as they were prior to 1900. Twenty percent of the Pacific Northwest dwarf shrub-steppe community types are listed in the National Vegetation Classification as imperiled or critically imperiled due to extensive livestock grazing, recreational use, and exotic plant invasions. Some species that are known to occur within this vegetation class include:

Mammals		
Preble's shrew	least chipmunk	northern grasshopper mouse
Merriam's shrew	yellow-bellied marmot	canyon mouse
California myotis	Washington ground squirrel	montane vole
western small-footed myotis	Belding's ground squirrel	sagebrush vole
Yuma myotis	golden-mantled ground squirrel	coyote
little brown myotis	Columbia ground squirrel	ermine
long-legged myotis	Townsend's ground squirrel	long-tailed weasel
long-eared myotis	Merriam's ground squirrel	American marten
western pipistrelle	Piute ground squirrel	American badger
big brown bat	northern pocket gopher	bobcat
spotted bat	Great Basin pocket mouse	mule deer
Nuttall's cottontail	deer mouse	white-tailed deer
white-tailed jackrabbit	bushy-tailed woodrat	bighorn sheep
black-tailed jackrabbit	desert woodrat	pronghorn antelope
Amphibians and Reptiles		
long-toed salamander	desert horned lizard	racer
tiger salamandert	long-nosed leopard lizard	night snake
Great Basin spadefoot	short-horned lizard	western whiptail
Woodhouse's toad	sagebrush lizard	western terrestrial garter snake
western toad	western fence lizard	common garter snake
Pacific tree frog	side-blotched lizard	western rattlesnake
northern leopard frog	rubber boa	gopher snake
Birds		
turkey vulture	greater yellowlegs	northern rough-winged swallow
Canada goose	lesser yellowlegs	cliff swallow
bald eagle	solitary sandpiper	barn swallow
sharp-shinned hawk	willet	rock wren
Cooper's hawk	long-billed curlew	canyon wren
northern harrier	mourning dove	mountain bluebird
red-tailed hawk	barn owl	American robin
Swainson's hawk	burrowing owl	sage thrasher
ferruginous hawk	great horned owl	European starling
rough-legged hawk	short-eared owl	chipping sparrow
golden eagle	long-eared owl	vesper sparrow
American kestrel	common nighthawk	lark sparrow
merlin	common poorwill	Brewer's sparrow
peregrine falcon	white-throated swift	black-throated sparrow
prairie falcon	black-chinned hummingbird	sage sparrow
chukar	Say's phoebe	grasshopper sparrow

flammulated owl	loggerhead shrike	white-crowned sparrow
western screech-owl	northern shrike	savannah sparrow
great horned owl	eastern kingbird	snow bunting
northern pygmy-owl	western kingbird	western meadowlark
gray partridge	black-billed magpie	Brewer’s blackbird
ring-necked pheasant	American crow	American goldfinch
sage grouse	common raven	brown-headed cowbird
sharp-tailed grouse	horned lark	
killdeer	bank swallow	

Desert Playa and Salt Scrub Shrublands

This habitat generally lies at the lowest elevations in hydrologic basins in the driest regions of the Pacific Northwest. Elevations range from 500 to 5,500 feet in Washington. The structural and compositional variation in these habitats is related to changes in salinity and fluctuations in the water table. Areas with little vegetation have highly alkaline and saline soils, are poorly drained or irregularly flooded. Desert playa habitat is less abundant than prior to 1900, due to livestock grazing. Agricultural use of these areas has not been a problem due to poor soil conditions. One-third of all desert playa habitat in the Pacific Northwest listed in the National Vegetation Classification are considered imperiled or critically imperiled. Some species that are known to occur within this vegetation class include:

Mammals		
Vagrant shrew	least chipmunk	northern grasshopper mouse
Merriam’s shrew	yellow-bellied marmot	desert woodrat
California myotis	white-tailed antelope squirrel	bushy-tailed woodrat
western small-footed myotis	Townsend’s ground squirrel	montane vole
Yuma myotis	Merriam’s ground squirrel	coyote
little brown myotis	Piute ground squirrel	mink
long-legged myotis	northern pocket gopher	long-tailed weasel
long-eared myotis	Great Basin pocket mouse	mule deer
western pipistrelle	little pocket mouse	bobcat
big brown bat	dark kangaroo mouse	bighorn sheep
spotted bat	Ord’s kangaroo rat	pronghorn antelope
pallid bat	chisel-toothed kangaroo rat	
Nuttall’s cottontail	deer mouse	
black-tailed jackrabbit	canyon mouse	
Amphibians and Reptiles		
Great Basin spadefoot	long-nosed leopard lizard	racer
Woodhouse’s toad	short-horned lizard	night snake
western toad	sagebrush lizard	western whiptail
Pacific tree frog	side-blotched lizard	western terrestrial garter snake
bull frog	western ground snake	common garter snake
desert horned lizard	striped whipsnake	western rattlesnake
		gopher snake
Birds		
great egret	American avocet	western kingbird
snowy egret	greater yellowlegs	loggerhead shrike
white-faced ibis	lesser yellowlegs	northern shrike
turkey vulture	solitary sandpiper	northern rough-winged swallow
black duck	willet	cliff swallow
mallard	long-billed curlew	barn swallow
northern pintail	marbled godwit	rock wren
bald eagle	sanderling	horned lark
sharp-shinned hawk	western sandpiper	mountain bluebird
northern harrier	least sandpiper	American robin
red-tailed hawk	Baird’s sandpiper	sage thrasher

Swainson's hawk	dunlin	European starling
ferruginous hawk	long-billed dowitcher	American pipit
rough-legged hawk	Wilson's phalarope	Brewer's sparrow
golden eagle	Franklin's gull	black-throated sparrow
American kestrel	mourning dove	sage sparrow
merlin	barn owl	white-crowned sparrow
peregrine falcon	burrowing owl	Brewer's blackbird
prairie falcon	great horned owl	American goldfinch
greater sage grouse	short-eared owl	brown-headed cowbird
sharp-tailed grouse	common nighthawk	black-billed magpie
black-bellied plover	common poorwill	American crow
snowy plover	white-throated swift	common raven
semipalmated plover	black-chinned hummingbird	
killdeer	Say's phoebe	
black-necked stilt	eastern kingbird	

__Eastside Grasslands__

This habitat develops in hot, dry climates in the Pacific Northwest. The grassland habitat is typically upland vegetation, but it may include riparian bottomlands dominated by non-native grasses. This habitat is typically found at elevations ranging from 500 to 6,000 feet in elevation. Bluebunch wheatgrass and Idaho fescue are the characteristic native bunchgrasses of this habitat and either or both species can be dominant. Grassland habitats have seen drastic declines since the early 1900s with agriculture, grazing, and introduction of exotic species contributing to that decline. Fifty percent of plant associations recognized as components of Eastside Grasslands habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled. Some species that are known to occur within this vegetation class include:

Mammals		
Preble's shrew	Nuttall's cottontail	long-tailed vole
vagrant shrew	white-tailed jackrabbit	western jumping mouse
Merriam's shrew	black-tailed jackrabbit	coyote
coast mole	yellow-bellied marmot	black bear
fringed myotis	Washington ground squirrel	grizzly bear
western small-footed myotis	Belding's ground squirrel	ermine
California myotis	golden-mantled ground squirrel	long-tailed weasel
Yuma myotis	Columbian ground squirrel	American badger
little brown myotis	northern pocket gopher	bobcat
long-legged myotis	Townsend's pocket gopher	mule deer
long-eared myotis	Great Basin's pocket mouse	white-tailed deer
silver-haired bat	Ord's kangaroo rat	bighorn sheep
big brown bat	California kangaroo rat	mink
hoary bat	deer mouse	pronghorn antelope
Townsend's big-eared bat	western harvest mouse	Rocky Mountain elk
western pipistrelle	northern grasshopper mouse	
pallid bat	montane vole	
spotted bat	sagebrush vole	
Amphibians and Reptiles		
long-toed salamander	northern leopard frog	racer
tiger salamander	painted turtle	night snake
Great Basin spadefoot	short-horned lizard	gopher
western toad	sagebrush lizard	western terrestrial garter snake
Pacific tree frog	western fence lizard	common garter snake
Columbia spotted frog	western skink	western rattlesnake
bull frog	side-blotched lizard	rubber boa

Birds		
turkey vulture	black-necked stilt	western bluebird
Canada goose	American avocet	mountain bluebird
mallard	greater yellowlegs	Townsend’s solitaire
American black duck	lesser yellowlegs	American robin
American wigeon	spotted sandpiper	sage thrasher
gadwall	solitary sandpiper	American pipit
blue-winged teal	sandhill crane	European starling
cinnamon teal	killdeer	green-tailed towhee
northern pintail	upland sandpiper	chipping sparrow
green-winged teal	long-billed curlew	sage sparrow
northern harrier	rock dove	white-crowned sparrow
sharp-shinned hawk	mourning dove	Brewer’s sparrow
Cooper's hawk	barn owl	clay-colored sparrow
Swainson’s hawk	great horned owl	lark sparrow
red-tailed hawk	long-eared owl	savannah sparrow
ferruginous hawk	burrowing owl	grasshopper sparrow
rough-legged hawk	snowy owl	vesper sparrow
golden eagle	short-eared owl	Lapland longspur
American kestrel	common nighthawk	snow bunting
merlin	common poorwill	bobolink
gyrfalcon	white-throated swift	western meadowlark
peregrine falcon	Say’s phoebe	Brewer’s blackbird
prairie falcon	eastern kingbird	brown-headed cowbird
gray partridge	western kingbird	American goldfinch
chukar	loggerhead shrike	black-billed magpie
ring-necked pheasant	northern shrike	American crow
greater sage grouse	northern rough-winged swallow	common raven
sharptail grouse	bank swallow	horned lark
wild turkey	cliff swallow	Lewis’s woodpecker
mountain quail	barn swallow	
northern bobwhite quail	rock wren	
California quail	canyon wren	

1.3 Overview of Habitat Functions and Values

Habitat refers to the physical and biotic features of the environment that sustain and support fish or wildlife and may be assessed at a variety of scales from the ecoregional to a specific site (e.g., a high elevation talus slope). The predominant vegetation (e.g., conifer forest) and/or the presence of particular structural elements (e.g., snags, cliff faces) are typically used to classify wildlife habitat (McComb, 2001). Habitat preference varies between wildlife species and over the course of the year for a given species of fish or wildlife. Generally, as habitat type changes, the assemblage of fish and wildlife species will also change; as habitat diversity increases the number and diversity of fish and wildlife species increases; ecotones (habitat type edges) have a high diversity of fish and wildlife species; and larger habitat blocks support a greater number of species than smaller habitat units (Castelle et al., 1992; O'Connell et al., 2000; O’Neil et al., 2001; Sheldon et al., 2003).

1.3.1 Habitat Functions

Habitat provides the resources necessary for individuals of a species to survive and reproduce. Habitat functions are often described as the ability to provide food (foraging habitat), protection from the weather and predators (cover), and allowing for successful reproduction (breeding habitat) (O’Neil et al., 2001). An additional function of habitat is to allow the movement of animals over the landscape through dispersal, allowing genetic mixing between populations; and migration; which allows a species to maximize available resources (Lemkuhl et al., 2001; McComb, 2001). Wildlife species vary in their habitat requirements and use of a particular habitat type will vary by season and over the life of the individual. Habitat generalists, such as deer or red-tailed hawks, thrive in a variety of habitat types, while habitat specialists, such as the harlequin duck require very specific habitat types and features. For most species, the habitat type selected for foraging will differ from habitat selected for thermal or security cover. Most species require specialized habitat features for reproduction (e.g., cavities for cavity-nesting birds) and for many species the availability of these breeding habitat features is used to determine the suitability of habitat (Anderson and Gutzwiller, 1994; McComb, 2001; Sheldon et al., 2003).

The suitability of habitat for a given wildlife species is determined by the habitat occurring within the species' range, the size of the habitat patch, whether the habitat is accessible (connectivity), the presence of requisite structural elements, and the amount of habitat alteration and disturbance (Morrison et al., 1998; McComb, 2001). Some habitats may only be used for a short period of time but are critical in sustaining a species. During migration, shorebirds are dependent on intertidal mud bays for foraging where they may stop for a few days at a particular site.

Providing travel corridors for wildlife that maintain connectivity between habitat blocks is an important role of habitat. This connectivity reduces the likelihood of populations becoming isolated and prone to extinction due to random events or inbreeding (Morrison et al., 1998; Lemkuhl et al., 2001; King County, 2003). If wide enough and suitable vegetation/structure is present, corridors may serve as habitat in their own right (O'Connell et al., 2000; Kauffman et al., 2001; King County, 2003). The potential value of corridors to wildlife is not entirely positive as corridors may contribute to the spread of fire, invasive species, and disease and may dampen speciation by contributing to genetic mixing (King County 2003). In a review of the value of habitat corridors to wildlife, King County (2003) determined that overall the benefit of maintaining connectivity between habitat patches and wildlife populations outweighs the risks to wildlife populations, particularly in landscapes with a high degree of human development.

Migration and dispersal habitat within Kittitas County includes riparian corridors and the foothills of the east Cascades. The County provides important wintering and stopover habitat for migratory waterfowl and raptors; valuable wintering, summer range, and calving areas for several large mammals including Elk, bighorn sheep, and deer; and territories for large predators such as grey wolves and grizzly bear.

1.4 Human Activity and Habitat Functions

For wildlife, disturbance may include a behavioral and an ecological component. The behavioral aspect of disturbance may be defined as any action, such as human presence or noise from machinery, which alters the behavior of an animal (Dahlgren and Korschgen, 1992; Martin, 2001). The ecological component of disturbance includes an alteration of the structure and/or floristics of wildlife habitat. Disturbance may include spatial and temporal components and direct and indirect effects. Factors such as the size of the affected area, the timing of disturbance, and the duration of the disturbance influence the degree of disturbance. Wildlife species vary in their tolerance of disturbance and habitat alteration and this tolerance may vary over the course of the year (Martin, 2001; McComb, 2001). The sensitivity of wildlife species to disturbance may depend on the distance of the activity from the subject species, screening vegetation or terrain, and in some cases, the previous exposure (habituation) of the individual to the activity.

1.4.1 Ecological Disturbance

Habitat alterations may be temporary (e.g., clear cutting a forest stand) or permanent (e.g., converting grassland to a residential development). These alterations often refer to changes in vegetation structure (e.g., converting mature forest to a seedling stand) or floristics (e.g., deciduous forest to shrub field) and may include introducing exotic species and disrupting nutrient cycling processes. Table 4 contains a list of common development activities that can alter habitat and negatively impact species associated with those habitats in Kittitas County.

Habitat fragmentation, the isolation of habitat patches, is a source of disturbance that may affect habitat suitability well beyond the site of the altered habitat. For wildlife species such as the wolverine, the presence of a road may serve as a dispersal barrier, fragmenting the habitat and rendering otherwise suitable habitat on the far side of the road inaccessible (Claar et al., 1999; Lemkuhl et al., 2001). Habitat alteration may change the vegetative community and structural elements of a site, affecting the density or species assemblages of wildlife using the site (McComb, 2001). Generally, as the size of the habitat area increases, the number of species and individuals the area can sustain also increase. The maximum number of individual animals of a given species that a particular area can support is referred to as carrying capacity (Robinson and Bolen, 1984). Habitat alterations may decrease or increase a site's carrying capacity. For most wildlife species, as the size of a habitat patch is reduced or as the habitat is converted to more urbanized uses, carrying capacity is reduced. The remaining habitat patches have greater edge habitat, are more exposed to domestic animals that prey on native wildlife, and have less connectivity to other habitat areas.

Table 4. Effects of Disturbance and Habitat Alteration on Wildlife

Activity	Habitat Effect	Sensitive Species	Areas at Risk in Kittitas County
Clearing	Changes in habitat composition, complexity, and structure, loss of snags and large-diameter trees, habitat fragmentation, alteration of local hydrology, potential introduction of nonnative species.	Snag dependent species (pileated woodpeckers, cavity nesting ducks), forest interior or old-growth associated species (fisher, northern goshawk). Large trees in riparian/shoreline areas important for bald eagle and great blue heron nest and perch sites.	Much of old-growth in analysis area has been harvested. Potential for habitat loss throughout the County, especially near urban areas. Riparian and shoreline areas are especially important as habitat.
Grading	Loss of soil organic layer, potential soil compaction, loss of nest/den sites, alteration of local hydrology, increased sedimentation of local waters, potential for landslides, mass wasting on steep slopes.	Burrowing animals such as ground squirrels, burrowing owls, shrews, pocket gophers, badgers, and foxes.	Identified geologically hazardous areas, areas with erodible soils, shoreline areas with steep slopes. Undeveloped grasslands and shrub-steppe habitat.

Activity	Habitat Effect	Sensitive Species	Areas at Risk in Kittitas County
Urbanization	Loss of open space, breeding, feeding, cover, and dispersal habitat; loss of unique habitats and species diversity, habitat fragmentation, increased prevalence of introduced species, increased wildlife injury/mortality from vehicle collisions, domestic cats and dogs, increased behavioral disturbance from human presence.	Species intolerant of human activities or with large home ranges (gray wolf, wolverine, grizzly bear, bighorn sheep), ground-nesting birds (California quail, dark-eyed junco), species associated with unique habitats (rare plants, butterflies).	Open space and natural lands adjoining urban centers – Ellensburg, Cle Elum.
Shoreline development	Loss/alteration of shoreline vegetation, habitat fragmentation, alteration of shoreline morphology (shoreline armoring), degraded water quality (runoff, faulty septic systems), and degraded instream habitat.	Species intolerant of human activities (bald eagles, great blue heron) or dependent on clean water and intact shoreline ecosystem (salmonids).	All freshwater lakes and streams in Kittitas County.
Agricultural practices	Alteration of local hydrology, degraded water quality from agricultural runoff. Many wildlife species benefit from agriculture and are dependent on crops as a source of food. Crop damage is potential source of conflict for wildlife.	Species associated with habitat edges (red-tailed hawk) sensitive to loss of natural areas. Waterfowl, including geese may depend on crops as food during migration. Elk and deer populations may be controlled to reduce crop damage.	Eastern portion of County and areas surrounding the Yakima Valley, including the Teanaway area.
Introduction of non-native species	Potential loss of breeding, feeding, and cover habitat; displacement and extirpation of native species; ecosystem simplification. In riparian habitat as an example, alteration of native riparian habitat functions, including associated wildlife refuge, insect litter, and replacement of coniferous shade producing trees.	Insects dependent on rare native plants, aquatic or wetland associated species (beaver), and neotropical migrant birds.	County wide, especially riparian/wetland habitats and grasslands.
Increased noise/light	Flushing from breeding or foraging areas, interruption or interference with courtship, potential increased susceptibility to predation.	Species intolerant of human activities (marbled murrelets, northern spotted owl, and northern goshawks).	Undeveloped areas of the County with relatively low levels of ambient noise and light.

Activity	Habitat Effect	Sensitive Species	Areas at Risk in Kittitas County
Human presence/recreational activities	Flushing from breeding or foraging areas, interruption or interference with courtship, potential increased susceptibility to predation.	Species intolerant of human activities (marbled murrelets, northern spotted owl, and northern goshawks, great blue heron).	Undeveloped areas of the County with relatively low levels of human use.

Source: Ferguson et al. (2001); Lemkuhl et al. (2001); Sheldon et al. (2003).

While the majority of Kittitas County's land base remains in open space, much of the open space has been altered by mining, agriculture, or forestry and the habitat value of these lands has been reduced from historic conditions. Significant portions of the wetlands and floodplains in Kittitas County have been converted to agricultural lands, particularly in areas adjacent to the Yakima and Teanaway Rivers. The human population of the County continues to grow, converting open space areas to housing developments. The County is served by an extensive road and highway system, but these roads may represent barriers to wildlife dispersal and contribute to wildlife mortality. Interstate 90, U.S Route 97, State Route 10, and State Route 970 are major arterials that may limit the dispersal of wildlife. Residential development along the freshwater shorelines, particularly the Yakima and Teanaway Rivers, has reduced the habitat value for fish and wildlife in these areas. Industrial development is limited in the County; however, forestry related practices continue to fragment habitats, reduce migration corridors, and contribute to habitat degradation in habitats such as riparian areas through increased sediment delivery from logging roads and reduced buffer functions.

1.4.2 Behavioral Disturbance

Direct effects of behavioral disturbance on wildlife can include an interruption of activity, flushing, and abandonment of a site or young. Indirect effects may include weight loss due to reduced food intake, or population decline as a result of lower breeding success for disturbed pairs (Castelle et al., 1992). Human presence may be sufficient to disturb some wildlife species, while other species may be relatively tolerant of humans. The time of year or wildlife activity may influence the sensitivity of wildlife to disturbance. Some species may be tolerant of human presence or activities while foraging but are highly sensitive to human presence while breeding or rearing young (McComb, 2001; Stinson et al., 2001; Quinn and Milner, 2004). Common loons are highly sensitive to human development and activities at nesting lakes and have abandoned nests as a result of human disturbance (Richardson et al., 2000). Activities such as the use of heavy equipment, blasting, and pile driving may disturb species for up to 0.25 mile beyond the source of the noise (Ruediger et al., 2000; Watson and Rodrick, 2002; Kennedy, 2003). Recreation can be a major source of disturbance in breeding and wintering habitat (Claar et al., 1999; Stinson et al., 2001). Conflicts with farmers as a result of crop damage may contribute to the decline of the elk herds. Wildlife viewing also may be a source of disturbance. Recreational fisherman and bird watchers have interrupted feeding bald eagles (Watson and Pierce, 1998; Stinson et al., 2001).

Federal and state agencies and local jurisdictions may mitigate human disturbance of wildlife by prohibiting the intentional disturbance of wildlife species/ individuals and designating areas as off limits to public entry. Management recommendations for a number of species (lynx, bald eagles, great blue herons) include restricting human activities around nesting or breeding sites (Ruediger et al., 2000; Watson and Rodrick, 2002; Quinn and Milner, 2004).

The KCC addresses, in some part, alterations to fish and wildlife habitat (KCC 17A.07); however, it does not effectively address disturbance to wildlife species. The KCC currently identifies specific land use activities that are subject to review for consistency with the critical area regulations; however, the existing code does not specifically call out buffers or management zones to protect wildlife species from disturbance.

1.5 Habitat Management and Protection Tools

Protection and management of FWHCAs requires protection of individual species and populations as well as the habitat areas that meet all of their life stage needs. Appropriate identification and mapping of species and habitats, use of buffers, restrictions on the timing of certain land use activities, and habitat restoration/mitigation are effective tools for accomplishing these goals.

1.5.1 Acquisition, Designation, Rating, and Classification

Fish and wildlife habitat may be protected through the purchase and ownership of property by private parties, non-profit organizations, and natural resource agencies such as the U.S. Forest Service, USFWS, WDNR, WDFW, or Kittitas County; or by classification/designation through state and federal laws or local jurisdiction's land use ordinances. The USFWS designates critical habitat for federally listed species. Land use in designated critical habitat is usually restricted and requires consultation with the USFWS prior to actions by other federal agencies. The WDFW PHS Program identifies lands used by priority species and management recommendations may limit the timing or extent of land use actions. Public agencies may designate their lands for the management of fish and wildlife habitat or condition land use practices through rules and permitting requirements. KCC, Title 17A identifies critical areas where land use may be restricted, often to the benefit of fish and wildlife habitat.

The Critical Areas Assistance Handbook (Ousley et al., 2003) recommends that local jurisdictions use PHS data in designating FWHCAs and that when possible, large, round or square blocks of habitat should be emphasized for FWHCAs rather than small or linear tracts.

1.5.2 Buffers

Buffers are vegetated lands separating critical areas from more intensive land uses and are intended to reduce potential impacts to the critical areas from activities beyond the buffer (O'Connell et al., 2000; Sheldon et al., 2003). Land use regulations have required buffers around wetlands and streams for a number of years and buffers have been the subject of numerous scientific studies and reviews (Castelle et al., 1992; Knutson and Naef, 1997; O'Connell et al., 2000; Kauffman et al., 2001; Sheldon et al., 2003).

For wildlife, the principal functions of buffers are to provide habitat (feeding, cover, and breeding) and travel corridors; microclimate modification; organic input; and to ameliorate the impacts of human disturbance (light, noise, human intrusion) (Castelle et al., 1992; Kauffman et al., 2001; Sheldon et al., 2003). Because buffers are often ecotone habitats between upland and aquatic or wetland areas, they often have a high diversity of wildlife (Castelle et al., 1992; Knutson and Naef, 1997; O'Connell et al., 2000; Kauffman et al., 2001). The suitability of habitat buffers for wildlife is related to the width and floristic composition of the buffer (Castelle et al., 1992; Knutson and Naef, 1997; Sheldon et al., 2003). Generally, wider buffers with more complex plant communities have higher habitat value. Forested buffers provide more habitat niches and functional value to wildlife than scrub-shrub buffers, which in turn are more effective as habitat than buffers dominated by herbaceous vegetation (Castelle et al., 1992; Knutson and Naef, 1997; Sheldon et al., 2003).

Buffers provide habitat for a significant proportion of the Pacific Northwest's wildlife species, from invertebrates to large mammals (Castelle et al., 1992; Knutson and Naef, 1997; Kauffman et al., 2001). Because amphibians require moist conditions protected from temperature extremes, they are more closely associated with wetland and riparian buffers than other wildlife taxa. Many amphibian species breed and rear young in open/standing water yet spend the majority of their life cycle in the adjacent upland habitats. Of the 33 amphibian species documented in the Pacific Northwest, all require free water or moist terrestrial sites for breeding (Leonard et al., 1993). Vegetated buffers can provide essential cover, foraging, and dispersal habitat within the environmental conditions needed by amphibians (Castelle et al., 1992; Knutson and Naef, 1997; Sheldon et al., 2003).

As travel or dispersal habitat, buffers are preferred habitat for a number of wildlife taxa including amphibians, birds, small mammals, and large mammals. Because small mammals and amphibians often have relatively small home ranges and are limited in their ability to move long distances, buffers provide the necessary cover and microclimate for these species to access water bodies and wetlands (Knutson and Naef, 1997; Kauffman et al., 2001; Sheldon et al., 2003). Overhead canopy is essential for adequate security cover for a number of species (lynx, fishers, northern spotted owls, pileated woodpeckers) that tend to avoid crossing open areas. Due to their linear nature, riparian corridors are especially valuable for connecting blocks of suitable habitat (Kauffman et al., 2001; Sheldon et al., 2003).

Buffers moderate the microclimates of wetlands, streams and adjacent uplands by providing shade, reducing the temperature range, and diminishing the effects of wind and precipitation (Kauffman et al., 2001; Sheldon et al., 2003). Shading and moderating water temperature are important buffer functions in maintaining water quality and a high dissolved oxygen content required by stream invertebrates and salmonids (Sheldon et al., 2003).

Wetlands and riparian areas are often very productive habitats with high primary production (plants) supporting diverse ecosystems (Kauffman et al., 2001). The high plant productivity and low geographic positions contribute to the development of deep, fertile soils. Because riparian areas, including the vegetated edges of wetlands, are transitional between aquatic and upland habitats, they have a higher diversity of plant and animal species than the adjoining uplands (Castelle et al., 1992; Kauffman et al., 2001; Sheldon et al., 2003).

How wide a buffer needs to be to provide effective habitat is dependent on the wildlife species of interest (Table 5). For many forest birds and deer and elk, riparian buffers should be at least 200 feet in width (Knutson and Naef, 1997). To maintain the species number of neotropical migrant birds, Keller et al. (1993) and Hodges and Krementz (1996) recommended buffers of at least 328 feet (as cited in Knutson and Naef, 1997).

Table 5. Recommended Buffer Widths to Provide Effective Wildlife Habitat

Wildlife Taxa	Buffer Width in Feet
Invertebrates	100
Reptiles and amphibians	100 to 312
Forest dwelling birds	200
Neotropical migratory birds	328
Bald eagle	164 to 656
Great blue heron	328 to 984
Small mammals	39 to 305
Large mammals	200 to 328

Buffers are applied to wetlands and streams in part to protect wildlife habitat functions and values. The KCC defines buffers as an area which is an integral part of a critical area and which enhances its protection (KCC 17A.02.050). The KCC requires buffers ranging from 20 to 200 feet for wetlands (KCC 17A.04.020) and 10 to 200 for streams (KCC 17A.07.010 (2)). However, wildlife species that are not highly associated with wetland or riparian habitats are not protected by these buffer provisions and may warrant species- or habitat-specific buffer standards.

Where development may impact fish and wildlife habitat outside of critical areas such as riparian habitat, floodplains, or wetlands, the KCC identifies that designation of critical habitat shall be the mapped location of a threatened, endangered or sensitive priority species (KCC 17A.07.020 (1)). No applicable buffer widths are identified by KCC for these areas; however, protective measures for areas outside regulated critical area shall be determined by reference to applicable state and federal law for the protection of threatened, endangered, or sensitive priority species (KCC 17A.07.020 (2)). Some jurisdiction such as Grant County (GCC 24.08.360) require the applicant to prepare a habitat management plan identifies provisions to retain native vegetation and buffer habitat areas. By comparison, Pierce County's Development Regulations for critical areas specify that point locations (nest or den site) for special status wildlife should be protected by a 1,000-foot diameter buffer and that habitat areas should be protected by a 100-foot buffer.

1.5.3 Reporting Requirements

The KCC currently only requires the preparation of a critical area checklist by applicants, which includes:

1. A legal description of the land;
2. The location of critical areas on the identified land;
3. Any voluntary methods or activities as it pertains to critical areas, including incentives offered by local or state government;
4. Plans to scale showing location of proposed work, dimensions of proposed structures, estimates of fill/excavation, drainage facilities, and significant natural features (Survey not normally required);
5. Provisions for waiver of critical area delineation; and
6. Provisions for field verification of critical area checklist.

The checklist is then processed by the Kittitas County Planning Department, which then makes a determination as to whether or not critical area is located on the property and makes a final decision consistent with the underlying permit concerning the critical area designation and related mitigation (KCC 17A03.040).

1.5.4 Timing Restrictions

Some species of wildlife may be particularly sensitive to disturbance during their breeding seasons and restrictions on mechanized activities within a given distance of nest/den sites are a means of habitat protection. The WDFW management recommendations for bald eagles recommend restricting activities within 880 feet of an active bald eagle nest, January 1 through August 15 (Watson and Rodrick, 2002) and within 0.5 mile of northern goshawk nests, March 1 through September 30 (Desimone and Hays, 2003).

The USFWS and NMFS have also developed timing restrictions for work that may impact listed species (see Timing Restrictions, Section 2.3.6 below).

1.5.5 Habitat Mitigation

Mitigation refers to the avoidance or minimization of project related impacts to critical areas. Mitigation may also include the restoration or enhancement of existing fish and wildlife habitat or the creation of new habitat, when impacts are unavoidable. Where required, mitigation often includes the approval of a mitigation plan, monitoring of the mitigation site for a specified period (5 to 10 years), and posting of a mitigation bond. Except for wetlands, specific guidelines for mitigation of fish and wildlife habitat are not specified in the KCC.

1.6 Review of Kittitas County FWHCA Regulations – Wildlife

1.6.1 Existing Kittitas County Code

The County's overall framework for habitat protection is contained in KCC 17A.03 and 17A.07. These sections identify and designate the species and habitats that are subject to the code requirements in accordance with GMA guidelines. Habitat and species designations could be clarified to facilitate implementation of the code provisions, reduce overlap and duplication of regulations, and improve/enhance predictability and consistency during development review. Also, many of the existing regulations rely on compliance with other provisions of the code (e.g., KCC 17A.04-Wetlands) or other state or federal regulations (e.g., state water quality standards), but as currently written, these other provisions may not provide complete protection for species or habitat functions. For example, the regulatory requirements for priority species habitat (KCC 17A.07.020) indicates that they are protected from dredging or filling through KCC 17A-04.010- Wetlands, but the existing wetland regulations do not expressly prohibit dredging or filling in areas occupied by priority species or habitat. So while, minimizing duplication of regulations is an appropriate goal, the County should take care to ensure that the development regulations are well integrated across titles, chapters, articles, and sections.

Habitats for species of local importance are defined as a FWHCA in KCC 17A.02.090, and specifies the process for designating these areas. However, to date, no species or habitats of local importance have been identified. The following is a list of other findings about the existing code:

- KCC17A.01.015 establishes the purposes of the regulations consistent with GMA. These are to protect fish and wildlife and their habitats to maintain their natural geographic distribution. Existing regulations have a weak emphasis on protection of aquatic species and habitats, including salmonid habitat.
- Current designation does not include: land essential for preserving connections between habitat blocks and open space; areas with which listed species have a primary association, ponds less than 20 acres, streams, ponds and lakes planted with game fish; or state natural preserves or conservation areas.
- There is no clear link between many of the definitions provided and the critical area designation and development standards with respect to FWHCAs
- The code designates habitats and species of local importance, but none are identified.
- For regulations linked to species, as opposed to habitats, it is unclear how staff will determine if a proposed development could affect a particular species or group of species. Sources of mapped information are not well documented and the procedure for keeping maps and designations accurate and up-to-date over time is unclear.
- The existing provisions of KCC 17A include relatively broad performance standards with few prescriptive requirements. Many of the regulatory standards in KCC 17A.03.035 and 17A.03.040

give considerable discretion to staff, which allows flexibility during the development review process, but may result in insufficient or inconsistent FWHCA management approaches. The challenge of interpreting some of the existing regulations may be exacerbated by gaps in the code, namely:

  - The lack of specific buffer standards for habitat types other than streams and rivers;
  - The lack of specific mitigation requirements to compensate for adverse effects on species or habitats; and
  - The lack of specificity as to how effects on species and habitats are to be measured, reported and/or monitored.

- The existing KCC does not include provisions to restrict certain activities or regulate development during key wildlife life stages such as breeding periods.
- Overall, the KCC lacks detail in identifying the extent of FWHCAs, requirements for minimizing or avoiding impacts, performance standards for allowed activities within FWHCAs, required mitigation for unavoidable impacts to FWHCAs, and monitoring success of mitigation.

1.6.2 Considerations for Code Updates

Based on the findings above about the inadequacies of wildlife protections in the existing code, the following considerations for code updates are proposed:

- Revise purpose statements to include habitat restoration as one of the goals of the regulations. Revise purpose statements to include preservation of terrestrial habitat functions and values (as well as river and stream functions) to support wildlife. In addition, add Endangered Species Act compliance and consistency with BAS as goals of this Article.
- Rename 17A.07 – Fish and Wildlife Habitat Conservation Areas. Wetlands are still an FHWA, but would be regulated under its existing section (17A.04.010).
- Revise the designation categories in KCC 17.07 to match the GMA guidelines.
- Identify the United States Fish and Wildlife Service as agencies that identify listed species (17A.02.240).
- Clarify the distinction between these three categories of FHWCAs: 1) Priority Species Habitat; 2) Habitats for Species of Local Importance; and Species of Local Importance. Define Priority Habitats (snags, cliffs, caves, etc.).
- Clarify that locally important species are a specific subset of PHS and listed species with specific value/importance for Kittitas County. Suggested locally important species include: bighorn sheep, turkey vulture, and chukar.
- Clarify that locally important habitats are a specific subset of PHS and are of specific value and importance for Kittitas County. Suggested locally important habitats may include elk winter range, golden eagle breeding territories, and greater sage grouse leks.
- Reference sources of mapped data and codify procedures for mapping updates. For example, it is recommended that Priority Habitats and Species databases be updated every six months to account for new information as it is generated.
- Definitions, performance and reporting standards must be included or expanded in KCC to ensure that allowable activities within critical areas undergo a review, approval, and monitoring process. This will help ensure that activities will not adversely impact terrestrial habitats or that loss of habitat functions will be appropriately mitigated. For example, clearing outside of wetlands,

riparian habitat, or floodplains is allowed under existing KCC, but many priority terrestrial species and habitats occur outside these areas. A clear path for documenting existing conditions in these areas, identifying potential impacts, potential mitigation requirements, or monitoring is allowed development activities.

- The County may improve protection and management of FWHCAs by adding prescriptive standards that address the size, amount, location, configuration, and other habitat characteristics that are needed to maintain populations of target species in Kittitas County.
- Determine buffer requirements for species consistent with BAS and WDFW management guidelines. For example, some recommended buffers (radius) include:
    - Bald eagle nest sites – 800 feet; communal roosts – 400 feet; assess potential impact to exposed foraging areas within 1,500 feet.
    - Common loon nest sites – restrict access and disturbance during nesting season and new structures within 492 feet of nest sites and brood rearing areas.
    - Great blue heron rookeries – 984 feet for habitat alteration or disturbance activities during nesting season, no logging within 3,281 feet during nesting season; 328 foot buffer on wetland foraging areas within 2.5 miles of rookery.
    - Northern spotted owl – 0.7 mile around nest tree.
    - Northern goshawk nest sites – 30 acres; post-fledging areas, 420 acres.
    - Peregrine falcon nesting cliffs – avoid disturbance and restrict access during breeding season within 0.5 mile of cliff rim, 0.25 mile of cliff face.
    - Pileated woodpecker – retain forested stands, 7 acre minimum in suitable habitat.
    - Harlequin duck nest sites – maintain stream buffers of 164 feet or greater, restrict water activities on nesting streams during nesting season.
    - Vaux's swift nest sites – 400 feet
    - Townsend's big-eared bat nursery sites – 450 feet
    - Gray wolf den sites – restrict access and mechanized activity within 0.25 mile.
- Include limitations on development activities during breeding and nesting periods for important species. An example of this may include:
    - Bald eagle – January 1 to August 31.
    - Common loon – April 1 to September 1.
    - Great blue heron – February 15 to July 31.
    - Northern spotted owl – February to June.
    - Northern goshawk – March 1 to September 30.
    - Peregrine falcon – March to July.
    - Pileated woodpecker – late March to early July.1
    - Harlequin duck – April to August.1
    - Vaux's swift – early May to September.1
    - Townsend's big-eared bat nursery sites – November 1 to February 28.4
    - Gray wolf den sites – April 1 to June 15.4
- Consider including specific performance standards for allowed activities within FWHCAs based on the nature of the proposed activity.
- Consider upgrading reporting standards for FWHCAs including the requirement of information on impacts, mitigation, and monitoring. See Section 2.3.3 of this report for specific recommendations.

- Consider explicitly stating the preferred mitigation sequence for FWHCAs of impact avoidance, impact minimization, and impact mitigation. See Section 2.3.4 of this report for specific recommendations.

2.0 FISH AND OTHER AQUATIC SPECIES

2.1 Overview of Inventory

Kittitas County is situated in central Washington on the eastern slopes of the Cascade Mountains between the Cascade Crest and the Columbia River in the Columbia River basin. The County encompasses 2,300 square miles within three major basins or Water Resource Inventory Areas (WRIAs):

- Upper Yakima (WRIA 39),
- Alkali-Squilchuck (WRIA 40), and
- Naches (WRIA 38).

Most of the County's area (78 percent) lies within the Upper Yakima basin, which drains into the Yakima River. The Alkali-Squilchuck basin (17 percent) is in the eastern part of the County and drains into the Columbia River. A small portion (5 percent) in the southwestern part of the County is in the Naches basin and drains into the Little Naches River, which becomes the Naches River joining the Yakima River in Yakima County.

The aquatic habitats of Kittitas County support a number of special status species and priority habitats and species. Within the County there are over XXXX miles of riverine/stream habitat and numerous large lakes or impoundments (Keechelus, Kachess and Cle-Elum Reservoirs). The principal aquatic priority habitats on non-federal lands in the County are found along the Yakima River, and at Cle Elum, Kachess and Keechelus Reservoirs. The reservoirs identified above have blocked access to suitable habitat upstream of the reservoirs and have genetically isolated fish populations above the reservoirs. Much of the County's upper headwater tributary streams occur in forest lands managed by the U.S. Forest Service. The Columbia River system is the largest river system in the County and forms the County's eastern boundary. The Columbia River system supports Chinook salmon, coho salmon, sockeye salmon and steelhead, as well as bull trout and white sturgeon (WDFW, 2012). Further discussion of Kittitas County's FWHCAs with respect to fish species and aquatic habitat is provided below.

2.1.1 Species and Habitats

Federally Listed Species Habitat

Listed fish species found within Kittitas County include the threatened Middle Columbia River distinct population segment (DPS) steelhead, threatened Upper Columbia River DPS steelhead, endangered Upper Columbia River Spring-run evolutionarily significant unit (ESU) Chinook salmon, and the threatened Columbia River distinct population segment (DPS) bull trout (USFWS, 2012; NMFS, 2011). As defined and administered by NMFS, Middle Columbia River ESU of steelhead, Upper Columbia River DPS steelhead, and Upper Columbia River Spring-run ESU Chinook salmon are the only anadromous ESA-listed species potentially occurring in Kittitas County waters. Upper Columbia River DPS steelhead and Upper Columbia River Spring-run ESU Chinook salmon only occur within the mainstem Columbia River and use the area as both an upstream and downstream migration corridor. The Middle Columbia River DPS steelhead is the only federally listed salmonid as defined and administered by NMFS as occurring in the Yakima River basin. As defined and administered by USFWS, bull trout are a threatened species that potentially occurs throughout the Columbia River watershed, including the

Yakima River and many of its tributaries. The following is a brief discussion of each listed salmonid documented as occurring in the Yakima Basin, which was taken from the *Yakima County Review of Best Available Science for Inclusion in Critical Areas Ordinance Update* (YCPD, 2006).

Summer Steelhead

Historically, steelhead were probably found wherever spring Chinook were found, in addition to a variety of other stream habitat types. Yakima Basin steelhead generally spawn in intermittent streams, in side channels of larger rivers, and in smaller streams and streams with steeper gradients, which are typically unsuitable for spring Chinook or coho. Summer steelhead are capable of spawning in practically any stream reach that contains at least a pocket of gravel and suitable water depths and velocities. It is probable that the historical spawning distribution of summer steelhead included virtually all accessible portions of the Yakima Basin, with the highest spawning densities occurring in complex, multichannel reaches of the mainstem Yakima and Naches Rivers, and in third and fourth-order tributaries with moderate (1 to 4 percent) gradients. Estimates of the size of the historical steelhead run range from 20,000 to 100,000.

Current steelhead distribution in the Yakima Basin is much more restricted and more spatially variable than it was historically. Satus and Toppenish Creeks in Yakima County represent over half of the spawning, with a smaller proportion in the Naches and a much smaller proportion in the upper Yakima (the Yakima mainstem and tributaries upstream of the Naches confluence). The average number of spawning adults between 1985 and 2000 was approximately 1,256 fish (the range being between 505 in 1996 and 2,840 in 1988), which is only about 1.3 to 6 percent of historical estimates.

Historically, the Upper Yakima basin supported the largest numbers of steelhead, but it now supports the fewest. The upper basin was able to support such a large proportion due to its overall size and its abundance of habitats, including mainstem and tributary reaches. The steelhead decline of the upper basin can be attributed to habitat simplification, habitat blockage, log splash damming, unscreened diversions, and unnatural releases from the reservoirs during the summer, when fry are just emerging from their redds.

There are four genetically distinct populations of wild steelhead in the Yakima basin: upper Yakima stock, Naches stock, Satus Creek stock, and Toppenish Creek stock. Scientific analyses indicate that wild and hatchery-raised rainbow trout and steelhead in the upper Yakima and Naches interbreed. Wild Satus and Toppenish Creek steelhead, on the other hand, show no evidence of interbreeding with hatchery trout or steelhead. Over 3 million hatchery trout (primarily South Tacoma and Goldendale stock) have been planted in the upper Yakima and Naches since 1950, and 1.6 million hatchery steelhead (primarily Skamania stock) have been planted since 1961.

Spawning steelhead begin passing Prosser Dam in the lower basin in September, and tend to reside there during the colder parts of December and January, before resuming migration from February through June. The steelhead migration has two peaks, one in late October, and one in late February or early March. The relative numbers of wild fish returning during the fall and winter-spring migration periods varies from year to year, depending on the duration of the thermal window in the fall.

Scientific studies of steelhead migration patterns between 1990 and 1993 indicate that most fall run steelhead spawners actually overwinter in the mainstem Yakima, in reaches with deep holes and low velocity. About 6 percent hold between Sunnyside Dam and Roza Dam. The final migration to the spawning grounds begins between January and May, with fish that will eventually spawn in lower elevation tributaries generally beginning to move earlier. There is some evidence that the cue triggering this final run is thermal, as very few fish ascended Satus Creek during midwinter floods, and virtually none of the eventual Naches spawners began moving until water temperatures reached 30°C. Most Yakima steelhead are tributary spawners; over 90 percent of the tagged steelhead spawned in the Naches River and its tributaries, in Satus Creek, or in Toppenish Creek.

In the higher-elevation tributaries of the upper Naches (the Little Naches River), spawning occurs from late April through late May, with a peak in early May.

Over 70 percent of the fish referred to as upper Yakima spawners actually spawn in the Yakima mainstem between Roza Dam and Ahtanum Creek. Of the remaining 30 percent, 14 percent spawn in the Teanaway River and its forks, and the rest spawn in various upper Yakima tributaries and mainstem reaches. As nearly as can be determined, spawning occurs in the upper Yakima mainstem and the higher-elevation upper Yakima tributaries according to the following approximate schedule:

- Upper Yakima mainstem—in Yakima Canyon (including Umtanum and Wilson/Naneum Creeks) late March to mid May, with a peak in late April; and above Yakima Canyon from mid April to late May, with a peak in early May.

Steelhead fry emergence probably occurs at the following times in the following places:

- Upper Naches tributaries—late June through late July.
- Upper Yakima mainstem in Yakima Canyon (including Umtanum and Wilson/Naneum Creeks)—early June through early July.
- Upper Yakima mainstem above the Yakima Canyon—mid June through late July.
- Upper Yakima tributaries—late June through early August.

Steelhead rearing migrations are not well understood compared to spring Chinook. The presence of steelhead juveniles in small tributaries throughout the summer, sometimes in high densities, indicates that the fish are less inclined to migrate downstream for early rearing than are spring Chinook. However, steelhead juveniles are found in substantial numbers in the Yakima Canyon, far from spawning areas, so a gradual downstream dispersal obviously occurs. Juvenile wild steelhead typically rear in freshwater for one or more years before outmigrating to the sea.

Bull Trout

Historically, wild bull trout occurred throughout the Yakima River Subbasin. Today they are fractured into isolated stocks. Although bull trout were likely never as abundant as other salmonids in the Yakima basin, they were certainly more abundant and more widely distributed than they are today. In June 1998, the USFWS listed bull trout in the Columbia River basin as threatened under the Endangered Species Act. Currently, nine bull trout stocks have been identified in the Yakima Basin. Six stocks are present in Kittitas County: in the Naches River, Yakima River, Teanaway River, and Cle Elum, Kelchelus, and Kachess Reservoirs. All bull trout stocks are native fish sustained by wild production; there are no hatchery bull trout stocks in Washington State. According to WDFW, there is no information to indicate that these are genetically distinct stocks; they are treated separately because of the geographical, physical, and thermal isolation of the spawning populations (Reclamation, 2002).Three bull trout life-history forms are present in the Yakima basin: adfluvial, fluvial, and resident.

Adfluvial stocks occur in Keechelus, Kachess, and Cle Elum Reservoirs. Adfluvial stocks spawn and, in the early stage, rear in streams, with most growth and maturation occurring in lakes or reservoirs. Adults enter mainstem rivers early in summer, often holding near their natal tributaries for months before migrating upstream. Most mature adults range in size from 20 to 32 inches.

A fluvial stock is present in the mainstem Yakima River. Fluvial bull trout spawn and, in the early stage, rear in smaller tributaries, with major growth and maturation occurring in mainstem rivers. They may move randomly throughout river systems, generally congregating near spawning tributaries in the summer. Mature adults are usually smaller than anadromous or adfluvial bull trout, ranging from 16 to 26 inches long.

A resident stock occurs in the North Fork Teanaway River. Resident bull trout spend all life stages (spawning, rearing, growth, and maturation) in small headwater streams, often upstream from impassable barriers. Mature adults can vary in size from 8 to 15 inches, but they are seldom larger than 12 inches in total length. Resident bull trout have been observed to mix and interbreed with migratory forms unless physically separated by barriers. It is possible that anadromous forms occurred in the Yakima basin in the past.

The run timing of the Keechelus Reservoir stock are distinct. Run timing for other Yakima stocks either is not distinct from other Washington State bull trout or is unknown. According to WDFW, the Kachess, Kelchelus, Yakima River, and North Fork Teanaway stocks are critical; the condition of the Cle Elum stock is unknown (WDFW, 1998). An adfluvial bull trout population could still be present in the Cle Elum Reservoir; however, no spawning populations have been documented in the upper Cle Elum basin. It is thought that the adfluvial bull trout from the Cle Elum basin may have been replaced by nonnative lake trout, which have been naturally reproducing in the Cle Elum Reservoir since being stocked in the 1920s (Reclamation and Ecology, 2012). Additional data are needed to determine the status of these unknown stocks (YBFWRB, 2012).

There are only a few historical references (mostly old catch records) that indicate the presence of bull trout in Yakima River tributaries. In all streams where bull trout are noted in the historical catch records, relatively few fish were recorded compared to other game fish. Whether this is a reflection of historically low population is difficult to tell. Until information is collected to determine otherwise, all bull trout in the upper Yakima River mainstem will be considered as one stock with a fluvial life history pattern. For now, the Yakima fluvial stock is assumed to be composed of fish that inhabit the mainstem between Roza Dam and the upper reservoir dams--Cle Elum, Kachess, and Keechelus. Although the genetic characteristics of the stock have not been determined, bull trout in the mainstem of the Yakima River are considered distinct from other Yakima subbasin stocks, based on physical, geographical, and thermal isolating factors (e.g., dams, warm water temperatures, or irrigation diversions) (Reclamation, 2002).

Bull trout are strongly influenced by temperature and are seldom found in streams exceeding summer temperatures of 18ºC. Cool water temperatures during early life history results in higher egg survival rates, and faster growth rates in fry and possibly juveniles as well. All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools. Preferred spawning habitat consists of low gradient streams with loose, clean gravel, and water temperatures of 5 to 9º C in late summer and early fall. Depending on the life-history form, rearing and overwintering habitats vary, but all require cool, clean water, with insects, macro-zooplankton, and small fish for larger adults. Slow juvenile growth delays maturation until about age five, and reproduction may only occur on alternate years. Bull trout may live for 12 or more years, and can reach over 20 pounds when adequate forage is available. Stock densities of bull trout are generally much lower than that of other native game fish such as cutthroat trout, rainbow trout, or mountain whitefish. The migratory forms of native char may travel long distances to reach spawning tributaries. Mature native char normally penetrate farther upstream than any other salmonids present in the watershed (Reclamation, 2002).

Additionally, several areas in the basin have been identified as bull trout critical habitat (USFWS 2010) that may be candidates for bull trout reintroduction (or introduction) efforts. These areas in Kittitas County include the forks of Little Naches River and tributaries, upper Taneum Creek and Cold Creek (tributary to Keechelus Reservoir) and the Middle Fork Teanaway River. Taneum Creek and the Little Naches River forks are specifically listed in the USFWS 2002 Draft Bull Trout Recovery Plan as potential local populations, as they are thought to be areas of historic distribution and/or have high quality habitat that could support a local population of bull trout. Threats and recovery actions that would benefit these potential populations will be identified as this aspect of the USFWS Recovery Plan is further developed (YBFWRB, 2012).

State Listed Species Habitat

State priority habitats and habitats associated with state priority species include areas having high recreational value or relatively rare species. Of particular importance or concern in Kittitas County are salmonids listed as State priority species. Salmonid-bearing streams in Kittitas County generally contain several anadromous and/or resident priority salmonid species that include Chinook, coho, and sockeye salmon (including kokanee), bull trout, rainbow/steelhead trout, and westslope cutthroat trout (Table 6). Salmon are also associated with other types of priority habitats and species, particularly in relation to riparian areas, so the protection of salmonid habitats serves to protect other species dependent on similar or associated habitats.

Cle Elum, Kachess, and Keechelus Reservoirs were once natural glacial lakes that supported sockeye salmon. With construction of dams at the outlet of these Reservoirs in the early 1900s, sockeye became extirpated from the Yakima basin due to lack of access to spawning habitat and the loss of essential lake rearing habitat. The reintroduction of sockeye salmon into Cle Elum Reservoir began in 2009 with the release by the Yakama Nation of 1,000 adult sockeye (Wenatchee and Lake Osoyoos stocks), 1,500 adults in 2010, and 4,800 adults in 2011 (Reclamation and Ecology, 2012; Johnston, 2012).

Although endemic coho salmon were extirpated from the Yakima River basin in the early 1980s, natural reproduction of hatchery-reared coho is now occurring in the Yakima River. The dams on the mainstem Columbia River, unscreened irrigation diversions in primary rearing habitat, and overharvest of wild stocks contributed to the extirpation of coho salmon from the Yakima River basin. The Yakama Nation currently releases approximately 1.0 to 1.7 million coho smolts in the Yakima basin annually from both in-basin and out-of-basin broodstocks (Newsome, 2012).

Pacific and river lamprey are other priority anadromous species potentially found in Kittitas County streams. However, not much is known about their life history, historic distribution, or current limiting factors in the Yakima basin. Both species are considered extremely rare. Approximately five adult Pacific lamprey have been observed at Prosser Dam on the lower Yakima River on an annual basis since 1985 (Johnston, 2009). Other priority habitats and fish species include mountain sucker, leopard dace, Umatilla dace, pygmy whitefish, and white sturgeon (Table 6).

Habitats and Species of Local Importance

Species of local importance are defined in the KCC as fish and wildlife species that are of local concern because of their population status or their sensitivity to habitat manipulation (KCC 17A.02.260). However, no fish species are identified as a species of local importance. Neither does the KCC identify particular habitat types or locations of habitats associated with species of local importance. For both species of local importance and habitats for species of local importance, the designation of these areas as FWHCAs is dependent upon nomination of species or habitat of local importance by residents of the

County. In addition, the nomination must be supported by evidence showing that the nomination meets specific criteria before being adopted as a species or habitat for species of local importance.

For species of local importance, the nomination and decision criteria must consider:

1. Concern due to population status; or
2. Sensitivity of the species to habitat manipulation.

For habitats for species of local importance the nomination and decision criteria must consider:

1. A seasonal range or habitat element, which if altered, may reduce the likelihood that the species will maintain or reproduce over the long term;
2. Areas of high relative density or species richness, breeding habitat, winter range, and movement corridors;
3. Habitat with limited availability and high vulnerability to alteration; and
4. Whether these habitats are already identified and protected under the provisions KCC or other County ordinances or state or federal law.

Many species of fish are associated with protected habitats such as wetlands and streams. Several species of resident fish, such as the westslope cutthroat trout and pygmy whitefish have restricted distributions. For example, pygmy whitefish are known only to inhabit Cle Elum, Kachess, and Kelchelus Reservoirs in Kittitas County. Kokanee, the landlocked sockeye salmon, and rainbow trout are also good candidates for Species of Local Importance because of their importance as sportfish.

Naturally Occurring Ponds

Refer to subsection 1.1.4 for a discussion of naturally occurring ponds.

Waters of the State

Waters of the state within Kittitas County include the Columbia and Yakima Rivers and their associated tributaries and the lakes found throughout the County.

Waters Planted with Game Fish

Information on water bodies with planted game fish is not available in the PHS data. In 2012, WDFW's Spring 2012 Hatchery Trout Stocking Plan for Lakes and Streams included plantings of catchable trout in Cooper, Mattoon, Lost, and North Rio Fito Lakes and numerous ponds including Easton Ponds, Kiwanis Pond, Lavender Pond, Woodhouse Ponds, Naneum Pond, and McCabe Pond (WDFW, 2012b). WDFW planted no catchable trout in Kittitas County streams in 2004. In eastern Washington, WDFW does not typically plant other game fish species or trout fry (WDFW, 2012b).

State Natural Areas

Refer to subsection 1.1.7 for a discussion of state natural areas.

Lands Essential to Habitat Connectivity

Refer to subsection 1.1.18 in the Wildlife section for a discussion of these lands.

2.1.2 Aquatic Habitats

Habitats for Anadromous Salmonid Species

All anadromous salmonid species in Kittitas County are considered priority species. Habitats for anadromous salmonid species include both freshwater streams and lakes. Habitat use is dependent on the life stage and species, but in general there is considerable overlap in the range of habitat variables used by different salmonid species. Freshwater streams provide spawning and early-rearing habitat for all anadromous fish species, whereas lakes are where some anadromous fish grow to maturity prior to returning to streams to spawn. Freshwater salmonid life stages require cold-water streams having complex structural habitat and clean gravels free of fine sediment. Upon hatching, juveniles spend varying lengths of time (from days up to 2 years depending on species and stock) in freshwater prior to migrating to sea. After entering the estuary, juvenile salmonids typically spend a period of time inhabiting and foraging among coastal and estuary shoreline habitats.

The streams and rivers of Kittitas County that contain anadromous salmonid species are numerous, and many of the areas designated as FWHCAs support habitats required by anadromous salmonids. The Yakima River and associated tributaries drain the majority of Kittitas County, which flows through Yakima County before discharging to the Columbia River in Benton County. Major river reaches and tributaries include the mainstem Yakima River, the Cle Elum River, Teanaway River, Swauk Creek, Taneum Creek and the Little Naches River, all of which contain several anadromous salmonid species and stocks. The Little Nachess is on the border between Yakima and Kittitas Counties and entirely on Forest Service land with the exception of several small areas. Other smaller drainages independent of the Yakima watershed also support anadromous salmonid populations.

Kelchelus, Kachess, and Cle Elum Reservoirs are all impoundments of historic lakes on the Yakima River or the Cle Elum River and all drain the Yakima watershed. No permanent fish ladders are provided at these facilities to allow for upstream or downstream migration of anadromous salmonids. A temporary fish ladder has been installed on Cle Elum Dam and the Yakama Nation has been trucking and releasing salmonids above the dam and has introduced coho and sockeye salmon into the reservoir. Reclamation proposes to install permanent fish passage facilities at all three dams in the future (Reclamation and Ecology, 2011).

An overview of the status, habitat associations and distribution of anadromous salmonid species in Kittitas County is found in Table 6.

Table 6. Habitat Associations and Distribution of Priority and Listed Fish Species in Kittitas

Species	Federal / State Status	General Location/Distribution
Pacific lamprey	Species of Concern/None	*Habitat*: The larvae of Pacific lamprey are filter feeders that inhabit fine silt and mud substrates in backwaters and quiet eddies of coldwater streams with currents less than 1-foot per second. The larvae may spend four to seven years in freshwater and typically transform into juveniles in October or November and then either migrate to the sea immediately or hold until spring. Adults return to spawn in freshwater between March and October, hold in deep pools and then spawn the following spring (Wydoski and Whitney, 2003). *Distribution*: Coastal streams from southern California to the Gulf of Alaska. In Washington, the species is found in most large and coastal and Puget Sound rivers and occurs long distances inland into the Columbia, Snake, and Yakima River systems. In the Yakima basin, the species is considered extremely rare and none have been documented in Kittitas County above Roza Dam.
River lamprey	Species of Concern/Candidate	*Habitat*: River lamprey are an anadromous species and require clean gravel substrate in streams for spawning and egg incubation. After hatching, lampreys burrow in silt and mud, often in off-channel areas, where they typically remain for a period of years. During this stage, lampreys require relatively stable habitats (Close et al., 1995). *Distribution:* Found in coastal and inland streams from northern California to southeastern Alaska, but little information is available regarding the population status of river lamprey in Washington.
White sturgeon	Priority species	*Habitat*: White sturgeon primarilyoccupy bottom habitats in large river systems. Young of the year sturgeon prefer hard clay, mud, silt, gravel, and sand substrates at depths ranging from 40 to 90 feet. Juveniles prefer boulder bedrock substrates in the 50 to 70 foot depth range. Adults occupy bottom habitats of varying degrees; however, they tend to choose large, deep pools and eddies in main river channels. Juveniles and sub-adults occupy off-channel sloughs during the summer months, but move to deeper waters during the winter. *Distribution*: White sturgeon are found in marine waters and freshwaters from Montery Bay California to Cook Inlet in northwestern Alaska. In Kittitas County, white sturgeon are primarily limited to the Columbia River, as the Yakima River provides insufficient depths to support the species.
Leopard dace	None/Candidate	*Habitat*: Leopard dace usually occur in stream habitats with fairly low current velocity. Juveniles typically prefer shallow backwater pools while adults typically occupy habitats up to three feet in depth over rocky substrates covered in silt (Wydoski and Whitney, 2003). *Distribution*: Spotty distribution in the Columbia and Fraser River systems. In Kittitas County, the leopard dace is likely to occur in the mainstem Columbia River and Yakima River. Leopard dace are considered extremely rare in the Yakima

Species	Federal / State Status	General Location/Distribution
		River as evidenced by only three specimens being collected between Roza Dam and Prosser Dam (RM 47-128) between 1997 and 1999 electrofishing and seining studies (Wydoski and Whitney, 2003).
Umatilla dace	None/Candidate	*Habitat*: Umatilla dace are a benthic species found in relatively productive low-elevation streams and require clean substrates of rock, cobble, and boulder with velocities strong enough to minimize sedimentation of substrate. Generally found in shallow (less than 3 feet in depth) water adjacent to streambanks. Adult dace seek out deeper habitats with larger substrates that allow for refuge at varying flow conditions (Wydoski and Whitney, 2003). *Distribution*: Umatilla dace, similar to leopard dace, have a spotty distribution in the Columbia River Basin east of the Cascade Mountains. In Washington, this species has only been identified in the Columbia, Yakima, Okanogan, Similkameen, Kettle, Colville and Snake Rivers. 53 Umatilla dace were collected below Prosser Dam on the Yakima River during electrofishing and seining studies from 1997 to 1999. None were collected from the Yakima River below Roza and Sunnyside Dams during that same time period (Wydoski and Whitney, 2003).
Mountain sucker	None/Candidate	*Habitat*: The mountain whitefish is widely distributed in streams and lakes throughout Washington. In streams, they are found primarily in riffle habitats during the summer, but move to large pools or slow-moving runs during the winter. Mountain whitefish move into large pools prior to spawning to ripen and then move into swifter riffle habitats or runs to spawn (typically in the fall) (Wydoski and Whitney, 2003). *Distribution*: Mountain whitefish are likely the most abundant fish in the Yakima River and their distribution is throughout the basin.
Bull trout	Threatened/Candidate	*Distribution:* Because bull trout require very cold water temperatures for certain life-history stages, the distribution of bull trout is generally restricted to upper reaches of sub-basins. Bull trout are distributed throughout the mainstem Columbia and Yakima Rivers. Yakima River tributaries that are known or presumed to support bull trout include: Kachess River (Kachess Reservoir) and Box Canyon and Mineral Creeks; Cabin Creek; Gold Creek (Keechelus Reservoir); Cle Elum River (Cle Elum Reservoir) and tributaries including the Cooper River (Cooper Lake), Fortune Creek, and the Waptus River; Teanaway River including the West Fork, Middle Fork, and North Forks and tributaries including DeRoux Creek, Jack, Indian, Middle, Standup, Stafford, and Beverly Creeks; Swauk Creek and Williams Creek; Taneum Creek; Manastash Creek (potential); Little Naches River and Milk and Pileup Creeks (WDFW, 2012).

Species	Federal / State Status	General Location/Distribution
Chinook salmon	Upper Columbia Spring-run is endangered Yakima Spring-run Chinook are not federally listed. State Candidate species	*Habitat*: Juveniles and adults require cold, well-oxygenated water. Spawning generally occurs in riffle areas with clean gravel and cobble substrates. Juveniles use pool habitat and instream cover such as LWD, spaces among cobbles, and undercut banks as resting areas and/or for refuge from predators. Cobble substrate and off-channel habitats such as secondary channels, backwaters, or ponds provide important refuge from flows for overwintering juveniles. After river entry, adults on spawning migration use resting pools, which provide refuge from river currents and high water temperatures that are often encountered in the summer and early autumn. *Distribution*: Not much is known about the distribution of fall-run Chinook in the Yakima basin. Species distribution is the mainstem Columbia River and the Yakima River, including a small portion in Kittitas County. Spring-run Chinook can be found in the mainstem Columbia and Yakima Rivers and in Yakima River tributaries including: the Little Naches River and its tributary Quartz Creek; Taneum Creek, Swauk Creek, Manastash Creek; Cle Elum River, Kachess River, Big Creek, Tucker Creek (rearing), Cabin Creek (rearing), and the Teanaway River (North, Middle, and West Forks and several tributaries), Umtanum (rearing); and Squaw, Cooke, Badger, and Naneum Creeks (rearing) (WDFW, 2012).
Coho	Priority species	Distribution: Primarily extirpated throughout much of its historical range in the Yakima basin. Efforts are currently underway to reintroduce coho salmon to the Yakima basin. Currently, coho are primarily restricted to the mainstem Columbia and Yakima Rivers and the Teanaway River. Streams above Cle Elum and Kachess provide potential suitable habitat for the species (WDFW, 2012). The Yakama Nation has successfully reintroduced coho above Cle Elum Dam.
Kokanee	Priority species	Distribution: Found in Keechelus, Kachess, and Cle Elum Reservoirs. Spawn in upstream tributaries.
Pygmy whitefish	Species of Concern/Sensitive	*Habitat:* Pygmy whitefish most often occupy deep, unproductive (oligotrophic lakes) with temperatures below 50°F. Migration is limited to spawning in moderate to high velocity tributary streams. While in lakes, they typically occupy depths greater than 20 feet (Wydoski and Whitney, 2003). *Distribution:* Pygmy whitefish are found in Kachess, Keechelus, and Cle Elum Reservoirs in Kittitas County (Wydoski and Whitney, 2003).
Rainbow trout/steelhead/inland redband	Threatened/Candidate for steelhead Priority species for rainbow trout and redbands	*Habitat*: Similar general instream habitat requirements as other salmonids. Steelhead have an extended freshwater juvenile rearing period as with Chinook and coho salmon, but also require habitat for feeding and resting during an extended adult freshwater phase. *Distribution*: Summer-run steelhead are found in both the Columbia and Yakima River mainstems and use many of their

Species	Federal / State Status	General Location/Distribution
		tributaries for spawning and rearing. The mainstem Yakima River provides spawning, rearing and migration habitat, while the mainstem Columbia River is primarily a migration corridor for upstream spawning migrations and outmigration of smolts and kelts. Yakima tributaries known to support spawning and rearing of steelhead include: Big Creek; Teanaway River (North, Middle and West Forks and tributaries including Indian, Dickey, Jack and Stafford Creeks); Cle Elum River, Kachess River (presumed); Peterson Creek, Tillman Creek, Taneum Creek, Manastash Creek, Umptanum Creek, Swauk Creek (Iron Creek and Williams Creek tributaries); and the Little Naches River (Quartz Creek and Matthews Creek tributaries). Columbia River tributaries include Cherry Creek, Johnson Creek, Whiskey Dick Creek, Quilomene Creek, Brushy Creek, and Tarpiscan Creek (WDFW, 2012). In addition, resident rainbow trout are found throughout the Yakima River drainage and often interbreed with steelhead.
Sockeye salmon	None/Candidate	*Habitat*: Similar general instream habitat requirements for migration and spawning as other salmonid species. Sockeye salmon are unique in that juveniles rear in freshwater lakes for up to a year prior to migrating to the ocean. *Distribution*: Sockeye salmon were once widely distributed in the Yakima basin; however, construction of dams at the outlet of once natural lakes (Kachess, Keechelus, and Cle Elum) eliminated the necessary lake rearing period for juveniles and the species disappeared from the watershed. The Yakama nation began reintroducing sockeye to Cle Elum Reservoir in 2009 after temporary fish passage facilities were installed on Cle Elum Dam. The released sockeye are of the Wenatchee and Lake Osoyoos stocks and were captured at Priest Rapids Dam on the Columbia River (Reclamation and Ecology, 2011). Sockeye of the Lake Wenatchee stock currently migrate through the Columbia River adjacent to Kittitas County on their upstream spawning migrations to the Wenatchee River and Lake Wenatchee. .
Westslope cutthroat trout	Priority species	*Habitat*: Westslope cutthroat trout have similar general requirements as all salmonids. The westslope cutthroat trout, unlike the coastal cutthroat trout, has only three life history forms, the resident (resides in natal stream year-round), adfluvial (rears in small streams and then moves to lakes to mature), and fluvial (rears in small streams and moves to larger streams/rivers to mature). *Distribution*: Ten populations of westslope cutthroat trout were identified in the Upper Yakima River Basin (Wydoski and Whitney, 2003). Five of the populations were determined to be genetically pure stocks, including the Cabin Creek and Naneum Creek stocks in Kittitas County. The other five populations including the North Fork Taneaum Creek, Wilson Creek populations within Kittitas County contained 5 to 20 percent hybrids with rainbow trout (Trotter et al., 1999). It is likely that the various life history forms of westslope cutthroat trout occur in many of the Yakima River tributary streams and lakes.

2.1.3 Overview of Aquatic Habitat Functions and Values

Productive salmonid habitat is necessarily complex owing to the myriad requirements of various lifestages. Salmonids require cold clean waters, silt-free substrates, natural flow conditions, and structurally complex habitat suitable for spawning, rearing, and migration. The aquatic habitat features important for supporting salmonid populations include riparian condition, large woody debris (LWD) recruitment, fish passage, floodplain connectivity, channel migration, bank stability, pools, off-channel habitat, substrate/fines, water quality, and hydrology.

Riparian areas are the zones where aquatic and terrestrial ecosystems interact. Riparian vegetation provides habitat for many species of wildlife, and streamside or shoreline vegetation provides habitat functions for streams, and fish such as shade, bank stability, sediment/nutrient filtering, and organic nutrient input. In addition, riparian vegetation interacts with natural erosional and depositional processes of streams as channels migrate across valley bottoms to form instream habitat. As channels move back and forth through this channel migration zone (CMZ), instream pools and riffles are formed. Channel migration also promotes floodplain connectivity and recruitment of LWD, which can be a primary factor influencing channel form by the creation pools, riffles and off-channel habitats that are essential to support all life stages of anadromous salmonids (May, 2000).

Historically, natural riparian corridors in the Pacific Northwest were nearly continuous and the importance of riparian continuity is widely recognized (May et al., 1997; Naiman and Bilby, 1998; Wenger, 1999). Riparian corridor continuity is particularly important in smaller headwater streams because smaller streams generally make up most of the stream length within a watershed, and the influence of riparian vegetation on some stream habitat functions is greater for small streams (Binford and Bucheneau, 1993; Wenger, 1999; Beschta et al., 1987). Such areas upstream of fish-bearing waters help determine water quality, the magnitude and timing of flows, stream temperature, sediment, nutrients, and prey production in downstream waters.

Along lake shorelines, riparian vegetation is also a key element of ecological function and has a significant influence on the habitat value of the riparian zone, and in adjacent aquatic and terrestrial areas (Zelo and Shipman, 2000). Though not as well defined as for riverine systems, freshwater shoreline riparian zones serve many of the same functions (e.g., LWD, shading, organic matter production, sediment filtration, microclimate), as well as some additional functions unique to shorelines (Gregory et al., 1991; Naiman et al., 1992).

The following discussion is a review of major riparian functions and the level of functionality afforded by riparian buffers of varying widths as reported in the literature. Tables 7, 8, and 9 summarize the conclusions and recommendations for riparian buffer widths in frequently cited literature reviews of riparian buffer functions. These tables are not intended to be prescriptive, but serve to illustrate the range of effective buffer widths reported in the literature needed to provide a reasonable level of habitat functionality under most conditions. Buffer recommendations and functionality are frequently expressed in terms of site-potential tree height (SPTH), which is the height of mature trees that a given site can be expected to support.

Following the tables, further discussion of riparian functionality and considerations for determining buffer effectiveness is provided. In addition, riparian functions for lake shorelines are included in the discussion where appropriate.

Table 7. Stream Riparian Functions and Appropriate Widths Identified by May (2000).

Function	Range of Effective Buffer Widths (feet)	Minimum Recommended Width (feet)	Notes on Function
Large Woody Debris	33 to 328	262	1 SPTH based on longterm natural levels
Water Temperature	36 to 141	98	Based on adequate shade
Sediment removal and erosion control	26 to 600	98	For 80% sediment removal
Pollutant Removal	13 to 860	98	For 80% nutrient removal
Microclimate	148 to 656	328	Optimum long-term support

Table 8. Stream Riparian Functions and Appropriate Widths Identified by Knutson and Naef (1997).

Function	Range of Effective Buffer Widths (feet)
Large Woody Debris	100-200
Water Temperature	35-151
Erosion Control	100-125
Sediment Filtration	26-300
Pollutant Removal	13-600
Microclimate	200-525

Table 9. Stream Riparian Functions and Appropriate Widths Identified by FEMAT (1993).

Function	Number of SPTH	Equivalent (feet)
Large Woody Debris	.75	82.5
Shade	.75	82.5
Sediment Control	.75	82.5
Bank Stabilization	.5	55
Organic Litter	0.5	82.5
Microclimate	to be determined	to be determined

Spence et al. (1996) refer to the Forest Ecosystem Management Assessment Team’s (FEMAT) (1993) SPTH standard for riparian buffers in forested environments. A SPTH can be defined as the potential height of a mature tree at a particular location. A SPTH of 110 feet for forests east of the Cascade Mountains was established, and estimates are that a buffer width of approximately 0.75 SPTH (82.5 feet) is needed to provide minimum protection of stream shading, litter inputs, LWD, and nutrient regulation. FEMAT constructed curves that correlate the percent effectiveness of a function in relation to SPTH (Figure 1), and found that buffers designed to protect 100 percent of LWD recruitment will likely provide close to 100 percent of small organic litter as well.

Although data quantifying the effective zone of influence relative to root strength is scarce, FEMAT (1993) concluded that most of the stabilizing influence of riparian root structure is probably provided by trees within 0.5 SPTH of the stream channel (55 feet). As a result, buffer widths for protecting other riparian functions are likely adequate to maintain bank stability, except on steep slopes. Buffers designed to protect other riparian functions will generally control sediments to the degree that they can be controlled by riparian vegetation. Buffer widths designed to protect LWD recruitment and shading may be adequate to prevent excessive nutrient or pollution concentrations. Nevertheless, where land use activity is intense, buffers for protecting nutrient and pollutant inputs may need to be wider than those designed to protect other riparian functions, particularly when land use activities may exacerbate existing water quality problems. Little information exists and additional research is needed before buffer widths likely to protect riparian microclimate can be determined (Spence et al., 1996).

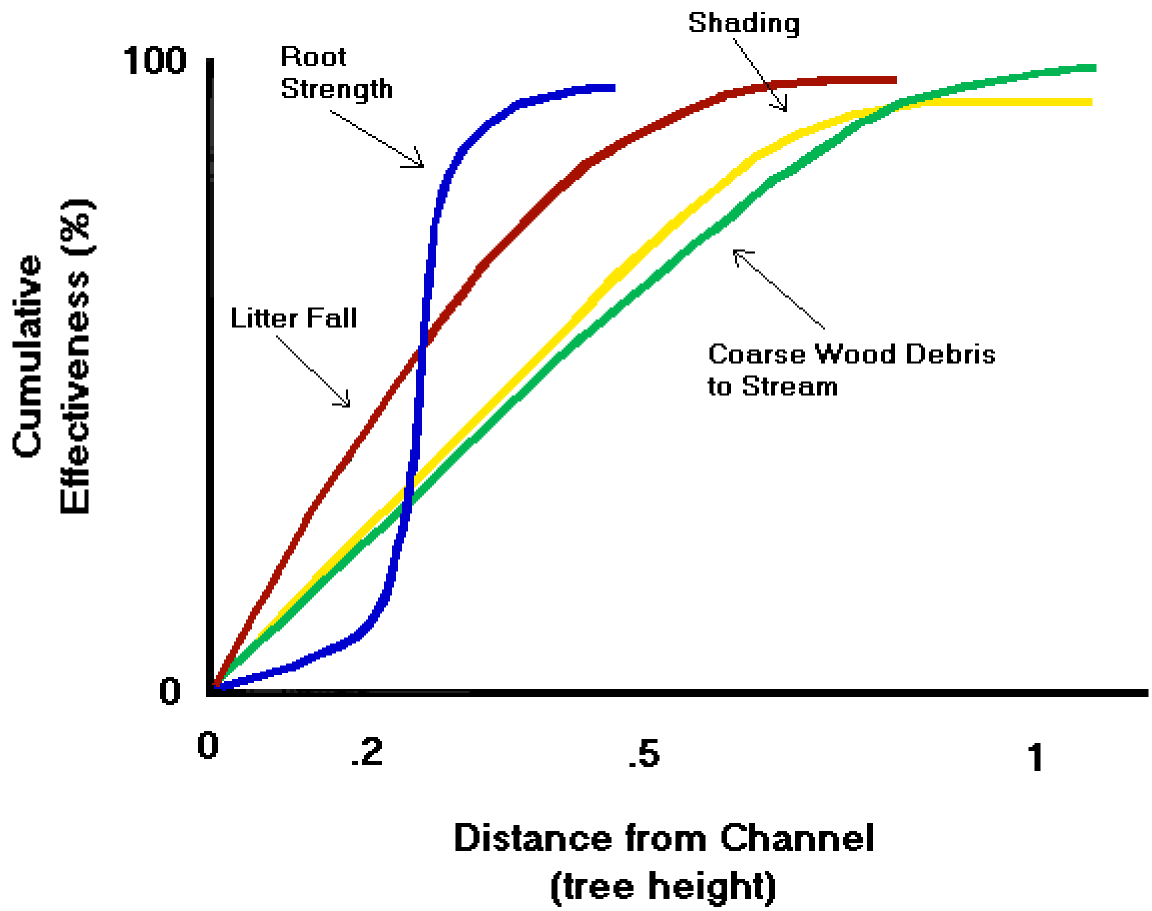

Figure 1. Curves correlating to the percent effectiveness of a function in relation to SPTH (FEMAT 1993).

The following sections provide additional description of riparian functions and concepts including:

- • Channel migration zones,
- • LWD recruitment,
- • Stream shading and temperature,
- • Bank stabilization and habitat formation,
- • Filtering of sediment, nutrients and chemicals,
- • Organic input and nutrient source, and
- • Microclimate.

Though the following discussion is primarily focused on stream habitats, additional discussion of how riparian vegetation influences lake shorelines is included where appropriate.

2.1.4 Channel Migration Zones (CMZs)

The importance of protecting the CMZ is well-documented, and to protect habitat functions supported by the CMZ, many investigators recommended that riparian buffers be measured laterally from the edge of CMZs where they occur, rather than from the ordinary high water mark (OHWM) as is typically required by most existing regulations (Knutson and Naef, 1997; May, 2000; WDNR, 1999, 2003; Smith, 2002). Knutson and Naef (1997) state "the channels of some streams, particularly larger streams and rivers in broad, alluvial valleys, may migrate across the valley as a result of natural erosional and depositional processes; the area over which the channel is expected to migrate is called the channel migration zone." As stream channels migrate across valley bottoms, riparian vegetation interacts with natural erosional and depositional processes, which promotes floodplain connectivity, LWD recruitment potential and the formation of instream habitat (May, 2000).

From a regulatory standpoint, the definition of CMZs varies. The Washington Forest Practices Board (WDNR, 1999) defined CMZs as "...the area that streams have recently occupied (in the last few years or less often decades), and would reasonably be expected to occupy again in the near future." However, the Forests and Fish Report (WDNR, 1999) provided the following guidance for defining CMZs:

> "Operationally, the CMZ should be equivalent to the area that a stream is expected to occupy in the time period it takes to grow a tree of sufficient size to provide geomorphic/ecological functions in the channel. On smaller streams, it may be appropriate to be concerned where the stream could move within 100 years or less. However, larger wood is needed to function in larger, high-energy channels. To be functional, recruitment trees must be very large, with root wads attached. As a consequence, on a larger stream, it may be necessary to include areas in the CMZ that the stream could occupy in the next 200 years or more."

Regardless of the time frame used to define a CMZ, what ultimately determines the presence of a CMZ is physical evidence of channel migration such as inactive channels, old meander bends, sloughs, oxbows, or floodplain terraces. By definition, such features only occur within CMZs and any classification system of channel migration potential can only be derived from such evidence of channel migration. In general though, channel migration can be expected to occur in lower gradient streams and rivers having broad valleys (that were often formed by such channel migration processes over long periods of time), which are typical of those reaches designated as "Shorelines of the State" (i.e., having a mean annual flow equal to or greater than 20 cubic feet per second (cfs)) in Kittitas County. However, In Kittitas County many streams or portions of streams have the potential to migrate including the Yakima River, Coleman Creek, Wilson Creek, Manastash Creek, Taneum Creek, Teanaway Creek, Cooper River and Gold Creek (Personal Communication, Patricia Olsen, Ecology, April 2012). Additional details and protocols for identifying and delineating CMZs can be found in WDNR (2003).

2.1.5 Large Woody Debris Recruitment (LWD)

Woody debris consists of root wads, trees, and limbs that fall into the stream as a result of bank undercutting, mass slope movement, normal tree mortality, windthrow, or debris flow. The majority of woody debris is supplied by the riparian area, and to a lesser extent, by the zone of influence. Woody debris is often transferred from tributaries during debris flows. Woody debris affects channel shape by forming obstructions (in single pieces or in large jams) that alter stream flow and velocity, which in turn promotes erosion and deposition in the channel bed and create a variety of habitat niches.

Woody debris traps organic and inorganic matter. Trapped organic matter, such as leaves, insects, or fish carcasses, provide the basic food supply within the stream environment. Trapped salmon carcasses, for instance, import nutrients from the ocean and function as fertilizer for downstream habitats. Trapped inorganic matter such as sand and gravel creates habitat and provides spawning grounds for fish. Woody debris in and around the stream channel creates upland habitat for a variety of organisms. Decaying woody debris functions as habitat for riparian seedlings, influencing plant succession. Woody debris amends the physical and chemical properties of the underlying soil. By trapping water, woody debris increases the amount of biologically and chemically active surface area, activating consumption of organic matter by invertebrates (Bolton and Monohan, 2001; Chesney, 2000; Knutson and Naef, 1997; Montgomery and Buffington, 1993, Mikkelsen and Vesho, 2000; Naiman and D'ecamps, 1997).

2.1.6 Shading and Temperature

As reviewed in GEI (2002), thermal modeling results indicate that stream temperature in any given location is primarily dependent on the temperature of water directly upstream, or the input water temperature. Riparian vegetation generally serves to reduce solar heating and maintain water temperatures. Under undisturbed conditions, stream temperatures are maintained because the surface and groundwaters than comprise streamflow are thermally protected by upland and riparian vegetation and soils. As forested area in a watershed is removed, thermal protection is removed and the ratio of warmer surface to cooler groundwater in a stream increases. Combined with loss of thermal protection, stream temperatures increase. Therefore, actions in upper watersheds can lead to increased water temperatures in lowland areas, but adequate shading is required in lowland areas to prevent further solar heating.

The value of riparian buffers in moderating stream temperatures is well-established, but the effectiveness of different buffer widths varies depending on site conditions. Several authors (Beschta et al., 1987) have concluded that buffer strip widths of 100 feet or more generally provide the same level of shading as that of an old growth forest in the Pacific Northwest while several authors have recommended a minimum buffer width of 30 feet (Davies and Nelson, 1994). In forested areas, harvest treatments that leave overstory vegetation buffers adjacent to streams have been shown to have no significant impact on stream temperature (Lee and Samuel, 1976; Rishel et al., 1982; Lynch et al., 1984; Sugimoto et al., 1997). In coastal British Columbia, Gomi et al. (2003) conducted a 6-year field experiment to evaluate the effects of riparian buffer widths on stream and riparian ecosystems, including stream temperature response. Treatments included no timber harvesting, harvesting with 33-foot and 100-foot wide riparian buffers, and clear-cut harvesting with no buffer. The results indicated that water temperature in the streams with 33 -foot and 100-foot wooded buffers did not exhibit statistically significant warming. Todd (2000) examined various buffer functions and found that smaller riparian buffers (as narrow as about 40 feet) are required to protect water temperature and food web functions, and Johnson and Ryba (1992) recommend a similar buffer width of from 30 to 100 feet to effectively protect stream temperature. However, Brown and Kryier (1971) noted that on very small streams, adequate shade may be provided by brush species.

Along lake shorelines, shading from vegetation reduces light levels and helps regulate heating of the nearshore areas. Shading also reduces mortality and stress to insects (Pentilla, 2000).

2.1.7 Bank Stabilization and Habitat Formation

Streams tend to erode the outer banks of meander bends while depositing sediment as bars on the inside of the meander bends. Through this continual process of erosion and deposition, the location and quality of habitats and the meander pattern and position within the valley changes over time. This process acts in response to natural and unnatural disturbances within a watershed and serves to create and recreate salmonid habitat. For any given disturbance, the rate, magnitude, and nature of channel response in part depends on the condition of riparian vegetation.

Vegetation resists shoreline erosion, but often not as effectively as artificial structures. Diverse native vegetation can be expected to moderately resist shoreline erosion allowing channels to physically respond to disturbances, thereby forming and reforming salmonid habitat features over time (Reeves et al., 1995). As reviewed in Spence et al. (1996), roots bind streambank soils and slow water currents, thereby stabilizing stream banks. Stream currents carve the material underneath the root zone creating shelter and structural habitat for salmonids and terrestrial and aquatic macroinvertebrates. Other benefits of the natural channel formation and migration process include erosion of gravels from streambanks, which replenishes spawning substrate, and the undercutting of streamside trees, which become a primary source of LWD.

In many areas of the populated and developed lowland areas of Kittitas County, natural channel formation processes have been interrupted by armoring streambanks with artificial structures such as rock-riprap, to protect lives and property. This interruption of channel-forming processes may be necessary and permanent, but it must be acknowledged in such cases that complete resistance to shoreline erosion does not support reliance on natural habitat forming processes, and other means of providing habitat features, if possible, would be necessary.

As concluded in FEMAT (1993), an appropriate width for providing bank stabilization is 0.5 SPTH (Table 9). Based on this criterion, this distance will vary depending on site conditions, but would be expected to range from about 50 to 100 feet. While relatively narrow buffers of immature vegetation may provide adequate bank stabilization, particularly in low-gradient reaches of smaller streams, other studies recommend a width of about 100 feet as generally sufficient to control streambank erosion, even in areas of high mass wasting (Knutson and Naef, 1997; May, 2000; Cederholm, 1994).

2.1.8 Filtering of Sediment, Nutrients, and Chemicals

Uptake of dissolved chemicals, and filtration of sediments from overland runoff and flood water is an important riparian function (Cummins et al., 1994). The chemicals that constitute plant nutrients may be largely incorporated in the riparian zone’s biomass. This combined with the trapping of sediment within the riparian landscape contributes to the building of “new land” involved in channel or shoreline migration. Any action, such as clearing, that degrades the integrity of the riparian zone will hamper to some degree these chemical filtering, uptake and land-building functions.

Literature review by FEMAT (1993) indicated that healthy riparian zones greater 200 feet from the edge of a floodplain probably remove most sediment from overland flow. Sufficiency of buffer widths is dependent on slope steepness, with wider buffers required for steeper slopes (Vanderholm and Dickey, 1978). Given this, widths of 100 to 300 feet appear to be generally sufficient for filtering substantial proportions of sediment (50 to 90 percent) originating from hill slopes (Karr and Schlosser, 1977; Johnson and Ryba, 1992; Belt et al., 1992; Lowrance et al., 1986, 1988). While these recommendations are based mainly on short-term studies, some long-term studies have been conducted that also support a recommended buffer width of 100 to 300 feet for filtering sediment (Lowrance et al., 1986, 1988).

Buffer widths reported for removal of pollutants, nutrients and chemicals can vary widely based on vegetation type, soil type, and slope. Knutson and Naef (1997) report that buffer widths ranging from 13 feet to more than 850 feet are adequate for nutrient reduction or removal depending on site conditions. Though there is a wide range of effective buffer widths reported in the literature, widths of 100 feet are generally sufficient for removing nutrient or bacterial pollution (Lynch et al., 1985; Terrell and Perfetti, 1989). Terrell and Perfetti (1989) also report riparian widths of 200 and 600 feet as necessary for removing pesticides and animal waste and nutrients from croplands.

But numerous studies reported in GEI (2002) illustrate that significant sediment filtering and water quality benefits can be achieved in agricultural areas (generally low-gradient systems with little side-slope) by buffers or vegetation filter strips ranging from 25 to 50 feet, particularly in combination with suitable BMPs. If buffers are the primary means of protection against input of sediments, nutrients, pesticides and pathogens, then relatively wide buffers may be required. However, by employing appropriate BMPs such as sediment controls and managing the application of fertilizer and pesticides, the risk of transport into streams can be markedly reduced, thereby reducing the riparian buffer width required to effectively protect streams from these impacts.

2.1.9 Organic Input and Nutrient Source

Riparian trees and other vegetation furnish fresh waters with a "litter fall" of plant particles (leaves, pollen grains, etc.), and with terrestrial insects. These organic materials compose a major energy source for food webs that sustain production of salmonids, particularly in low- and mid-order streams (Gregory et al., 1991; Naiman et al., 1992; Cummins et al., 1994). Along small stream channels, outside sources of nutrients such as litter fall from healthy stands of riparian vegetation is a greater contributor to the aquatic food web than in-channel algae production, which tends to predominate as the basis in wider, less shaded streams (Vannote et al., 1980) and in standing waters. Clearing riparian vegetation may reduce or destroy the nutrient-providing function depending on the extent of the action and the relative importance of litter fall in sustaining nutrient input into the system.

2.1.10 Microclimate

Microclimate, defined as the local climate (humidity, wind speed, and air temperature) within the stream and riparian ecosystem, is primarily affected by the quality and extent of riparian vegetation (Pollack and Kennard, 1998). Watershed scale microclimate also influences stream temperatures, contributing to lower temperatures in forested watersheds than in urbanized or otherwise cleared watersheds. Brosofske et al. (1997) documented that riparian microclimate is important to consider in management because it affects plant growth, therefore influencing ecosystem processes such as decomposition, nutrient cycling, plant succession, and plant productivity. Thus microclimate alterations can affect structure of the riparian forest, the waters within it, and the well-being of many animals, including fish. Riparian buffer widths necessary for microclimate control are generally much wider than those necessary for other functions, with the exception of habitat for some species of wildlife. A riparian buffer width of 200 feet may provide minimum or partial microclimate function in some circumstances; however, widths greater than 300 feet are generally required to provide full microclimate protection (Spence et al., 1996; Chen et al., 1990; Brosofke et al., 1997; Franklin and Forman, 1987).

2.2 Human Activity and Aquatic Habitat Functions

Streams and rivers originating in the headwater areas of Kittitas County streams once flowed through dense forested areas and broad vegetated floodplains. These streams had natural flow regimes, excellent water quality, and complex instream cover. Today, healthy riparian areas are scarce or inadequate, and streams and rivers are frequently confined or controlled, or are realigned to accommodate agricultural or development activities. Human activities have had similar effects on lake habitats.

2.2.1 Freshwater Riverine Limiting Factors

Salmonid habitat conditions and productivity have been impacted by a variety of land use and water development actions in the watershed. These uses contributed to the development of the important agricultural, forestry, and mining industries in the Yakima Basin, but historical watershed modifications were often implemented with little or limited consideration of effects on salmonid resources. According to Haring (2001), the dramatic decline in salmon and steelhead production in the Yakima Basin is most likely associated with the combination of habitat-related impacts in the late 1800s and early 1900s:

- Irrigation development—Irrigation diversions were constructed on the mainstem Yakima and many of its tributaries. Most were constructed without upstream fish passage facilities or downstream juvenile fish screening, and many dewatered reaches downstream from the diversion.
- Construction of irrigation storage reservoirs—Dams at the outlets of naturally occurring Keechelus Lake, Kachess Lake, and Cle Elum Lake were built without upstream fish passage, precluding access and anadromous salmonid production from approximately 70 miles of highly productive fish habitat upstream of the dams. Construction of the original crib dams and the storage dams resulted in the extirpation of sockeye salmon from the Yakima River basin.
- Splash damming (log drives)—From 1879 through approximately 1915, splash dams were constructed on tributaries in the upper Yakima, and the channels were cleared in order to drive large log rafts downriver to lumber mills, resulting in a significant decline in suitable salmonid habitat in those basins.
- Mining—Discovery of gold in Swauk Creek in the 1870s led to extensive placer mining, which created extensive alteration of the channel, substrate, and banks, and caused extensive turbidity. This affected salmonid production in Swauk Creek and likely downstream in the Yakima River.
- Removal of beaver—Beaver dams were historically common throughout the watershed. Beaver trapping in the mid 1800s resulted in a loss of beaver dams that helped maintain hydrology during dry periods, resulting in an associated loss of valuable juvenile salmonid rearing habitat and possibly creating additional impairments to upstream fish passage.
- Grazing—Extensive grazing occurred in the late 1800s, particularly in higher elevation subwatersheds.

Snyder and Stanford (2001) acknowledge five factors limiting salmonid production in the Yakima Basin:

- Negative interactions between fish species—wild versus exotic and wild versus hatchery,
- Alteration of the flow regime,
- Impairment of water quality,
- Alteration of the natural temperature regime, and
- Reduction in habitat heterogeneity and floodplain connectivity.

In functional terms, the factors that limit the current productivity and carrying capacity of the component reaches of the subbasin may be divided into 10 classes. Factors affecting current natural production have been classified in terms of the specific element of the aquatic ecosystem they most directly impact. Aquatic ecosystems can be disaggregated into abiotic and biotic components. Six distinct parameters fully describe the abiotic components, and four describe the biotic components.

Abiotic elements include the following (Fast et al., 2001):

- **Water quality**—temperature, suspended sediment, turbidity, chemical pollution and pesticides, nutrient concentration, dissolved oxygen, biological oxygen demand.
- **Habitat accessibility**—the presence or absence of physical barriers to anadromous salmonids.
- **Habitat structure**—pool frequency and quality; fine sediment delivery and deposition; size distribution of substrate; and the quantity and distribution of large woody debris, off-channel

habitat (e.g., side channels and sloughs), and refugia (near-pristine habitat patches sheltering core populations).

- **Channel condition and dynamics**—width-to-depth ratio, streambank stability, channel stability, channel confinement and simplification, floodplain connectivity.
- **Instream flow/hydrology**—similarity of peak and base flows to normative values, similarity of drainage network to the historical drainage network, and mortalities (e.g., entrainment, predation, or stranding) caused by irrigation or hydropower diversions.
- **Watershed condition**—road density, condition, and location; disturbance history; and the quantity and distribution of riparian reserves (i.e., habitat patches of natural, late-succession riparian vegetation providing normative rates of large woody debris recruitment, shading, etc.).

The four major biotic elements are (Fast et al. 2001):

- **Predation**—both inter- and intraspecific.
- **Competition**—both inter- and intraspecific (e.g., between hatchery and wild fish, and between resident and anadromous morphs of the same species, especially in the case of steelhead).
- **Pathogens/parasites**.
- **Mutualism**—species that benefit each other, such as the fertilization by salmon carcasses of infertile streams, to the benefit of the entire aquatic community, or such as water retention and the beneficial habitat structure provided by beaver dams. (For the sake of organization, a major mutualistic element, riparian vegetation, has been grouped with habitat structure, an abiotic parameter.)

2.2.2 Altered Flow Regime

Dam construction and reservoir operation within the Yakima River basin drastically altered the natural flow regime of the Yakima River. The current flow regime:

- produces flows that are unnaturally low during fall and winter;
- reduces available fall and winter salmonid rearing habitat;
- fails to produce spring flood flows, which formerly helped flush smolts through the system;
- creates unnatural fluctuations that strand and kill fish or displaces them to suboptimal habitat;
- has unnaturally high flows all summer, which results in channel erosion and loss of habitat structure such as large woody debris (Reclamation, 2002).

Flow fluctuations within the Yakima River that occur as part of the Bureau of Reclamation’s Yakima Project operations may exacerbate erosion of riverbanks, harming native riparian vegetation. Pollution from agricultural return waters may impair the riparian vegetation along the river. Pesticides, sediment, and unnatural nutrient balances may deter native plant growth, possibly promoting the growth of nonnative species (Reclamation, 2002).

One byproduct of the Yakima Project that has become a key element in Yakima Basin water management is flood control. Flood control reduces both flood frequency and the extent of flooding, allowing counties to permit the development of the floodplain for other uses (e.g., agriculture or home building), which often results in diminishing riparian vegetation. Grazing livestock can damage riparian vegetation, as can the development of home sites along the river or tributaries, when new residents clear areas adjacent to the waterbody. However, not all development is necessarily detrimental to local riparian vegetation. For instance, upslope irrigation may actually raise a surface water table and increase the water available to some natural riparian areas, thereby increasing the growth of riparian vegetation (Reclamation, 2002).

Development of irrigated agricultural areas has reduced riparian areas by encouraging development of farmland in riparian and adjacent arid zones. Additionally, some natural stream channels are used to deliver irrigation water. Many of the natural streambeds in the upper Yakima Basin are used as delivery canals. Water is put into these waterbodies upstream, to provide water to downstream irrigators. The flow fluctuations that occur as a result of these practices may erode streambanks and destroy natural riparian vegetation (Reclamation, 2002).

2.2.3 Habitat Concerns

The following are the most critical aquatic habitat concerns in Kittitas County (Haring, 2001):

- Fish passage barriers (lack of instream flow, lack of fish passage), and lack of screening associated with irrigation diversions, which impairs fish passage into suitable habitat in the upper portions of tributaries.
- Impaired floodplain function on the Yakima River and many tributaries.
- Altered hydrology, resulting in unnaturally high flows through the irrigation season, and substantially reduced spring runoff in most years.
- Impaired riparian function on many tributaries.
- Lack of habitat complexity (e.g., little LWD, channel simplification, lack of pools).
- A high delivery of fine sediment and associated toxics, primarily from irrigation return flows.
- Lack of anadromous fish passage at Cle Elum, Keechelus, and Kachess Dams.

The salmonid production potential in the Yakima Basin is not nearly as bleak as the information above might indicate. The watershed has both existing production potential and significant habitat restoration potential. There are still areas with highly productive habitat conditions, and other areas where high quality habitat exists upstream of existing fish passage barriers. There is general support for the tenets of 1) protecting the best remaining habitat, 2) restoring those habitat areas that are still functioning, and 3) restoring severely impaired, nonfunctioning habitat where feasible. Salmonid recovery will require a combination of efforts (Haring, 2001):

- Habitat restoration and resource protection will require landowner commitment, participation, and stewardship. Land use regulations alone will not be effective.
- Revision, implementation, and enforcement of land use ordinances that provide protection for natural ecological processes within the instream and riparian corridors.
- Protection of currently functioning instream and riparian habitat, particularly in key habitat areas.
- Restoration of natural instream and riparian ecological processes, where they have been impaired.

2.2.4 Climate and Oceanic Conditions

There is mounting evidence that Pacific salmon, both of hatchery and natural origins, experience large year-to-year and decade-to-decade changes in productivity as a result of ocean conditions (Mantau and

Francis, 2003). In the Pacific Northwest, temperature and precipitation data go back about 100 years. During that time there have been four relatively distinct climatic periods:

- 1896-1914—Generally wet and cool.
- 1915-1946—Generally dry and warm.
- 1947-1975—Generally wet and cool.
- 1976-1994—Generally dry and warm.

Scientists have found that salmon returns in the Northwest show long-term behavior that closely follows climatic cycles (ISG, 1999; NRC, 1996). Anderson (1995, quoted in Taylor and Southards, 1997) analyzed climatic data and determined patterns of cool, wet periods and warm, dry ones. Anderson then compared these findings with Columbia River spring Chinook salmon returns going back to 1940. The correlation between spring Chinook and climatic patterns are very strong, and indicate that salmon returns increase during cool, wet periods and decline during warm, dry periods.

While there are undoubtedly human-induced effects on the fish, the natural variability may be a very significant influence as well (Taylor and Southards, 1997). While salmon stocks in the Northwest have showed low numbers in recent decades, Alaska salmon have had a major boom period. Climatologists have found that weather patterns in Alaska and the Northwest are out of phase: wet periods in the Northwest tend to be dry in Alaska and vice versa. The El Niño-Southern Oscillation and the Pacific Decadal Oscillation appear to be major drivers for this phenomenon. Salmon returns in the Northwest and Alaska are similarly out of phase. Anderson (1997) found that Chinook returns in the Rogue, Columbia, and Snake Rivers behave similarly over time; however, Columbia and Alaska salmon are out of phase, with the abundant 1950-1975 period in the Northwest corresponding with a very poor salmon period in Alaska (Taylor and Southards, 1997).

There are indications that global ocean and atmosphere conditions are the cause of the long-term climate variations. There also are data that indicate a switch in climate regimes occurred in 1994, and that the Pacific Northwest has returned to a wet, cool winter cycle. Some returning salmon numbers have increased dramatically over the last several years, following the 1997-1998 El Niño event (Taylor and Southards, 1997).

While it might be tempting to attribute all changes in salmon abundance to ocean conditions and to conclude therefore that stream corridor management is unnecessary, all human effects on the stream corridor reduce the capacity of the environment to produce and sustain salmon populations, which makes stream corridor management even more important when ocean conditions reduce natural production (NRC, 1996).

In 2009, the University of Washington Climate Impacts Group (CIG) published a study on the impacts of climate change on the Yakima River Basin, particularly on agriculture. The study predicted that the percentage of water shortage years will increase from the historical 14 percent to 32 percent in the 2020s, 36 percent in the 2040s, and 77 percent in the 2080s. Water shortages in the Yakima basin threaten instream flows for fish. Historically, snowmelt has been an important source of surface water in the Yakima basin, meeting most of the water supply demands in the spring and early summer. Under climate change, increased temperatures would lead to reduced snowpack as more precipitation falls as rain. Additionally, snowpack would melt earlier in the season. The CIG found that, with a 1^{o}C rise in temperature, snowmelt volume will be reduced by 12 percent. A 2^{o}C rise in temperature will cause a 27 percent decrease in snowmelt volume (Vano et al., 2009). This suggests that instream flows in the Yakima basin are particularly susceptible to climate change.

2.2.5 Harvest and Habitat Factors

A number of factors outside the Yakima River basin have lead to depletion of salmonids stocks in the basin. These include harvesting, both commercial and recreational on the Columbia River and in the ocean; mortality at downstream hydroelectric dams; habitat degradation from headwater logging and mining operations; floodplain and habitat degradation from roads and other development; and stranding of fish in unscreened irrigation diversions (ISG, 1999).

Harvests impact salmon productivities directly—by reducing the numbers in the spawning populations—and indirectly—by reducing the diversity in the population, which impacts factors important to basic productivity. Overfishing occurs when fishing removes enough spawners from a population to cause it to decline. Overfishing reduces the production of salmon by reducing or eliminating the populations that have adapted to the habitat types and environmental conditions of the basin (ISG 1999).

Prior to 1941, excessive harvest exploitation and widespread habitat degradation acted together to reduce the abundance of Columbia River Basin salmon stocks. Overfishing of the salmon runs by the commercial fishery in the lower Columbia River was documented as early as the 1870s. Seventeen years later, biologists were looking to the lower river fisheries to explain sharp declines in salmon returns to the Yakima River (particularly spring Chinook and sockeye) (McDonald 1894, quoted in ISG 1999).

Craig and Hacker (1940, quoted in ISG 1999) discuss in detail human population growth, logging, mining, hydroelectric power, and flood control and navigation as causes for the decline in salmon resources during the nineteenth and early twentieth centuries. Regarding factors contributing to the first major Columbia River Chinook salmon harvest declines, from 1884 to 1889, Craig and Hacker cite the reduction of late spring and early summer Chinook by fishing, and reductions in fishing effort as a result of falling demand for the relatively high-priced Columbia River salmon.

2.2.6 Habitat Management and Protection Tools

Designation, Rating, and Classification

KCC currently classifies streams using a five-tier typing system similar to that identified in WAC 222-16-030. New water types have been established in WAC 222-16-030, but this system will not go into effect until fish habitat water type maps have been adopted by the State. Until such time, the interim water typing system established in WAC 222-16-031 will continue to be used by the State. New water types are presented below for informational purposes along with a conversion table for the interim and new water types.

As excerpted from WAC 222-16-030, new water types are as follows:

- **Type S Water -** all waters, within their bankfull width, as inventoried as "shorelines of the state" under chapter 90.58 RCW and the rules promulgated pursuant to chapter 90.58 RCW including periodically inundated areas of their associated wetlands.
- **Type F Water -** segments of natural waters other than Type S Waters, which are within the bankfull widths of defined channels and periodically inundated areas of their associated wetlands, or within lakes, ponds, or impoundments having a surface area of 0.5 acre or greater at seasonal low water and which in any case contain fish habitat.
- **Type Np Water -** means all segments of natural waters within the bankfull width of defined channels that are perennial nonfish habitat streams. Perennial streams are waters that do not go dry any time of a year of normal rainfall. However, for the purpose of water typing, Type Np

Waters include the intermittent dry portions of the perennial channel below the uppermost point of perennial flow.

- **Type Ns Water -** means all segments of natural waters within the bankfull width of the defined channels that are not Type S, F, or Np Waters. These are seasonal, nonfish habitat streams in which surface flow is not present for at least some portion of a year of normal rainfall and are not located downstream from any stream reach that is a Type Np Water. Ns Waters must be physically connected by an above-ground channel system to Type S, F, or Np Waters.

Conversion between the water types presented in WAC 222-16-031 is shown in Table 10.

Table 10. Water Type Conversions from WAC 222-16-031.

Permanent Water Typing	Interim Water Typing
Type S	Type 1
Type F	Types 1 and 2
Type Np	Type 4
Type Ns	Type 5

Buffers

KCC buffer designations for rivers and streams are tiered to current State water typing classifications. KCC currently requires buffers ranging from 40 to 200 feet from the OHWM for all Type 1 and Type 2 streams; 20-50 feet from the OHWM of Type 3 streams; 10 to 20 feet for a Type 4 stream, extending from the intersection with a Type 1, 2, or 3 stream for a distance of 40 to 500 feet (40 to 500 feet upstream of the confluence with a Type 1, 2, or 3 stream, only a 15-foot building setback is required); no buffer is required for Type 5 streams, allowing for protection by a Type 1, 2 or 3 stream buffer and a 15-foot building setback (KCC 17A.07.010(2)) .

For protection of instream salmonid habitat conditions, a wide range of recommended riparian buffer widths is presented in existing studies (see previous discussion of riparian buffer functions). Variation in recommendations or buffer effectiveness is frequently due to variation in site conditions such as sideslope angle, stream type, geology, climate, etc. However, no studies recommend zero width, nor do the studies recommend the equivalent of more than several site potential tree heights. Design of riparian buffers must consider the ecological, cultural, and economic values of the resource, land use characteristics, and existing riparian quality throughout watersheds in order to address the cumulative impacts on stream functions and the resources being protected (Johnson and Ryba, 1992; Castelle et al., 1994; Wenger, 1999).

Appropriate buffer sizes will depend on the area necessary to maintain the desired riparian or stream functions for the given suite of land use activities. A wider buffer may be desired to protect streams from impacts resulting from activities such as trail construction, recreation, pets, garbage, and tree removal(e.g., for view improvements and hazard reduction). These concerns are often a greater concern in areas of high-intensity land use and thus wider buffers, or restrictions (such as building setbacks) that keep a potential hazard from occurring, may be needed, while narrower buffers may suffice in areas of low-intensity land use (May, 2000). It should be noted that opportunities for protection or improvement of buffer conditions in areas of high-intensity land use are often effectively foreclosed by existing development, or the existing habitat conditions are already highly altered. Under such conditions, establishing buffers wide enough to provide an effective full-range of riparian functions may be unattainable and other actions may be required to improve habitat conditions beyond what riparian buffers are able to provide. In addition, buffer vegetation type, diversity, condition, and maturity are equally as important as buffer width, and the best approach to providing high-quality buffers is to strive for establishing and maintaining mature native vegetation communities (May, 2000).

Pollack and Kennard (1998) recommended buffer widths of 250 feet on all perennial streams. Buffer widths of one SPTH would reasonably provide for a full range of riparian functions, and therefore, not contribute significantly to the loss of salmonid habitat. May (2000) and other extensive reviews provide detailed summaries of buffer width sizes necessary to achieve stream and riparian functions (Knutson and Naef, 1997; FEMAT, 1993). The conclusions of those reviews are presented in Tables 7, 8, and 9. However, as was previously discussed, these recommended buffer widths are largely driven by providing adequate long-term LWD recruitment potential, and are not necessarily inclusive of all situations. For example, along highly managed streams such as in agricultural, residential, or commercial areas, some functions normally provided (at least in part) by riparian buffers, such as flow attenuation or filtration of pollutants, can be provided by application of appropriate BMPs in combination with smaller buffers.

In addition, the importance of protecting the CMZ is well documented. Many researchers recommend that buffer widths be measured from the edge of the CMZ on streams with active channel migration zones (Knutson and Naef, 1997; May, 2000; WDNR, 1999; Smith, 2002). Incorporating CMZs into County regulations should be considered, but using CMZs as the basis for buffer determination poses some challenges in a regulatory context because the extent of the channel migration zone will vary from parcel to parcel and has not been determined for most streams and rivers in Kittitas County. However the task of determining CMZs in Kittitas County is underway and the information should be incorporated into determinations of appropriate buffer widths as it becomes available.

Timing Restrictions

Timing restrictions for conducting in-water work are necessary to protect habitat and life-stage requirements that differ by species and time of year. No timing restrictions for in-water work are specified in the current KCC, but windows for conducting work within the OHWM of freshwater and lake systems have been established by state and federal resources agencies. The general and approved fish work windows for most Kittitas County streams is from July 1 to September 30 (Table 11). However, there are numerous streams with slightly shorter work windows or ones that require a separate determination, as identified in WDFW's Hydraulic Project Approval (HPA) to be issued for each individual site.

Table 11. Allowable In-Water Work Windows for Kittitas County Streams

Washington Counties and State Waters including tributaries[1] - Water Resource Inventory Area (WRIA) is given in parentheses	Work is Allowed only Between These Dates
Kittitas County	July 1 - September 30
Brushy Creek (40.0612)	July 1 - February 28
Colockum Creek (40.0760)	July 1 - October 31
Quilomene Creek (40.0613)	July 1 - October 31
Stemilt Creek (40.0808) - Upstream of falls	July 1 - February 28
Tarpiscan Creek (40.0723)	July 1 - February 28
Tekiason Creek (40.0686)	July 1 - February 28
Whisky Dick Creek (40.0591)	July 1 - February 28
Yakima River (39.0002) - Roza Dam to Teanaway River	August 1 - August 31
Naches River (38.0003) - Tieton River to Bumping River	July 1 - August 15
Little Naches River (38.0852) - Mouth to Matthew Creek	July 16 - August 15
Little Naches River (38.0852) - Upstream of Matthew Creek	July 16 - August 15
Pileup Creek (38.0932)	July 16 - August 31
Gold Creek (38.MISC)	July 16 - February 28
Swauk Creek (39.1157)	July 16 - September 30
Baker Creek (39.1157)	July 16 - September 30
First Creek (39.1157)	July 16 - September 30
Iron Creek (39.1157)	July 16 - September 30
Williams Creek (39.1157)	July 16 - September 30
Boulder Creek (39.1157)	July 16 - February 28
Cougar Gulch (39.1157)	July 16 - February 28
Lion Gulch (39.1157)	July 16 - February 28
Yakima River (39.0002) - Teanaway River to Easton Dam	August 1 - August 31
Yakima River (39.0002) - Upstream of Easton Dam	August 1 - August 31
Cle Elum River (39.1434) - Mouth to Dam	July 16 - August 31
Cle Elum River (39.1434) - Upstream of Cle Elum Dam	Submit Application
Big Boulder Creek (39.1434MISC)	August 1 - February 28
Camp Creek (39.1434MISC)	August 1 - February 28
Fortune Creek (39.1434MISC)	August 1 - August 15
South Fork Fortune Creek (39.1434MISC)	August 1 - February 28

Washington Counties and State Waters including tributaries[1] - Water Resource Inventory Area (WRIA) is given in parentheses	Work is Allowed only Between These Dates
Howson Creek (39.1434)	July 16 - February 28
Little Salmon Le Sac Creek (39.1482)	August 1 - August 15
Paris Creek (39.1434MISC)	August 1 - February 28
Salmon Le Sac Creek (39.1520)	August 1 - February 28
Kachess River (39.1739) - Upstream of Lake Kachess	Submit Application
Kachess River (39.1739) - Below Dam	July 16 - August 15
Box Canyon Creek (39.1765)	Submit Application
Mineral Creek (39.1792)	August 1 - August 15
Lake Keechelus (39.1842) tributaries	July 16 - August 15
Gold Creek (Lake Keechelus) (39.1842)	Submit Application
Manastash Creek (39.0988)	July 16 - September 30
Naneum Creek (39.0821)	July 16 - September 30
Taneum Creek (39.1081) - Mouth to I-90	July 16 - August 31
Taneum Creek (39.1157) - Upstream of I-90	July 16 - September 30
Teanaway River (39.1236)	July 16 - August 31
NF Teanaway River (39.1260)	Submit Application
Umtanum Creek (39.0553)	July 16 - September 30
Wenas Creek, Below Dam (39.0032)	July 16 - October15
Wenas Creek, Upstream of Wenas Lake (39.0032)	July 16 - February 28
Other Yakima River tributaries not listed	July 16 - August 31

[1]The work time for a Kittitas County applies to all waters within that county, unless a work time is given for a listed water in that county. The work time for a listed water applies to all its tributaries, unless a tributary of that water is also listed.

2.2.7 Protection and Management of Anadromous Species

Habitat used by anadromous fish is potentially found in all types of FWHCAs. The KCC does not provide specific guidelines for protecting anadromous salmonid species, but the protection and management of anadromous salmonids is provided for in the existing critical areas regulations and other development regulations potentially applicable to aquatic habitats, which includes floodplain development regulations and the SMP.

Management strategies that promote and allow natural stream corridor processes to evolve over time tend to succeed because they work with the natural tendencies of a stream corridor, rather than working against them (Ebersole et al., 1997, quoted in Bolton and Shellberg, 2001). Existing habitat conditions, habitat limiting factors, and proposed protection measures for anadromous salmonids in Kittitas County have been presented in several completed or ongoing management documents (Haring, 2001; USFWS, 2002; NMFS, 2009; YBFWRB; 2009; YBFWRB, 2012).

Bull Trout

The following is a list of prioritized actions in Kittitas County that will lead to the recovery of the species, which are tiered to indicate high- to low priority for implementation.

> **Tier I: "Action" Populations:** These are populations where recovery actions would provide an immediate benefit to habitat conditions and population levels, and thus are the highest priority across all populations (Gold Creek and Box Canyon Creek).
>
> **Tier II: "Protection" populations:** These are populations to protect and to continue monitoring, but where actions are expected to solicit a limited population level response (Kachess River). These populations are the next priority tier for implementing recommended actions.
>
> **Tier III: "Monitor" populations:** These are populations where the priority action is to determine if bull trout are currently present, because the number of individuals in these populations is low or unknown. Implementation of recovery actions is a low priority. If an extant, a self-sustaining population of bull trout is discovered, or when supplementation/reintroduction efforts are initiated, these would be re-evaluated (Cle Elum River, Teanaway River, and Upper Yakima River).

As the method described above was applied, a comprehensive list of actions, prioritized among and within populations was created. The recommended actions may be Broad Scale Actions, Population-Scale Actions or Monitoring Actions. The scale of these actions varies temporally and spatially.

Broad Scale Actions are recognized as crucial to the recovery of bull trout populations but will require large scale coordination efforts from entities across the basin. These actions are described separately to draw attention to this distinction. The implementation of these actions will benefit bull trout on a long-term timescale and include the following (YBFWRB, 2012):

- **Restore Healthy Salmonid Populations:** Although there is no specific historic data on bull trout utilization of salmon resources in the Yakima basin, one can assume that bull trout thrived as a result of the abundance of numerous species of anadromous salmonids that historically returned to the Yakima basin to spawn and for which bull trout depended on as a source of prey (YBFWRB, 2012). There are many programs that are making progress towards this goal. The Yakima-Klickitat Fisheries Project (www.ykfp.org) is dedicated to enhancing stocks of salmon currently present in the basin (spring and fall Chinook) and reintroducing extirpated stocks (coho and summer Chinook). The Yakama Nation has also initiated a program to reintroduce sockeye salmon into Lake Cle Elum. Steelhead recovery is being implemented with habitat improvement projects throughout the basin, in addition to a Yakama Nation steelhead kelt reconditioning program.
- **Passage at Major Storage Facilities (Kachess, Kelchelus, Cle Elum):** These storage dams constructed between 1910 and 1933 do not have any fish passage facilities and act as barriers that exclude anadromous fish from the watersheds above these dams and prevent resident fishes that spawn above the dams, including bull trout, from regularly using downstream habitats. Bull trout that are lost downstream of these dams cannot return to spawn in their natal streams. This disruption of natural migration routes has had significant negative effects on Yakima basin bull trout populations including: isolation of populations resulting in an increased risk of inbreeding and loss of genetic diversity; reducing or eliminating the chance that stray fish could recolonize areas after an isolated catastrophic event either isolated or eliminated a local population; and limiting adult and juvenile productivity by limiting foraging areas and preventing the distribution

of ocean derived nutrients into upper watersheds provided by spawning Pacific salmon and steelhead.

Establishing volitional, two way fish passage at each of the storage dams in the Yakima Basin is identified as a priority by multiple agencies, for multiple fish species. In 2002, the Bureau of Reclamation began an assessment process to evaluate passage possibilities at each of the dams. Based on this process, Cle Elum and Bumping reservoirs were selected to move forward to feasibility studies, and a Final Cle Elum Fish Passage Environmental Impact Statement (EIS) was released in 2011 (see: http://www.usbr.gov/pn/programs/ucao_misc/fishpassage/index.html). Funding to construct the fish passage facilities is included in the Yakima River Basin Integrated Water Management Program (Reclamation and Ecology, 2011). Meanwhile, interim downstream fish passage was constructed at Cle Elum dam in 2005 and the Yakama Nation has been re-establishing a sockeye salmon run into this watershed by transporting adult sockeye from the Columbia River to Cle Elum Reservoir

Population Scale Actions are mostly specific to individual populations, or a group of populations. The focus is on-the-ground actions, many of them ready to be implemented if funding becomes available.

Monitoring Actions encompasses a wide variety of on-the-ground activities. Monitoring is an important way to track progress towards goals, document trends, and test hypotheses. It is often difficult to find funding for monitoring projects, thus making it critical to prioritize and clearly define the questions being asked. Monitoring Actions may include:

- **Population Monitoring:** Snorkel or redd surveys to detect presence of bull trout and to monitor trends in abundance, juvenile densities, etc.
- **Baseline Habitat Monitoring:** Gathering data on trends in habitat over time, such as temperature, flow, sediment, etc.
- **Implementation Monitoring of Completed and Recommended Actions:** Effectiveness monitoring to determine longevity of actions (e.g., cattle or camping exclusions) or intended habitat response (e.g., "Did the riparian restoration result in increased stream shade?").
- **Threats Research and Monitoring**: These actions address uncertainties regarding the threats severity ratings and effects on populations. For example, through the Threats Analysis, angling was identified as a threat that may be significant for most bull trout populations. Data collected during creel surveys could substantiate this and direct attention to problem areas.

Steelhead

Recovery of Yakima basin steelhead will include a suite of activities that, if implemented, will contribute to improved habitat conditions for all anadromous salmonids in the basin (NMFS, 2009; YBFWRB, 2009). The following focuses on recovery efforts pertinent to waters in Kittitas County:

- Continue efforts to protect existing functional habitat;
- Significantly improve passage flows and instream and riparian conditions in the Little Naches and Upper Yakima watersheds;
- Addressing the effects of reservoir operations and irrigation withdrawals on steelhead;
- Improving migration conditions in the Yakima River;
- Improving juvenile and kelt outmigration conditions at Rosa Dam; and

- Improving unimpeded passage for steelhead in key tributaries (Manastash Creek, Taneum Creek, and if feasible Naneum Creek and Cle Elum River)

Other Anadromous Fishery Recovery Actions

The Yakima-Klickitat Fish Project, a joint effort between the Yakima Nation and WDFW with funding from the Bonneville Power Administration (BPA), is developing hatchery programs to supplement spring- and fall-run Chinook salmon and reintroduce coho salmon into the Yakima Basin.

The Yakama Nation has begun reintroducing sockeye salmon above Cle Elum Dam and entities throughout the basin are proposing to provide upstream and downstream fish passage for all anadromous salmonids. This will restore a historical lake-dependent run of sockeye salmon to the Yakima Basin and provide an ocean-derived nutrient supply to the watershed. This will also serve to open up additional habitat to other anadromous salmonids and discontinue isolation of certain populations (bull trout for example).

An important component to the Columbia Basin ecosystem, Pacific lamprey are significant prey for a number of other species, provide marine nutrients to tributary ecosystems and are often viewed as the “canary in the coal mine” for ecological challenges facing other species like salmon. To address the decline of these species, the Columbia River treaty tribes (Umatilla, Nez Perce, Yakama, and Warm Springs) created a comprehensive restoration plan for Pacific lamprey. The *Tribal Pacific Lamprey Restoration Plan* is the first restoration plan for Pacific lamprey that will address lamprey restoration through a wide range of mainstem and tributary actions. The plan looks to halt the decline of lamprey by 2012 and reestablish lamprey populations throughout the mainstem Columbia River and its tributaries. The plan seeks to improve mainstem and tributary passage for juvenile and adult lamprey, restore and protect mainstem and tributary habitat, reduce toxic contaminants, and consider supplementation programs to aid re-colonization throughout the basin (CRITFC, 2011). Additional efforts to reverse the decline of Pacific lamprey are now underway, and are guided by the USFWS lamprey recovery planning and the Pacific Lamprey Recovery Plan for the Yakima Basin, which is being developed by the Yakama Nation Fisheries Program.

2.3 Review of Kittitas County Fish and Wildlife Habitat Conservation Areas Regulations – Fish and Aquatic Habitat

Kittitas County regulates critical areas, including FWHCAs, through Title 17A of the KCC, which was last updated in 1995 (Attachment 1). FWHCA areas are specifically addressed in KCC 17A.07.010 through 17A.07.030.

In adopting revisions to the critical areas code in 1995, the Kittitas County Board of Commissioners raised several important points, including the following:

- Kittitas County has a low per capita income, and the County has an obligation to ensure low-cost economic development and housing.
- Unmaintained wetland and stream buffers can encourage the growth and spread of noxious weeds.
- Voluntary farm conservation programs have already provided substantial benefits to water quality.

The amount of scientific information and agency guidance on FWHCA’s has grown substantially since the County's regulations were last updated. The purpose of this section is to evaluate whether the County's existing FWHCA regulations incorporate the best available science and are consistent with GMA requirements and current agency guidance. Considerations for changes to the County's regulations are provided where gaps or discrepancies are identified.

A detailed evaluation of every section of KCC Title 17A is beyond the scope of this report. Instead, we focus on the following major issues:

- Incorporation of GMA guidance on identifying FWHCAs
- Incorporation of best available science with respect to functions and values of FWHCAs
- Land use regulations within FWHCAs
- Reporting requirements for FWHCAs
- Mitigation Sequencing
- Timing Restrictions

2.3.1 Incorporation of GMA Guidance on Identification of FWHCAs

Existing Kittitas County Code

The existing KCC is unclear as to what constitutes a FWHCA. The existing code provides a definition for FWHCAs in KCC 17A.02.090 and indicates that FWHCAs are:

- Those lands in Kittitas County owned or leased by the Washington State Department of Fish and Wildlife;
- Those lands donated to or purchased by Kittitas County for corridors pursuant to RCW 36.70A.160;
- Wetlands;
- Big game winter range;
- Riparian habitat;
- Habitats for species of local importance.

However, the critical area designation and development standards are inconsistent with the definition provided above. It is understood that wetlands should be dealt with as a separate chapter; however, lumping the remaining FWHCAs under habitat is both confusing and inconsistent with GMA guidelines (Ousley et al., 2003). In addition, WCC does not specify that special consideration must be provided for anadromous fish species as specified in the GMA.

Considerations for Code Update

- Consider updating the designation of FWHCAs to include all elements of the GMA definition:
    - **Areas with which state or federally listed species (endangered, threatened, candidate, or sensitive) have a primary association.** Under the existing code, these species are typically protected under existing wetland, floodplain, and riparian habitat regulations, and if they occur outside these areas, the code defers to point locations of specific species and that protective measures shall be instituted based on implementation of state or federal laws.

Consider including specific reporting requirements such as preparation of a habitat management plan or critical area study for land use activities in proximity to known or suspected locations of state or federally threatened, endangered, or sensitive priority species regardless of the activities location.

- **State priority habitats and areas associated with state priority species.** Under the existing code, these habitats are typically protected under existing wetland, floodplain, and riparian habitat regulations, and if they occur outside these areas, the code defers to point locations of specific species and that protective measures shall be instituted based on implementation of state or federal laws.

  Consider including specific reporting requirements (see below) such as preparation of a habitat management plan or critical area study for land use activities in proximity to known or suspected locations of state or federally threatened, endangered, or sensitive priority species regardless of the activities location.

- **Habitats and species of local importance.** Under the existing code, these are broken out into two separate regulated areas "habitats for species of local importance" (KCC 17A.07.25" and "species of local importance" (KCC 17A.07.030).

  Consider consolidating the two categories since both are intrinsically tied to one another. Also consider adoption of several priority habitats and species that are not federally or state listed, but still maintain a priority species or habitat ranking due to rare occurrence or cultural, commercial or recreational value. These may include specific habitats for bighorn sheep such as winter and summer ranges, elk calving areas, waterfowl concentrations, or individual species such as prairie falcon, kokanee, or westslope cutthroat trout.

- **Naturally occurring ponds under twenty (20) acres.**

- **Waters of the state.** Currently identified as riparian habitat and somewhat consistent with the stream typing called out in WAC 222-16-031; however, including the interim stream typing system into the code (WAC 222-16-030) and revising definitions of stream types may be warranted. In the existing code, Type 4 and 5 waters are identified as "not truly waters", which is inconsistent with existing WAC definitions. In addition, Type 4 waters (Type Np under the interim typing) are identified as being intermittent in nature, which is also inconsistent. Type 4 waters (Np) should be identified as perennial (non-fish bearing) streams.

- **Lakes, ponds, streams, and rivers planted with game fish by a government or tribal entity.** While not specifically called out in the existing code, these areas may receive protection under the wetlands regulations; however, consideration should still be afforded these areas due to their recreational value.

- **State natural area preserves and natural resource conservation areas.** While none of these areas currently exist in Kittitas County, it should still be identified pending future identification of these areas in the County.

- **Land essential for preserving connections between habitat blocks and open space.**

- Consider including language that includes anadromous fish species and habitats within regulated FWHCAs, or alternatively, affords special consideration to these species and habitats.

2.3.2 Incorporation of Best Available Science With Respect to Functions and Values of FWHCAs

Existing Kittitas County Code

Currently, neither KCC Title 17A nor Title 14 reference the relationship between FWHCAs and other regulated critical areas such as frequently flooded areas (floodplains). In addition, there is currently no mention of the ecological functions these areas provide. These are some of the findings following review of the existing code:

- Stream buffers are measured from the OHWM with no provision for including channel migration zones (CMZ). Where channel migration occurs or is likely to occur, a buffer measured from the OHWM may not fully protect riparian functions. Of particular concern would be the ability of a stream channel to migrate (thereby recruiting LWD), and to form new instream habitat features such as pools, riffles, and off-channel areas important for several salmonid life-stages. Areas of likely channel migration need to be determined, as does the feasibility of protecting CMZs where they do or should occur.
- Existing stream buffer widths are 40 to 200 feet for salmon-bearing streams and 0 to 20 feet for non salmon-bearing streams. A 100-foot-wide buffer is generally adequate for protecting many riparian habitat functions and features. Where buffers do not provide a full range of habitat functions, other conservation measures and BMPs may be in place to offset some land-use impacts, but some riparian functions, most notably LWD recruitment, generally cannot fully be provided with buffers of less than 100 feet wide.
- Under KCC 17A.07.10, adjustments are allowed for standard buffer widths depending on demonstration of the need for increased or reduced buffer width requirements on a given site. No emphasis is placed on continuity of stream buffers, which has been shown to be an important aspect of effective buffers. Standard buffer adjustments establish no minimum buffer widths for cases of buffer width averaging or reduction. Without minimum standards, buffer continuity is jeopardized.
- There are no provisions for mitigation in instances of when buffer encroachments do occur, other than stating that the potential exists for revegetation. There are few performance standards established for the list of "activities allowed without a permit" in KCC 17A.03.020. As written, many of these allowable activities such as ditch maintenance, gravel extraction, maintenance of utilities, removal of beaver dams, and other potential construction and agricultural activities could adversely affect aquatic habitats and still be in compliance with KCC.

Considerations for Code Update

- Where a CMZ occurs or could be expected to occur, stream buffers should be measured from the lateral edge of the CMZ to protect stream migration and habitat-forming processes. CMZs should be designated throughout the County by stream reach, but in lieu of CMZ designations, flood-hazard boundaries or on-site delineation of CMZs could occur on a case-by-case basis as needed. Exceptions would be necessary in cases where bank modifications, permanent structures (roads, levees, etc.), or existing land uses effectively prevents channel migration.
- According to best available science, a buffer width of at least100 feet would reasonably provide for most stream riparian habitat functions important to fish populations. However, larger buffer widths may be necessary to provide adequate protections depending on site conditions (including fish use) and watercourse condition. Buffer width regulations tiered to existing or potential

habitat functions (i.e., providing greater or lesser protection where appropriate) would allow regulatory flexibility and provide for stream functions that can reasonably be expected on a given site. The minimum buffer width recommendations in this report (see Section 2.1.3) should be implemented unless it can be demonstrated that some other buffer width would be adequate or necessary to maintain existing stream and riparian functions.

2.3.3 Reporting Requirements for FWHCAs

Existing Kittitas County Code

The KCC currently only requires the preparation of a critical area checklist by applicants, which includes:

1. A legal description of the land;
2. The location of critical areas on the identified land;
3. Any voluntary methods or activities as it pertains to critical areas, including incentives offered by local or state government;
4. Plans to scale showing location of proposed work, dimensions of proposed structures, estimates of fill/excavation, drainage facilities, and significant natural features (Survey not normally required);
5. Provisions for waiver of critical area delineation; and
6. Provisions for field verification of critical area checklist.

The checklist is then processed by the Kittitas County Planning Department, which then makes a determination as to whether or not critical area are located on the property and makes a final decision consistent with the underlying permit concerning the critical area designation and related mitigation (KCC 17A03.040).

Considerations for Code Updates

Where development within a frequently flooded area will occur, the applicant should provide the adequate information to the County on existing site conditions, impacts, and mitigation (in addition to the information currently required in KCC 17A03.040). This information should be provided in the form of a Critical Areas Study (CAS), which should be prepared by a qualified specialist in the disciplines of fish and/or wildlife biology. The information provided on FWHCAs in the report can be utilized by Kittitas County to ensure compliance with the FWHCA provision of the CAO. The example language below summarizes the standard information that should be provided by the applicant:

1. The Critical Areas Study will provide one or more site plans, drawn to scale, showing:
   - A. The nature, location, dimensions, and elevations of the property in question;
   - B. Names and location of all lakes, water bodies, water-ways and drainage facilities within 300 feet of the site;
   - C. The proposed drainage system including, but not limited to storm sewers, overland flow paths, detention facilities and roads;
   - D. Existing and proposed structures, fill, pavement and other impervious surfaces, and sites for storage of materials;
   - E. All wetlands;

F. Designated fish and wildlife habitat conservation areas, and habitat areas identified for conservation or protection under state or federal or local laws or regulations (e.g., Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, Growth Management Act, Shorelines Management Act, Priority Habitat and Species List); and

G. Existing native vegetation and proposed revegetation.

2. If the proposed project involves grading, excavation, or filling, the site plan shall include proposed post-development terrain at appropriate contour intervals.
3. The Critical Areas Study/ application shall include a description of the extent to which a stream, lake, or other water body, including its shoreline, will be altered or relocated as a result of the proposed development.
4. The Critical Areas Study/ application shall include documentation that the applicant will apply for all necessary permits required by Federal, State, or local law.
5. Mitigation is required and whether the mitigation and monitoring plans and bonding measures proposed by the applicant.
6. Whenever mitigation is required to compensate for adverse impacts to critical areas, the development application will include:

    A. An analysis of potential impact as detailed above.

    B. A mitigation plan that meets the specific mitigation requirements for FWHCAs and that demonstrates no net loss of aquatic habitat functions and values.

    C. A monitoring plan that includes explicit performance standards and a monitoring protocol adequate to determine compliance with the stated standards.

2.3.4 Mitigation Sequencing

Existing Kittitas County Code

Mitigation sequencing is Mitigation sequencing is a concept defined in Washington state law (SEPA and the Shoreline Management Act, WAC 197-11-768 and 173-26). It is also part of the permit process under the federal Clean Water Act Section 404. Mitigation sequencing consists of the following steps taken in order:

1. Avoiding the impact altogether by not taking a certain action or parts of an action;
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts;
3. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;
5. Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and/or
6. Monitoring the impact and taking appropriate corrective measures.

Considerations for Code Updates

Incorporating a mitigation sequencing requirement to the County's FWHCA regulations would increase the incentive for applicants to avoid floodplain impacts and the need for mitigation. This would reduce the potential for net loss of functions that support fish and wildlife species. Specific considerations include:

- Definitions, performance and reporting standards must be included or expanded in KCC to ensure that allowable activities within critical areas undergo a review, approval, and monitoring process. This will help ensure that activities will not adversely impact aquatic habitats or that if loss of habitat functions are appropriately mitigated. For example, clearing drainage ditches is an allowable activity under existing KCC, but many ditches are altered stream channels supporting salmonids. Much of such open-ended code can be improved by requiring accepted performance standards as those required in the HPA process, or by implementing accepted strategies such as those described in documents such as the Ecology Stormwater Management Manual for Eastern Washington (Ecology, 2004).
- Establish requirements and performance standards for mitigation of buffer encroachments when they occur.

2.3.5 Timing Restrictions

Existing Kittitas County Code

Timing restrictions for instream work are not specified in KCC and there are no provisions stating that timing restrictions established by other agencies be adhered to.

Considerations for Code Update

KCC should specify that all in-water work timing will be consistent with approved fish work windows determined by WDFW and referenced in the WAC, including any deviations afforded by emergency or special circumstances as does WDFW.

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