Yakima River Basin Water Storage Feasibility Study
Fish and Wildlife Coordination Act Report

Prepared for
Pacific Northwest Region
Bureau of Reclamation
Yakima, Washington

October 10, 2007

Prepared by
U.S. Fish and Wildlife Service
Upper Columbia Fish and Wildlife Office
Spokane, Washington

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Upper Columbia Fish and Wildlife Office
Spokane, Washington 99206

October 10, 2007

MEMORANDUM

To: Study Manager, Yakima River Basin Water Storage Feasibility Study
U.S. Bureau of Reclamation, Yakima, Washington
Attention: Kim McCartney

From: Acting Project Leader, Upper Columbia Fish and Wildlife Office
U.S. Fish and Wildlife Service, Spokane, Washington

Subject: Planning Aid Memorandum for Yakima River Basin Water Storage Feasibility Study, with Attached Coordination Act Report.

This Planning Aid Memorandum (PAM) transmits the U.S. Fish and Wildlife Service's (Service) Coordination Act Report (CAR) (attached) pursuant to Task No.1 of the April 5, 2007, Interagency Acquisition (IA) with the Bureau of Reclamation (Reclamation) for the Yakima River Basin Water Storage Feasibility Study (Study). This PAM is being submitted pursuant to the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 15 U.S.C. 661 *et seq.*).

The Service appreciates the opportunity to work with Reclamation during the preparation of this CAR. Please contact Rick Donaldson (509)893-8009, or Greg Van Stralen (509)665-3508 x 20, if you have further questions or comments.

Attachment

C.

USFWS, Mid-Columbia FRO – Leavenworth (Jim Craig)
USFWS, CWFO – Wenatchee (Greg Van Stralen)
WDFW- Pasco (Mike Livingston)
Yakama Tribe- Toppenish (Tracy Hames)
NOAA Fisheries – Ellensburg (Dale Bambrick)

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INTRODUCTION

Pursuant to the Fish and Wildlife Coordination Act and the 2007 Interagency Acquisition (IA) between the U.S. Fish and Wildlife Service (Service) and the Bureau of Reclamation (Reclamation), the Service prepared this Coordination Act Report (CAR) for Reclamation's Yakima River Basin Water Storage Feasibility Study (Study). The purpose of the CAR is to: (1) describe the baseline condition of fish and wildlife resources within a defined geographic area likely to be affected (Affected Area) by the four Study alternatives under consideration in the Study; (2) generally describe the effects of the four Study alternatives on fish and wildlife resources in the Affected Area; and (3) provide recommendations to avoid, minimize and/or compensate for adverse impacts to fish and wildlife resources associated with the four Study alternatives.

The Yakima River is the largest tributary to the Columbia River that lies entirely within the State of Washington. The river drains a portion of the eastern slope of the Cascade Mountain Range and the semi-arid mountains and lowlands of Kittitas, Yakima, Klickitat and Benton Counties. The common hydrologic pattern in the drainage is the result of most water originating in higher mountains, often as snow. Snowmelt feeds streams and rivers and recharges groundwater aquifers. This hydrologic system has been greatly modified by human activities, mostly to provide more dependable dry-season surface water supplies for agricultural use. Prior to the introduction of widespread irrigation in the Yakima River Basin (Basin) in the late nineteenth century, the Yakima River experienced nearly annual flooding due to spring snowmelt and run-off, this has been considerably reduced due to the development of various irrigation-related projects (USFWS 1996).

On average, the Yakima River has a very low gradient, averaging less than one tenth of one percent, from its mouth at the Columbia River, to a point 214 miles upstream at the base of Reclamation's Keechelus dam near Snoqualmie Pass (USGS 1991). Estimated average annual runoff in the Basin is about 3.4 million acre-feet per year. Once it leaves the Yakima Canyon, the river meanders across the lower Yakima Valley, often in a well-incised channel, except for 20 miles downstream of Sunnyside Irrigation Dam where the channel is braided. The lower Yakima River Valley (below river mile 123) is a fairly broad, flat, ancient floodplain of fertile soils, where agriculture has flourished in the years since irrigation was established. In 1992, the U.S. Geological Survey (USGS) commented that the Basin is one of the most intensively irrigated areas in the United States. The irrigated lands primarily produce fruits, vegetables, hops and livestock feed (USFWS 1996).

Large seasonal flow variations in the Yakima River have been modified since the late 19th century by development and operation of irrigation, hydropower and storage projects on the mainstem Yakima, Kachess, Cle Elum, Bumping and Tieton Rivers. The six storage reservoirs operated by Reclamation capture and store a portion of the spring runoff (about 1,070,000 acre-feet maximum storage) and release it in summer and early autumn for irrigation. While these reservoirs are managed primarily for irrigation uses, since 1981 some of the stored water has been used to benefit anadromous fish. Water releases are now made from these reservoirs in the winter to protect andromous fish redds in the upper Yakima River (Reclamation 1996a). Also, some reservoir releases during the summer are being managed to enhance spring chinook spawning activities in September and October. The operation of these reservoirs and many other irrigation facilities in the Basin is the responsibility of Reclamation's Yakima Project.

The Naches River sub-basin is tributary to the Yakima River, and drains a portion of the eastern side of the Cascade Range, east of Mount Rainier and northeast of Mount Adams. In terms of discharge, the Naches River is the largest tributary in the Basin.

I. PROJECT DESCRIPTION

By Act of Congress dated February 20, 2003, the Secretary of the Interior was directed, acting through Reclamation, to conduct a feasibility study of options for additional water storage in the Basin. Reclamation initiated the Storage Study in May 2003. After conducting appraisal assessments on a number of identified alternatives for water storage, Reclamation determined that three action alternatives are technically viable (Reclamation 2006). These three action alternatives along with the no action alternative will be studied in depth in this CAR to determine which alternative may be the most feasible.

I-1) <u>Black Rock Reservoir Alternative</u>

This alternative involves the creation of a reservoir within the predominantly shrub-steppe zone of the Mid-Columbia Basin. The Black Rock Valley lies between Rattlesnake Hills to the south and the Yakima Ridge to the north, and is tributary to the lower Yakima River sub-basin. The reservoir site is drained via Dry Creek (an intermittent waterway) into Cold Creek and thence via Cold Creek through the Hanford Works into the lower Yakima River near Richland. Black Rock Reservoir would have an active storage capacity of 1,300,000 acre-feet. The impoundment would be created by constructing a 760 foot high concrete face, rock-fill dam at the east end of the valley. Water pumped from the impoundment of Priest Rapids Dam on the Columbia River, would be conveyed to the proposed reservoir via aqueduct using a 3,500-cfs pumping plant. Water stored in the reservoir would be delivered to the Basin as needed using a 2,500-cfs reservoir outflow conveyance system and exchanged with Yakima River water. Yakima River water currently used by potential participating exchange irrigation entities would not be diverted by those entities and would instead be used to meet the Study goals. As an added economic benefit, power plants would be constructed at two points of discharge at Roza and Sunnyside canals. The reservoir would inundate State Route 24 for a distance of approximately 9 to 10 miles, requiring relocation and new construction of the highway along the southern end of the proposed reservoir (Reclamation 2007d).

I-2) <u>Wymer Reservoir Alternative</u>

The Wymer Reservoir alternative also involves the creation of a reservoir within the shrub-steppe zone of the Mid-Columbia Basin. The reservoir would be situated within the Lmuma Creek drainage, a small tributary to the upper Yakima River sub-basin (river mile 135.4) between Ellensburg and Yakima, about eight miles upstream from Roza Dam. The dam-site would be located about ¾ miles upstream from its confluence with the Yakima River. The dam itself would consist of a rock-fill structure about 450 feet high. A separate structure consisting of a 180-foot-high concrete rock-fill dike would be constructed in a saddle on the north side of the reservoir. Water would be pumped from the Yakima River into the reservoir, and used as needed to augment flow in the lower Yakima River sub-basin. At start-up, the reservoir would impound 169,076 acre-feet and would extend from about five miles upstream from the dam to Interstate 82 at its east end. Water stored in Wymer Reservoir would be delivered directly (gravity flow) to Yakima River from Lmuma Creek. Additional water provided to the Yakima River from Wymer Reservoir would be supplemented by changes in water releases from Reclamation's Cle Elum Reservoir, higher up in the Basin. Water releases from other Reclamation reservoirs in the Basin would also be used as needed in conjunction with the operation of Wymer Reservoir (Reclamation 2007d).

I-3) Wymer Reservoir Plus Pump Exchange Alternative

This alternative also involves the construction of a reservoir at the Wymer site, with the same dimensions and capacity as described in section I-2 (Alternative 2) but with the addition of a pump and pipeline system to augment water supply in the Yakima River below Roza Dam. To accomplish this, Reclamation would divert surface water from a point near the mouth of the Yakima River and transport the water back upriver to various points in the Sunnyside Valley and Roza Irrigation Divisions southeast of Yakima, Washington. The water delivered by this system would be exchanged for water that would normally be diverted from the Yakima River at Roza Dam and Sunnyside Diversion. Thus, water that would normally be diverted would remain in the Yakima River to improve fishery habitat and provide irrigation water to proratable water users[1] during dry years. Additional water provided to the Yakima River from Wymer Reservoir would be supplemented by changes in flow releases from Cle Elum Reservoir, higher up in the Basin. Water releases from other Reclamation reservoirs in the Basin would also be used as needed in conjunction with the operation of Wymer Reservoir (Reclamation 2007d).

I-4) No Action Alternative (Without Project)

The No Action Alternative is intended to represent the most likely future expected in the absence of constructing additional water storage facilities. This alternative includes future implementation of water conservation measures and water acquisitions authorized under Section 1203 of Title XII of the Act of October 31, 1994. These actions would improve the availability of water supplies for irrigation and would protect fish and wildlife resources by providing water during the time of year when fish would be migrating for spawning. This alternative is the baseline from which the action alternatives are measured for benefits and impacts (Reclamation 2007d).

[1] *"Proratable water users"* are identified in the 1945 Consent Decree and are those users whose Project water rights dates to May 10, 1905 and receive less that a full supply in water short years (RECLAMATION, in litt. 2007).

II FISH AND WILDLIFE RESOURCES[2] IN THE AFFECTED AREA (BASELINE)

In this CAR, the *"Affected Area[3]"* (Figure 1) is considered the geographic area based on the Service's interpretation of Reclamation's three action alternatives and the no action alternative described as follows:

> The Cle Elum and Yakima Rivers, and associated riparian zones downstream from Cle Elum Dam to its confluence with the Columbia River; the Naches River[4] and associated riparian zone as affected by backwater from the Yakima River; the footprint of the proposed Wymer and Black Rock dams and reservoirs and appurtenant facilities; all areas affected by seepage down-gradient from the two proposed dams and reservoirs; a disturbance zone or buffer of 0.31 miles (0.5 kilometers) in width around the perimeter of the two proposed reservoirs up-gradient from the contour correlating with maximum pool elevation of those water bodies, to account for any development impacts that are likely to occur; pipeline alignments and appurtenant facilities (e.g. pumping plants, access roads, staging areas) associated with aqueducts to and from the Wymer and Black Rock reservoir sites; and the corridor associated with realignment of Highway 24 displaced by the filling of Black Rock Reservoir[5].

II-1) <u>Resident Fish</u>

Resident native salmonids that currently exist in streams and lakes of the upper Yakima sub-basin include bull trout (*Salvelinus confluentus*), westslope cutthroat trout (*Oncorhynchus clarki*), rainbow trout (*Oncorhynchus mykiss*), kokanee (*Oncorhynchus nerka*), mountain whitefish (*Prosopium williamsoni*) and pygmy whitefish (*Prosopium coulteri*)(Pearson *et al*. 1998 and WDFW 1998). Eastern brook trout (*Salvelinus fontinalis*) a non-native (introduced) salmonid is also present. Of the species listed above, those of special concern include bull trout (listed as federally threatened), westslope cutthroat trout, and pygmy whitefish (state sensitive). Although bull trout tend to exhibit several different life history strategies, they will be included in the resident fish analysis for this report.

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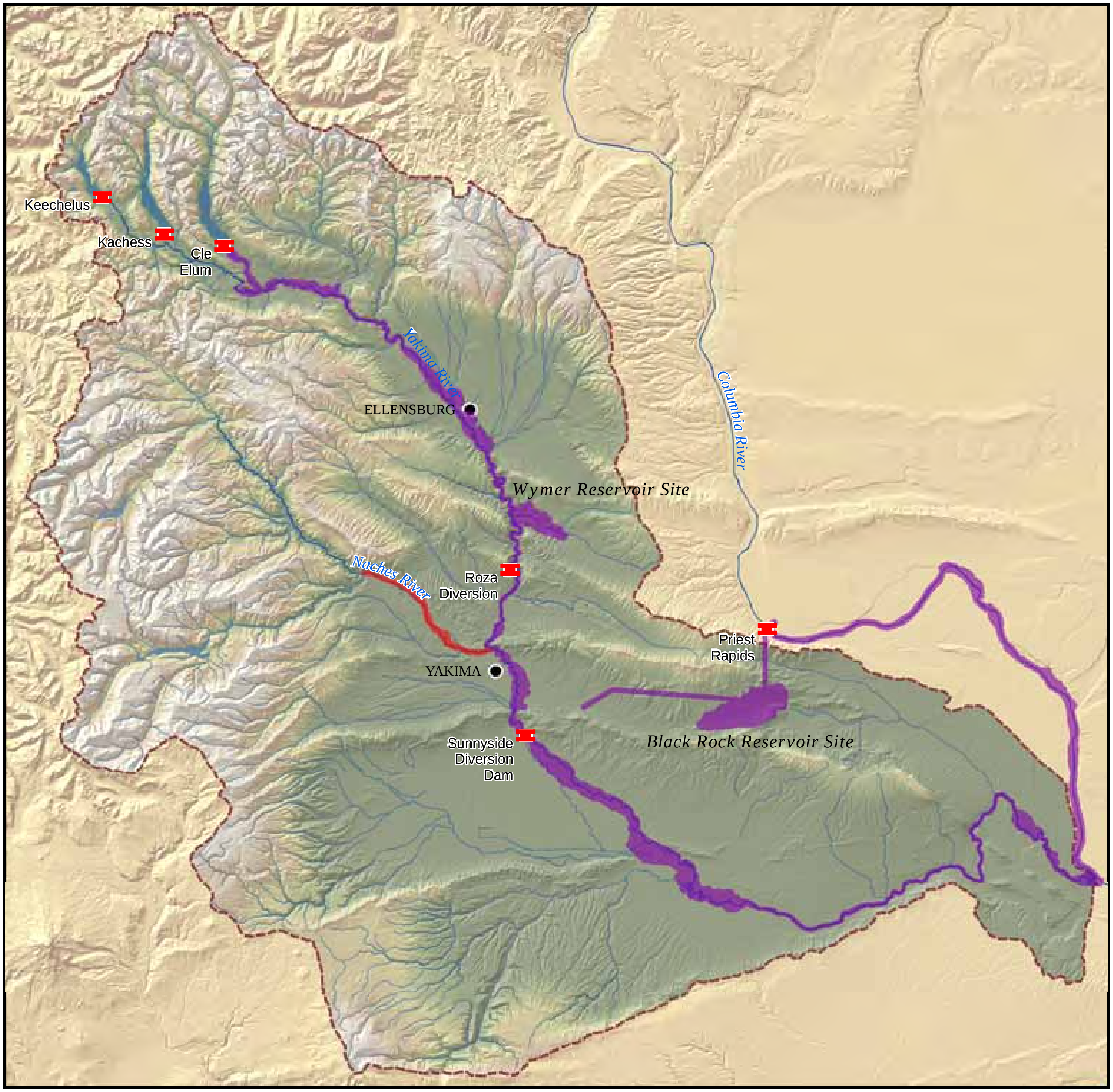
[2] The term "wildlife resources" as used herein include birds, fishes, mammals, and all other classes of wild animals and all types of aquatic and land vegetation upon which fish and wildlife are dependent (16 USC 666(b))

[3] For the purpose of this CAR, the "Affected Area" is defined as the entire area that may be affected directly or indirectly with the implementation of any of the three action alternatives and not merely the immediate area involved in the action. The "Affected Area" would be defined similarly under the no action alternative. The former, is similar to the usage of the term "Action Area" in section 7 Endangered Species Act consultations. Furthermore, "direct effects" are those which are caused by the action and occur at the same time and place, while "indirect effects" are those which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable (40CFR §1508.8(a&b) and 50 CFR § 402.02).

[4] The Service has been informed by Reclamation that the Naches River downstream from its confluence with the Tieton River would be used to convey water stored in Reclamation's two water storage facilities in the Naches sub-basin during implementation of the action alternatives. Subsequently, this reach was delineated as part of the Affected Area, but no analyses was conducted as part of this CAR.

[5] The Service did not have spatial data for some of these structures (e.g., Yakima Pump Exchange pipeline and associated infrastructure and the Highway 24 realignment corridor), therefore no analyses were done for these activities, nor delineated as part of the Affected Area.

Figure 1



Department of the Interior
U.S. Fish & Wildlife Service
Yakima River Basin Storage Project

Affected Area

N

0 10 20 Miles

Dams
Yakima Basin Boundary
Affected Area - 94,550 Acres
Area Used in Analyses
Area Not Used in Analyses

This map was produced by the Upper Columbia Fish & Wildlife Office of the USFWS on 9/21/07. No warranty is made by the U.S. Fish and Wildlife Service as to accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

Westslope cutthroat appear to be fairly abundant and widely distributed within the Basin, particularly in the upper reaches (higher elevations) of tributaries to Keechelus Lake and the Yakima River. Cutthroat trout are more common and numerous in the Naches River. Cutthroat, as well as other resident salmonid species, provide recreational angling opportunities throughout the upper basin. Resident rainbow trout and mountain whitefish angling in the upper Yakima River and in the lower reaches of tributary streams is extremely popular. In fact, the trout fishery in the upper Yakima River is considered one of the best "blue ribbon" catch-and-release fisheries in Washington State.

Thirty-seven resident non-salmonid species are present in the Yakima Basin (Pearsons *et al.* 1998). The most abundant non-salmonids in the upper Yakima Basin are speckled dace (*Rhinichthys osculus*), longnose dace (*Rhinichthys cataractae*), redside shiners (*Richardsonius balteaus*), northern pikeminnow (*Ptychocheilus oregonensis*), largescale suckers (*Catostomus macrocheilus*), bridgelip suckers (*Catostomus columbianus*), and several sculpin species, including mottled, torrent, piute, and shorthead sculpins (*Cottus sp.*). Although these non-salmonid species do not receive the notoriety of salmonids (trout, salmon, and steelhead) or other lower river non-salmonid game fish (such as bass and catfish) they are nevertheless an important component of the aquatic environment. Most serve as forage for other game and food fish. Burbot (*Lota lota*), a native species, is also a fish species present in the Keechelus, Kachess, Cle Elum, and Bumping reservoirs.

Two other species, although not as abundant as those listed above, but important due to their status are the mountain sucker (*Catostomus platyrhynchus*) (a state candidate species) and the Pacific lamprey (*Lampetra tridentata*) (a federal species of concern). Mountain suckers occur within the basin and it is possible that lamprey do as well, although few have been observed in the Yakima River. Although not listed, there are numerous fish species inhabiting the mid to lower zones of the Yakima River that may potentially be impacted by the proposed Black Rock and Wymer alternatives. For a complete fish species list for the Basin refer to Pearsons et al. 1998.

II-2) <u>Wildlife</u>

The Service evaluated eight mammal and eleven bird species using the Washington GAP vertebrate distribution models (WAGAP) (Johnson and Cassidy 1997; Smith et al. 1997, respectively). Some of these species were also evaluated using the Priority Habitats and Species Database (WDFW 2006).

The Affected Area includes core habitat[6] for seven of the eight evaluated mammal species (Johnson and Cassidy 1997) and ten of the eleven evaluated bird species (Smith et al. 1997). Mammal species include, mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*), Townsend ground squirrel (*Citellus townsendi*), black-tailed jackrabbit (*Lepus californicus*), , pallid bat (*Antrozous pallidus*), small-footed myotis bat (*Myotis subulatus*) and Merriam shrew (*Sorex merriami*). Bird species whose core habitat is found include; golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), burrowing owl (*Athene cunicularia*), short-eared owl (*Asio flammeus*), long-billed curlew (*Numenius madagascariensis*), loggerhead shrike (*Lanius ludovicianus*), greater sage grouse (*Centrocerus urophasianus*), sage sparrow

[6] "Core Habitat" refers to a vegetation zone that is core, or important for a particular species. Developed by Washington Department of Fish and Wildlife for use in their GAP analysis

(*Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), and sage thrasher (*Oreoscoptes montanus*).

It is important to note the WAGAP did not show core habitat in the Affected Area for the bald eagle (*Haliaeetus leucocephalus*). The bald eagle distribution model only shows core habitat for those areas west of the Cascade Mountains. However, the Priority Habitats and Species Database (WDFW 2006) shows that the Affected Area provides important seasonal habitat for the bald eagle, including nesting and wintering habitat. Please see section **II-6 (<u>Federally Listed Threatened and Endangered Species, Candidates and Species of Concern within the Affected Area) for greater details.</u>**

Although no core habitat has been identified for them, numerous other species of wildlife may inhabit the diverse habitats that lie within the Affected Area. Elk (*Cervus canadensis*), coyote (*Canus latrans*), and badger (*Taxidea taxus*), are some of the mammals that utilize shrub-steppe habitat. Bird species utilizing shrub-steppe habitat include western kingbird (*Tyrannus verticalis*), western meadowlark (*Sturnella neglecta*), and mourning dove (*Zenaida macroura*). Some of the reptiles and amphibians found in shrub-steppe habitat include western rattlesnake (*Crotalus virdis*), Great Basin spadefoot toad (*Spea intermontana*) and northern sagebrush lizard (*Sceloporus graciosus*) (USFWS 1996).

Typical wildlife species that may utilize the wetland and riparian habitats within the Affected Area include, beaver (*Castor canadensis*), mink (*mustela vison*) and river otter (*Lutra canadensis*). Reptile and amphibian species found in these habitats include, western painted turtle (*Chrysemys picta*), and spotted frog (*Rana pretiosa*). Common avian species include, Wilson's phalarope (*Phalaropus tricolor*), belted kingfisher (*Megaceryle alcyon*), peregrine falcon (*Falco peregrinus*), and hairy woodpecker (*Picoides villosus*). Species of waterfowl that utilize the wetland and riparian habitats within the Affected Area include, mallard (*Anas platyrhynchos*), and American wigeon (*Anas Americana*) (USFWS 1996).

The Black Rock Reservoir site provides core habitat for short-eared owls, burrowing owl, long-billed curlew, loggerhead shrike, sage thrasher, Townsend ground squirrel, black-tailed jackrabbit, Merriam's shrew, mule deer, pallid bat and small-footed myotis. This site contains some core habitat for ferruginous hawks, loggerhead shrike and sage sparrow. It also contains a small amount of core habitat for sage grouse. In addition, the footprint area has supported nesting habitat for the burrowing owl and long-billed curlew, and serves as peripheral habitat for the white-tailed jackrabbit (Johnson and Cassidy 1997, Smith et al. 1997 and WDFW 2006).

The Wymer Reservoir site is situated within bighorn sheep winter range and core habitat. Townsend ground squirrel burrows, golden eagle and ferruginous hawk nests have been observed at the site. This site also includes core habitat for short-eared owl, long-billed curlew, loggerhead shrike, sage sparrow, brewer's sparrow, sage thrasher, black-tailed jackrabbit, Merriam's shrew, mule deer, pallid bat and small-footed myotis bat. About half of the site is core habitat for greater sage grouse, and the it serves as peripheral habitat for white-tailed jackrabbit (*Lepus townsendii*) (Johnson and Cassidy 1997, Smith et al. 1997 and WDFW 2006)

For a more comprehensive list of wildlife species that might be found within the Affected Area, please refer to Appendix A.

II- 3) <u>Riparian</u>

As used in this CAR, the term *"riparian"* is defined as the area adjacent to flowing (i.e. streams, rivers) waters that contain elements of both aquatic and terrestrial ecosystems which mutually benefit each other (WDFW 1995). They generally occur as relatively narrow linear units along aquatic habitats. Riparian zones typically include wetlands, such as palustrine emergent (PEM) palustrine forested (PFO) and palustrine scrub-shrub wetlands (PSS), riverine and in some cases lacustrine habitats (Cowardin 1979). Riparian areas also include forested and scrub-shrub habitats that are too dry to be classified as wetlands, gravel bars, and other stream related habitats and vegetation. Thus, palustrine, lacustrine, and riverine habitats would be considered a subset of the overall area described as the riparian zone in this CAR. Wetlands identified by class[7] and quantified in acres are described in section II-4, below.

In the Yakima Subbasin, floodplain (riparian habitat) loss has been estimated at 77% in the Cle Elum Reach, which extends from the mouth of the Cle Elum River downstream to the mouth of the Teanaway River, 82% in the Union Gap Reach, which extends from the mouth of the Naches River downstream to the mouth of Ahtanum Creek, and 95% in the Upper Wapato Reach, which extends from Wanity Slough downstream to the mouth of Satus Creek (Yakima Subbasin plan, supplement 2004).

The most profound alteration of riparian habitat occurred with the development of irrigated agriculture, and subsequent regulation of river flows (Yakima Subbasin plan, supplement 2004). This development has altered the river's historic hydrograph and, along with road and levee development and land conversion, has resulted in separation of the river from its historic floodplain. Regulation of river flow alters the flow regime and the mosaic of habitats, compromising wetlands (Kingsford 2000). It typically redistributes water by reducing flooding to many habitats and sometimes permanently flooding or reducing flow variability to other habitats. These changes alter vegetation communities, the deposition and breakdown rates of leaf litter on floodplains that influence habitat conditions after inundation, and lead to significant declines in macroinvertebrate diversity and density (Boulton and Lloyd 1992, Jenkins and Boulton in review). Large-scale habitat conversion and degradation has resulted from vegetation removal and increased abundance of noxious weeds. Riparian cottonwood and willow dependence on shallow alluvial groundwater make them extremely susceptible to water table changes (Amlin and Rood 2002; Rood et al. 2003). Reduction in water table height can be lethal to seedlings, and thus limit or prevent recruitment of new trees (Rood and Mahoney 1990, Segelquist et al. 1993). Until regulated rivers are allowed to return to more natural flow patterns, riparian zones in these areas will continue to degrade, and with them the ecological health of associated rivers (Nowakowski et al. 2006). Cottonwood forests, one of the most important features of interior riparian wetlands, have been reduced in extent and quality.

Upland riparian forests found in the Affected Area typically have an overstory of black cottonwood (*Populus balsamifera spp. trichocarpa*). During the last century, cottonwood forests in the Yakima floodplain have been degraded due to an extreme alteration of the natural

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[7] For the preparation of this CAR, the Service used Cowardin's (1979) Classification of Wetlands and Deepwater Habitats in conjunction with National Wetland Inventory (NWI) data to map and quantify wetland acreage, with some exceptions, as noted in the CAR.

hydrograph in the Yakima River associated with water diversions for irrigation. Because of changes in the river hydrograph, cottonwood recruitment has declined significantly, having significant long-term secondary impacts to wildlife habitat as this resource declines in area and quality. Before the alteration of the hydrograph, a greater portion of these upland cottonwood forests in the Yakima River riparian zone would have likely been classified as palustrine forested wetlands (PFO). Regardless, the cottonwood forest in the upland riparian zone in a sixty mile reach[8] of the Yakima River was determined to be 3,704 acres in area. (Elliott 2007a, Cowardin 1979 and Reclamation 2007b).

II-4) <u>Wetlands</u>

> *"In general terms, wetlands are lands where saturation with water is the dominant factor determining the nature of the soil development and the types of plant and animal communities living in the soil and at its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated or covered with water. The water creates severe physiological problems for all plants and animals, except those that are adapted for life in water or saturated soil"* (Cowardin 1979: p 3).

Wetlands in Washington have declined 30 percent, with the loss of freshwater wetlands estimated at 25 percent, from historic levels (USFWS 1990). Losses have been attributed to agriculture conversion including grazing; filling for solid waste disposal, road construction and commercial, residential and urban development; construction of dikes, levees and dams for flood control, water supply and irrigation; discharges of materials, hydrologic alteration by canals, drains, spoil banks, roads and other structures; and groundwater withdrawal. Aside from direct losses in the quantity of wetlands, many wetlands have also been reduced in quality from the above factors. Wetlands in Washington and more specifically, wetlands in the Affected Area (Figure 2) provide an array of functions, such as important habitat for fish and wildlife, groundwater recharge, floodwater storage, nutrient uptake, and recreational opportunities. Because the Affected Area is mostly situated in a semi-arid environment, wetlands are extremely important to the survival of numerous wildlife species as they provide some of the best vegetative growth for food and cover, invertebrate production and water (USFWS 1996).

Several species of waterfowl dependent on riparian and wetland habitat may be found in the Affected Area. Sandhill cranes (*Grus canadensis*) and swans (*Cygnus species*) historically nested in the Basin. Other migratory birds species found in the riparian/wetland zone include; yellow-headed black bird (*Xanthocephalus xanthosephalus*), red-winged blackbird (*Agelaius phoeniceus*), Eastern kingbird (*Tyrannus tyrannus*), yellow warbler (*Dendroica petechia*), and Brewer's blackbird (*Euphagus cyanocephalus*) (USFWS 1996).

Some common wetland plants in PEM class wetlands found in the Affected Area include common cattail (*Typha latifolia*), hardstem bulrush (*Scirpus acutus*), spikerush (*Eleocharis species.*), sedges (*Carex species*), scouring rush (*Equisetum hyemale*), various grasses such as reed canarygrass (*Phalaris arundinacea*), meadow foxtail (*Alopecurus pratensis*) and common reed (*Phragmites australis*). Palustrine Forested class plants found in the Affected Area include black cottonwood, a dominant overstory species. Willows (*Salix species*), red-osier dogwood

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[8] The subject river reach lies between Ahtanum Creek and Prosser (i.e., approximately eighteen miles below the confluence of Satus Creek.

(*Cornus stolonifera*), alder (*Alnus species*) and birch (*Betula species*), are typical understory species found in PFO class wetlands in the Affected Area. Typical plant species found in PSS class wetlands in the Affected Area include willows, alder, red-osier dogwood, common chokecherry (*Prunus virginiana*) and young cottonwood. Aquatic beds can include pondweeds (*Potamogeton species*), coontail (*Ceratophyllum demersum*), Eurasian milfoil (*Myriophyllum spicatum*) and/or duckweeds (*Lemna species*) (USFWS 1996).

The elevational range of wetlands delineated by the Service in the Affected Area vary from 2200 feet at the base of Cle Elum Dam to about 340 feet at the confluence of the Yakima River with Columbia River near Richland, Washington (USGS 1989 and 1992).

Yakima River Wetland, Riverine and Lacustrine Habitats (Figure 2): Using Cowardin's classifications and NWI data, the Service mapped wetlands, riverine and deepwater habitats in the Yakima River floodplain. These mapped features were confined to the area found within the Federal Emergency Management Agency (FEMA) designated Zone A[9]. Wetlands within the Yakima River floodplain have decreased in extent and quality due to the diversion of water for irrigation purposes at several points below Cle Elum Dam. The most significant impact to wetlands has been the modification of the historic hydrograph due to water storage facilities located upstream from the Affected Area (e.g., Bumping, Rimrock, Keechelus, Kachess, and Cle Elum Lakes (Reclamation 2007b). This is most evident in the lack of cottonwood recruitment below Union Gap (Elliott 2007b). In addition, several miles of the Yakima River above its confluence with the Columbia River are subject to inundation by Lake Wallula, an impoundment created by the Corps of Engineers operation of McNary Dam. The area of wetland, riverine, and lacustrine habitats (in acres) is quantified in Table 1, below.

Columbia River Wetland, Riverine and Lacustrine Habitats (Figure 2): The Service used a similar method to determine the area of wetlands, riverine and lacustrine habitats in the Columbia River floodplain, except that mapping using NWI data was not confined by FEMA floodway maps. The operation of several reservoirs upstream from the Hanford Reach (e.g. Lake Roosevelt, Hungry Horse) has modified the hydrograph in the Columbia River Basin, with likely detrimental effects to wetlands**.** However, similar to the lower Yakima River, the Columbia River is influenced by the operation of McNary Dam and Lake Wallula. The area of wetland, riverine and lacustrine habitats (in acres) is quantified in Table 1, below.

Black Rock Reservoir Site; Wetland Habitat (Figure 3): The identification of wetland habitat at the Black Rock Reservoir site was based on field observations and use of GAP landcover data (instead of NWI) data. The overall goal of Gap Analysis is to identify elements of biodiversity that lack adequate representation in the nation's network of reserves (i.e., areas managed primarily for the protection of biodiversity). Gap Analysis is a coarse-filter approach to biodiversity protection. It provides an overview of the distribution and conservation status of several components of biodiversity, with particular emphasis on vegetation and terrestrial vertebrates. Digital map overlays in a Geographic Information System (GIS) are used to identify vegetation types, individual species distribution, and species-rich areas that are unrepresented or

[9] FEMA defines "Zone A" as *"areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage"* (i.e., 26% chance of flooding during a 30 years period). The Service concluded that the influence of any flows associated with the various actions and the no action alternative would not reach beyond this zone (FEMA 2007).

under represented in existing biodiversity management areas[10]. Gap Analysis functions as a preliminary step to more detailed studies to establish boundaries for potential additions to the existing network of reserves. The Service's analysis of wetlands at the Black Rock Reservoir site was confined to that area found within the footprint of the proposed dam, impounded reservoir (at maximum pool elevation) and indirect impact area around the perimeter of the dam and reservoir (0.31 miles [1/2 km] in width. The Black Rock Valley is located in a semi-arid environment; the primary drainage in the Affected Area is considered an intermittent/ephemeral watercourse tributary to the lower Yakima sub-basin. Although the plant community has been altered for agricultural purposes, it is unlikely that there were any wetlands historically found in the Affected Area. In fact, the only wetlands identified through our analysis are relatively small in area (0.9 acres) and created by an impounded pond. They are not considered a natural occurrence (Davidson et al. 2007).

Wymer Reservoir Site; Wetland and Riverine Habitats (Figure 4): The identification of wetland and riverine habitats identified at the Wymer Reservoir site was based on field observations and use of GAP landcover data (instead of NWI) data. The Service's analysis of wetlands at the Wymer Reservoir site was confined to that area found within the footprint of the proposed dam, impounded reservoir (at maximum pool elevation) and in the indirect impact area around the perimeter of the dam and reservoir (0.31 miles [1/2 km] in width). Wetlands in the Wymer Reservoir site are found exclusively in the riparian zone in both Lmuma Creek and an unnamed tributary in the proposed impoundment area. Seeps were observed in the riparian corridor of Lmuma Creek. The riparian/wetland plant community has been significantly degraded due to extensive past and ongoing livestock grazing, as such these provide minimal value functioning habitat for wildlife. Remnant vegetation in the riparian/wetlands area included some cottonwood, willow and black hawthorn. Some emergent vegetation was also observed. Even though the flow of Lmuma Creek is not regulated, there was no evidence of cottonwood recruitment, apparently a result of livestock grazing (USFWS 2007). Wetland habitat in acres is quantified in Table 1, below.

Wymer Reservoir Site plus Pump Exchange; Wetland and Riverine Habitats (Figure 4): Same impacts to wetlands at the Wymer Reservoir site as with the Wymer Reservoir only alternative[11].

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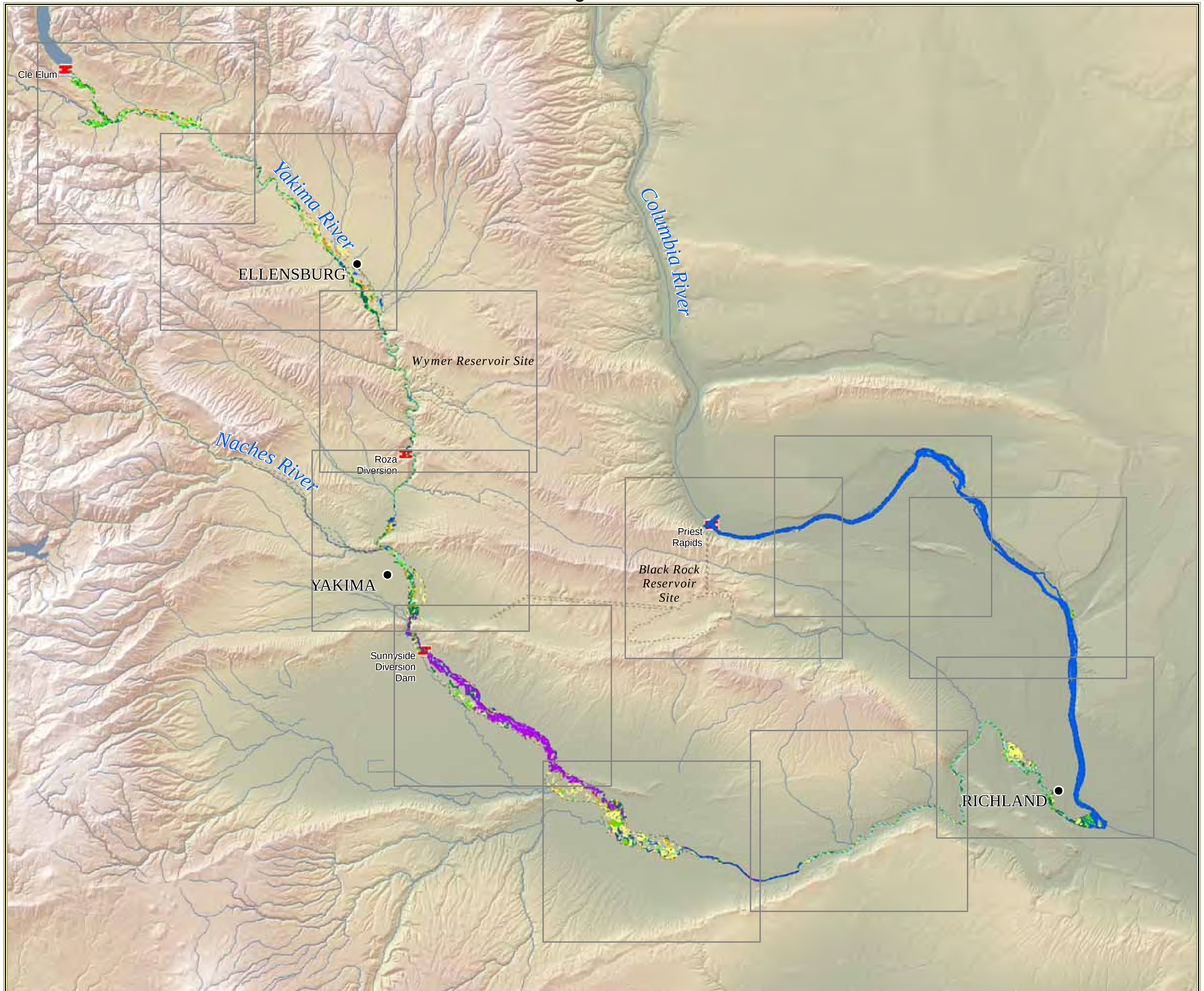
[10] Biodiversity management area - specially designated public or private lands with an active ecosystem management plan in operation whose primary purpose is to contribute to regional maintenance of native genetic, species and community levels of biodiversity, and the processes that maintain that biodiversity

[11] Wetlands that may be present along the alignment for the pump exchange/pipeline were not included in this analysis due to lack of spatial data

Figure 2



Department of the Interior
U.S. Fish & Wildlife Service
Yakima River Basin Storage Project

Wetlands in the Affected Area (National Wetlands Inventory)

Master map for 11 wetland maps (1:100,000 scale).

N

0 10 20 Miles

- Dams
- Affected Area

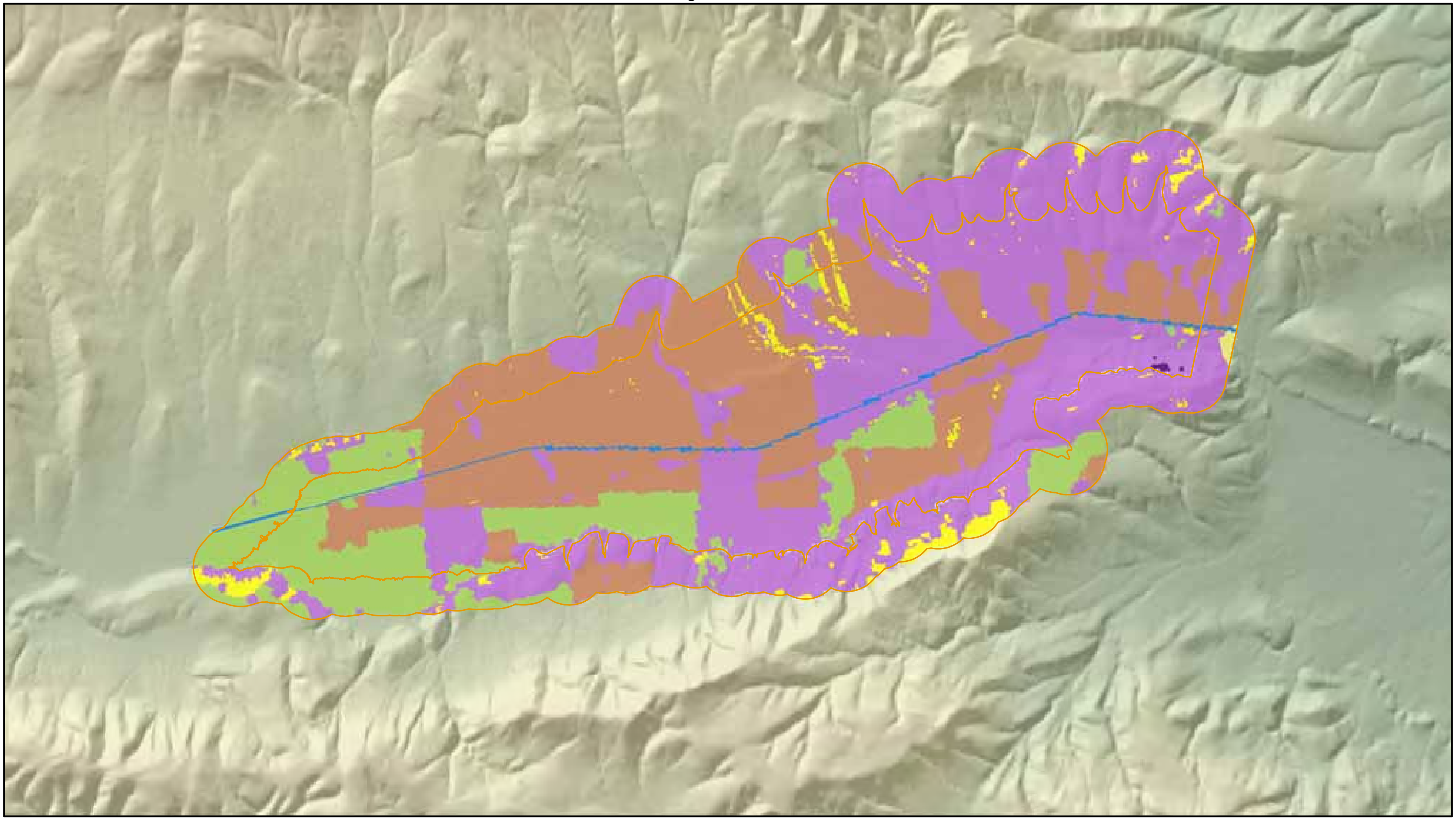
Wetland Habitat in Affected Area

- Palustrine Emergent (PEM)
- Palustrine Scrub Shrub (PSS)
- Palustrine Forested (PFO)
- Other Palustrine
- Riverine
- Lacustrine
- Upland Cottonwood Stands*

*NWI data clipped to data digitized by the Yakama Nation Wildlife Program & Natural Resource Department in 2006.

This map was produced by the Upper Columbia Fish & Wildlife Office of the USFWS on 9/20/07. No warranty is made by the U.S. Fish and Wildlife Service as to accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

Figure 3



Black Rock Vegetation Area - Total 8770 Acres*

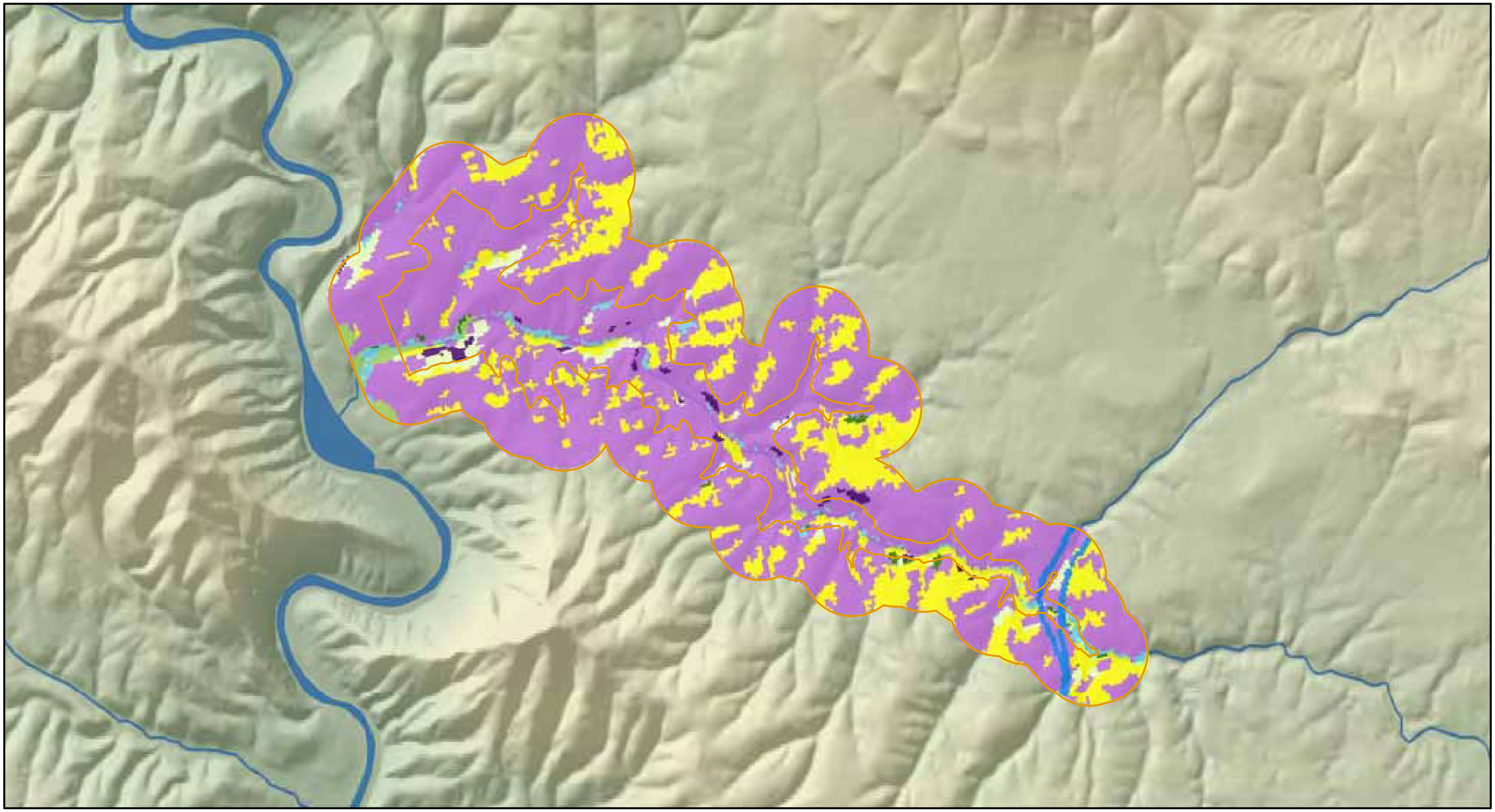
N

- Grassland - 113 Acres
- Riparian - 1 Acre
- Shrub-Steppe - 3539 Acres
- CRP - 3771 Acres
- Crops/Agriculture - 1226 Acres
- Developed - 113 Acres
- Cliff/Canyon - 7 Acres
- Buffer Area

**Buffer acreages not included in legend. All analyses are based on data from Northwest Gap Analysis Project Draft land cover data. USGS National Gap Analysis Program. University of Idaho, Moscow, Idaho.*

0 1 2 Miles

Figure 4



N

0 1 2 Miles

Wymer Vegetation Area - Total 1392 Acres*

Buffer Area

Barren - 62 Acres

Grassland - 167 Acres

Riparian - 50 Acres

Crops/Agriculture - 11 Acres

Developed - 7 Acres

Wetland/Closed Depression - 4 Acres

Shrub-Steppe - 1055 Acres

Cliff/Canyon - 30 Acres

Forest - 6 Acres

**Buffer acreages not included in legend. All analyses are based on data from Northwest Gap Analysis Project Draft land cover data. USGS National Gap Analysis Program. University of Idaho, Moscow, Idaho.*

This map was produced by the Upper Columbia Fish & Wildlife Office of the USFWS on 9/13/2007. No warranty is made by the U.S. Fish and Wildlife Service as to accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

TABLE 1: Wetlands and Deepwater Habitats Identified in Affected Area (USFWS 1981-2002)

Wetlands identified by class[12] (in acres)	Black Rock Reservoir Site[13] & associated infrastructure	Wymer Reservoir Site & associated infrastructure	Wymer Reservoir Site with Pump Exchange & associated infrastructure	Yakima River floodplain[14] : Cle Elum Dam downstream to Columbia River	Columbia River floodplain: Priest Rapids Dam down-steam to Yakima River
PEM	*	*	*	3540 acres	156 acres
PFO	*	*	*	3733 acres	3 acres
PSS	*	*	*	1967 acres	142 acres
Palustrine-other	0.9 acres (POWHH	*	*	1295 acres	43 acres
Palustrine unclassified	*	83 acres	83 acres	N/A	N/A
Riverine	N/A	N/A	N/A	5900 acres	0
Lacustrine	N/A	N/A	N/A	1785 acres	15,983 acres
Total acres	0.9 acres	83 acres	83 acres	18,220 acres	16,327 acres

* No specific data was available to determine wetland class at these sites, thus wetlands are identified as Palustrine unclassified

II-5) <u>Shrub-Steppe Habitat</u>

Prior to European settlement, shrub-steppe habitat was found in a nearly contiguous 10.4 million acre tract that occupied nearly all of eastern Washington (Dobler 1990). Since that time, shrub-steppe habitat in eastern Washington and the Basin has declined significantly in both area and quality. Young (1976) calculated that this habitat covers 2,000,000 acres within the Basin. However, this habitat has undergone significant losses and degradation and is now listed as an endangered ecosystem in Washington (Noss et al. 1995). Dobler (1990) calculated that roughly 60 percent of the historical, native shrub-steppe habitat in Washington has been converted to other uses. Additionally, changes have occurred to the remaining habitat including heavy grazing from livestock, altered fire frequencies, exotic species invasion and off-road vehicle use. Shrub-steppe habitats are valuable for many reasons: as a cultural resource for native and other Americans; as an economic resource, as viable habitat for species dependent on shrub-steppe, as recreational opportunities and as educational opportunities. Shrub-steppe lands provide very important habitat for a number of species of plants and animals, many of which are in decline.

Undisturbed vegetation in the shrub-steppe habitat is dominated by big sagebrush as the principal shrub and bluebunch wheatgrass (*Pseudoroegneria spicata*) as the principal grass (Daubenmire 1970). Much smaller amounts of gray rabbitbrush (*Chrysothamnus nauseosus*) and green rabbitbrush (*Chrysothamnus viscidiflorus*), spiny hopsage (*Grayia spinosa*), three-tip sage (*Artemisia tripartita*) and horsebrush (*Tetradymia canescens*) may occur in the shrub layer.

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[12] Cowardin 1979
[13] The *"Reservoir site"* at both Black Rock and Wymer Reservoir sites includes the area within 0.31 mile (1/2 km) wide buffer zone around the perimeter of the impoundment area as well as the footprint of the impoundment area and dam
[14] See description of FEMA Zone A, above

Cheatgrass (*Bromus tectorum*), an exotic annual, has become widespread throughout the region. In some area it has replaced the native grass species amid the native shrubs and forbs. In other areas, shrubs are completely absent and cheatgrass is essentially the only grass species that occurs.

TABLE 2. Shrub-Steppe Habitat (in acres) within the Affected Area

Location	Shrub-steppe Habitat (in acres)*
Black Rock Reservoir site	3,539 acres
Black Rock Reservoir disturbance buffer	3,052 acres
Wymer Reservoir site	1,055 acres
Wymer Reservoir disturbance buffer	2,579 acres
Affected Area (other than above)	7,349 acres
Total Affected Area	17,574 acres

* - (Davidson et al. 2007)

II-6) <u>Federally Listed Threatened and Endangered Species, Candidates and Species of Concern within the Affected Area</u>

Threatened and Endangered Species

Bald Eagle (*Haliaeetus leucocephalus*)[15] – Suitable habitat includes those areas that are close to large bodies of water and provide a substantial food base such as along rivers with anadromous fish, good populations of resident fish, abundant waterfowl and good mammal populations. In the Yakima River Basin, bald eagles are found along the shores of reservoirs and rivers. Territory size and configuration are influenced by the availability of perch trees for foraging, quality of foraging habitat and distance of nests from water supporting adequate food supplies. Bald eagles are sensitive to a variety of human recreational, resource and development activities. Human disturbance must be kept to a minimum during the nesting season.

The location of bald eagle nests are influenced by factors such as relative tree height, diameter, species, form, position on the surrounding topography, distance from water and distance from disturbance (Anthony and Isaacs 1989). Bald eagles usually nest in the same territories each year and often use the same nests repeatedly. Nest trees usually provide an unobstructed view of an associated water body and are often prominent locations on the topography. Snags and trees with exposed lateral limbs or those with dead tops are often present in nesting stories and are used as roosts, perch sites or access points to and from the nest.

Bald eagle winter habitat is mostly associated with areas of open, ice-free water where fish are available and/or waterfowl congregate (Stalmaster 1987). Additionally, eagles may be scattered through upland areas feeding on ungulate carrion, game birds and rabbits (Swenson et al. 1981). In areas where waterways do not freeze, adult eagles tend

[15] The bald eagle was delisted from as a federally listed threatened species under the Endangered Species Act on August 8, 2007. It is still protected by Federal law under the Migratory Bird Treaty Act and the Bald Eagle Protection Act.

to remain on the territory year-around. The majority of the bald eagles wintering in central and eastern Washington are winter migrants (Fielder 1992). Some move relatively short distances to lower elevations or inland for food sources. Most eagles that breed in the Pacific recovery zone area winter in the vicinity of their nests. Five documented bald eagle nests occur in the Basin. Two are located upstream of Ellensburg, WA, another one is located near the mouth of the Yakima Canyon and two additional nests have been documented in the lower Yakima valley. Two documented bald eagle communal roost sites occur in the Basin. One of the two communal roost sites is located in the Affected Area (WDFW 2006). A communal roost site is an area where several bald eagles spend the night within close proximity of each other.

Bull trout (*Salvelinus confluentus*) **–** The coterminous United States population of the bull trout *(Salvelinus confluentus)* was listed as threatened on November 1, 1999 (64 FR 58910). Bull trout in the Columbia River Distinct Population Segment were listed as threatened on June 10, 1998. The threatened bull trout occurs in the Klamath River Basin of south-central Oregon and in the Jarbidge River in Nevada, north to various coastal rivers of Washington to the Puget Sound and east throughout major rivers within the Columbia River Basin to the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Cavender 1978, Bond 1992, Brewin and Brewin 1997, Leary and Allendorf 1997).

The bull trout is a wide ranging, salmonid species that formerly inhabited most of the cold lakes, rivers and streams throughout the western states and British Columbia. It exhibits two life forms, resident and migratory. The resident form inhabits streams and grows to about twelve inches. The migratory form commonly exceeds twenty inches in length and spawns in streams where juveniles live for some time before migrating to rivers and lakes. Bull trout are piscivorous and require an abundant supply of forage fish for vigorous populations.

Bull trout require cold water, with 7-8^{o}C appearing optimal and 15^{o}C maximum. Spawning occurs in cooling water below 9^{o} C. Optimal incubating temperature seems to be 2-4^{o}C. Spawning occurs from August through November and eggs hatch in late winter or early spring. Emergence occurs in early April through May, commonly following spring peak flows. Because of extended time in the substrate, bull trout are susceptible to mortality in unstable conditions. Successful reproduction requires channel and substrate stability and adequate winter water flow to prevent the substrate from freezing. Bull trout require complex forms of instream cover. Adults use pools, large woody debris and undercut banks for resting and foraging. Juveniles also use side channels and smaller wood in the water. Channels for moving between safe wintering areas and summer foraging areas are also necessary.

Bull trout are dispersed throughout the Yakima Basin. Resident and migratory (both fluvial and adfluvial) bull trout are found within the Yakima Core Area. A core area denotes certain populations which the Service utilizes to measure bull trout recovery. Bull trout in the Yakima Core Area are currently found in 16 local populations. There are preliminary discussions about possible reintroduction of one additional population (Taneum Creek). Currently 8 of the 16 populations may contribute individuals to the mainstem Columbia River based on information developed in genetic and radio telemetry reports in the Yakima Core Area (Mizell and Anderson 2006).

The Yakima Core Area populations persist at low numbers, in fragmented, local populations. Since 1998, redd counts have varied from 455-687, averaging 534. The overall trend in redd counts in the Yakima Core Area is unstable and decreasing and because of the lack of interconnectivity, it is currently considered to be at intermediate risk from the deleterious effects of genetic drift. Given the lack of consistent population-census information, the low numbers of spawning migratory bull trout in most of the local populations, the continued lack of connectivity, and decreased numbers of redds in one of the largest populations, bull trout in the Yakima Core Area are considered to have low resiliency and to be at increased risk of extirpation from stochastic events.

In order to increase the knowledge of fluvial and resident bull trout populations, the Washington Department of Fish and Wildlife, in coordination with the Service, initiated a radio telemetry study in 2003 for the Basin (Mizell and Anderson 2006). Radio-tagged fluvial and resident bull trout have provided significant information and insight into population movement patterns, habitat preferences, and over-wintering areas. The main populations of the Naches River bull trout i.e. Tieton (Clear Creek, Indian Creek, S.F. Tieton) Rattlesnake Creek, Bumping River, Crow Creek, American River, Kettle Creek and Union Creek local populations are similar yet readily identifiable as genetically separate. They exhibit nearly identical over wintering behavior in the mainstem Naches but individual population timing varies significantly. Over wintering occurs in several main holes where the populations intermingle over the winter months then separate out for spawning. Spawning site fidelity was found to be extraordinarily high (at or near) 100% by radio telemetry, and was reinforced by the genetics findings. The Ahtanum population was found to be an isolated or semi-isolated population with only one tagged fish moving far enough off of the spawning ground to go below an individual fork of the Ahtanum. Therefore, the North Fork, Middle Fork and South Fork Ahtanum populations are very nearly isolated from each other, let alone the Yakima and Naches Rivers. Crow Creek was also found to be a semi-isolated population, although the potential for movement exists. Several juveniles and adults were found on or below the spawning ground during non spawning surveys, and three fish were encountered as juveniles in the main stem Naches/Bumping Rivers. Bull trout in the Naches River over wintered from the fall into the following spring in water cool enough that temperatures did not play a significant role in their survival. The tracked fish moved upwards in the mainstem Naches in the early summer, before the warm temperatures in the lower river became an issue. Habitat choices seemed to be driven more by velocity than by riparian cover, with the subjects choosing a velocity where cover was provided by surface obfuscation, and prey was readily available.

Within the project area, the extent of designated bull trout critical habitat is within streams and rivers within the Basin, the only core area within the Middle Columbia River Basin Critical Habitat: Unit 20. Critical habitat in the Yakima River Core Area supports 16 local bull trout populations, one potential local population (Taneum Creek), and Feeding, Migratory and Over-wintering (FMO) habitat throughout the core area. The majority of designated critical habitat lies within the lower portions of the larger river system on non-federal lands. The project area encompasses spawning and rearing and

FMO habitat within designated critical habitat reaches for these local populations. Eleven of sixteen local populations actually have designated critical habitat within them. There is some critical habitat which contains FMO habitat that is outside of tributaries with local populations.

Ute Ladies'-Tresses Orchid (*Spiranthes diluvialis*) – A perennial, terrestrial orchid with stems approximately 8 to 20 inches tall, arising from thick, tuberous roots. Its narrow leaves can reach 11 inches in length. Basal leaves are the longest and become reduced in size up the stem. The orchid occurs along riparian edges, gravel bars, old oxbows, high flow channels, and moist to wet meadows along perennial streams. It typically occurs in stable wetland and seepy areas associated with old landscape features within historical floodplains of major rivers. It is also found in wetland and seepy areas near freshwater lakes or springs. *Spiranthes diluvialis* was first discovered in Washington at Wannacut Lake in Okanogan County (also in the Okanogan watershed and ecoregion) in 1997 (Bjork 1997). In 2000, this species was also found along a reservoir bordering the Columbia River near Chelan in Chelan County (Chief Joseph watershed) within the Columbia Plateau ecoregion (Ferig et al. 2005). At present, there are no known populations of Ute ladies' tresses within the Affected Area (WNHP 2007).

Candidate Species[16]

Greater sage grouse – A large, gallinaceous species up to 30 inches in length and two feet tall, weighing from two to seven pounds, and has a long, pointed tail with legs feathered to the base of the toes. In eastern Washington, the sage grouse is found from 1,000 to 4,000 feet in elevation (the highest point on the Yakima Training Center. In other states it is found in open sagebrush plains from 4,000 to over 9,000 feet in elevation, and is an omnivore, feeding on soft plants, primarily sagebrush, and insects.

The historic range of the sage grouse included Washington, Oregon, eastern California, Nevada, Idaho, Montana, Wyoming, western Colorado, Utah, South Dakota, North Dakota, Kansas, Oklahoma, Nebraska, New Mexico, Arizona and the Canadian provinces of British Columbia, Alberta and Saskatchewan. They are no longer found in Nebraska, Kansas, Oklahoma, New Mexico, Arizona, and British Columbia. The distribution of greater sage grouse has contracted, most notably along the northern and northwestern periphery and in the center of the historic range. Range-wide estimates of sage grouse abundance prior to European settlement in western North America vary, but consensus estimate is that there may have been about 1.1 million birds in 1800. The 1998 range-wide spring population numbered about 157,000 sage grouse. More recent estimates put the number of sage grouse range-wide at roughly between 100,000 and 500,000 birds. Recent surveys indicate there are two relatively isolated sage grouse populations remaining in Washington. One population is found in Douglas and Grant counties, predominantly on private land. The other population is found on the federally managed Yakima Training Center in Kittitas and Yakima counties which, together with the

[16] Candidate species are plants and animals for which the Fish and Wildlife Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act ,but for which development of a proposed listing regulation is precluded by other higher priority listing activities.

Hanford site, comprise the largest block of shrub-steppe remaining in Washington. The Yakima Training Center is adjacent to the northern boundary of the potential Black Rock footprint, and borders the extreme eastern end of the potential Wymer footprint. These sage grouse populations are isolated from surrounding populations in Idaho and Oregon (Hays et al.1998). The Affected Area is located within sage grouse core habitat. The Wymer and Black Rock footprints both contain some sage grouse core habitat (Johnson and Cassidy 1997).

Mardon Skipper (*Polites mardon*) – A small tawny-orange butterfly dependent on native, fescue-dominated grasslands in Washington, Oregon, and northwest California. It has a stout, hairy body and the upper surface of both wings is orange with broad dark borders. The wings from below are light tan-orange with a distinctive pattern of light yellow to white rectangular spots.

The Mardon skipper is found in prairie and meadow habitat with abundant Idaho fescue (*Festuca idahoensis*). Mardon skippers complete one life cycle annually, and in Washington adults emerge from chrysalids between May and July for a month-long flight period. After mating, females deposit their eggs into native bunchgrass where they hatch after 6-7 days. Larvae feed on fescue grass for about three months and pupae hibernate through the winter and spring.

The historic range and abundance of the Mardon skipper is not precisely known because systematic and quantitative studies were not conducted prior to 1980. Historically, specimens of the butterfly were collected in three counties in Washington (Thurston, Klickitat and Yakima).

Basalt daisy (*Erigeron basalticus*) – A tap-rooted perennial herb with one to several sprawling stems per plant. The stems are 4-6 inches long, leafy, especially toward the tip. Most of the leaves are about 1 inch in length, wedge-shaped in outline, and three-lobed at the tip. The flowers are typically daisy-like, with white to lilac ray flowers, about ¼ inch long, surrounding a cluster of small disk flowers.

Basalt daisy has been observed in an approximately 20 square-mile area in and adjacent to Yakima Canyon in Yakima and Kittitas counties, Washington. It grows in crevices in basalt cliffs on canyon walls, with northerly, easterly and westerly aspects. Elevations range from1250 to 1500 feet. The habitat is exclusively on basalt cliffs along the Yakima River and Selah Creek, both of which have cut through basalt from the Yakima Basalt Formation. The basalt daisy occurs at several locations within the Yakima River Basin portion of the Affected Area (WNHP 2007).

Umtanum desert buckwheat (*Eriogonum codium*) – A low caespitose, herbaceous perennial, the above ground woody stem forming highly branched mates 8-28 inches across, arising from a stout woody taproot; leaves basal, persistent, oblanceolate to elliptic, ¼ to ½ inch long and 1/8 to ¼ inches in width.

Umtanum desert buckwheat is endemic to a very narrow range in Benton County in south central Washington. The only known population of this species occurs at elevations ranging between 1100 and 1320 feet on flat to gently sloping microsites near the top of the steep, north-facing basalt cliffs over looking the Columbia River. There are no known populations of Umtanum desert buckwheat within the Affected Area (WNHP 2007).

Species of Concern[17]

Fish and wildlife species of concern in the Basin include: burrowing owl, California floater (*Anodonta californiensis*) (mussel), Columbia clubtail (*Gomphus lynnae*) (dragonfly), ferruginous hawk, giant Columbia spire snail (*Fluminicola Columbiana*), loggerhead shrike, long-eared myotis (*Myotis evotis*), margined sculpin (*Cottus marginatus*), Pacific lamprey (*Lampetra tridentate*), pallid Townsend's big-eared bat (*Corynorhinus townsendii pallescens*), redband trout (*Oncorhynchus mykiss*), river lamprey (*Lampetra ayresi*), sagebrush lizard (*Sceloporus graciosus*), Townsend's ground squirrel, western brook lamprey (*Lampetra richardsoni*), black swift (*Cypseloides niger*), larch mountain salamander (*Plethodon larselli*), northern goshawk (*Accipiter gentilis*), olive-sided flycatcher (*Contopus cooperi*), peregrine falcon (*Falco peregrinus*), sharptail snake (*Contia tenius*), western gray squirrel (*Sciurus griseus griseus*), wolverine (*Gulo gulo*), westslope cutthroat trout (*Onchorhynchus clarki lewisii*) and pygmy whitefish (*Prosopium coulteri*). Although we have no specific information, several of these species are known to occur in habitats similar to those found in the Affected Area.

Plant species of concern include: Columbia milk-vetch (*Astragalus columbianus*), Suksdorf's monkey-flower (*Mimulus suksdorfii*), gray cryptantha (*Cryptantha leucophaea*), Palouse goldenweed (*Haplopappus liatriformis*), Hoover's desert-parsley (*Lomatium tuberosum*), liverwort monkey-flower (*Mimulus jungermannioides*), Persistent sepal yellowcress (*Rorippa columbiae*), clustered lady's slipper (*Cypripedium fasciculatum*), Wenatchee larkspur (*Delphinium viridescens*), least phacelia (*Phacelia minutissima*), whitebark pine (*Pinus albicaulis*), Seely's silene (*Silene seelyi*), Hoovers tauschia (*Tauschia hooveri*), long-bearded sego lily (*Calochortus longebarbatus* var. *longebarbatus*), obscure Indian-paintbrush (*Castilleja cryptantha*) and Pale blue-eyed grass (*Sisyrinchium sarmentosum*).

Two of the plant species listed above as *"Species of Concern"* have been found within the Affected Area. They are described below:

<u>Columbia milk-vetch</u>: A tap-rooted, low, sprawling perennial plant with pinnately-compounded leaves and reddish stems. The flowers are brilliant white, ¾ inch long in 2-10 flowered clusters. Columbia milk-vetch is restricted to an area approximately 25 miles by five miles along the west side of the Columbia River in Yakima, Kittitas, and

[17] *"Species of Concern"* is an informal term that refers to those species the U.S. Fish and Wildlife Service which might be in need of concentrated conservation actions. Such conservation actions vary depending on the health of the populations and degree and types of threats. At one extreme, there may only need to be periodic monitoring of populations and threats to the species and its habitat. At the other extreme, a species may need to be listed as a Federal threatened or endangered species. *"Species of Concern"* receive no legal protection under the Endangered Species Act, and the use of the term does not necessarily mean that the species will eventually be proposed for listing as a threatened or endangered species.

Benton counties, Washington. The species occurs within an elevational range of 500 to 2100 feet in the shrub-steppe vegetation zone. A known isolated population of Columbia milk-vetch is present within the Affected Area and in the vicinity of the proposed Black Rock Reservoir (WNHP 2007).

Suksdorf's monkey-flower: A slender often much-branched annual 1-6 inches tall; stem leaves are usually numerous and opposite, oblong-elliptic to linear in shape and sessile on the stem. Flowers are yellow and faintly spotted, borne on slender stalks originating in leaf axils. The species occurs in Washington in the Columbia Basin and Eastern Cascades physiographic provinces (Benton, Chelan, Kittitas, Klickitat, and Yakima counties. The species occurs in open, moist, or rather dry places, from the valleys and foothills to moderate or occasionally rather high elevations in the mountains. In Washington, suksdorf's monkey-flower occurs within the sagebrush steppe vegetation type. A known isolated population of suksdorf's monkey-flower is present within the Affected Area and is in the vicinity of the proposed Wymer Reservoir (WNHP 2007).

III POTENTIAL EFFECTS TO FISH AND WILDLIFE RESOURCES: (WITH AND WITHOUT THE PROJECT)

III-1) Resident fish

Analysis of the environmental effects to bull trout and other resident fish species for the Black Rock and Wymer action alternatives was performed with several modeling tools. Due to the scope and magnitude of these modeling tools and the limited time allotted to the Service for analysis of these tools, we provide a cursory approach in determining effects to bull trout and resident fish. We provide this cursory analysis in the context of changes in daily average flows and changes in the amount and type of bull trout and resident fish habitat. Each model will be briefly described along with its application to the analysis. The following modeling tools were provided to the Service by Reclamation:

The Riverware model is a hydrologic water routing model used to estimate daily average stream flow at several locations throughout the Yakima Basin, plus estimate daily irrigation diversions and estimate daily reservoir storage volume by reservoir for each alternative. A detailed description of the Riverware model can be found at The Center for Advanced Decision Support for Water and Environmental Systems' (CADWES) website: http://cadswes.colorado.edu/riverware/.

Riverware was used to estimate daily average stream flow for each alternative at the following locations on the Yakima River: Easton (river mile 202), Cle Elum River, Umtanum (river mile 140), Parker Dam (river mile 104) and on the Naches River: near the city of Naches (river mile 17). Stream flow data from these locations was used for the flow-to-habitat models described below. Riverware was also used to provide stream flow data for approximately 50 stream reaches of the Yakima, Naches, Tieton, Bumping and Cle Elum rivers for the Yakima River Decision Support System (YRDSS) and Ecosystem Diagnostic and Treatment (EDT) models described below.

Two-dimensional hydrodynamic models were developed for the Easton, Ellensburg, Union Gap, Wapato, and lower Naches River floodplains. These models simulated hydraulic conditions over a wide range of streamflows ranging from low base flow conditions to overbank. The output from the 2-D models was used as input for the YRDSS, but it is the YRDSS that produces the habitat versus discharge functions by which the alternatives can be compared. Accordingly, it is the YRDSS that generates the comparative statistics for all of the decision variables.

The YRDSS uses the RiverWare output for each day in each year of the period of record (1982-2003) for the "no action" alternative and the applicable action alternative which reflects different operational criteria. Each of these scenarios produces different hydraulic characteristics that are simulated by the 2-D models. These characteristics are translated within the YRDSS into a time series of available fish habitat for various fish species and life stages using habitat suitability criteria. The amount of fish habitat over time is calculated using Geographical Information System (GIS) coverages for both the no action alternative and the action alternatives, and comparative statistics are generated. In general, the Service shall use bull trout and resident rainbow trout for applicable alternative comparisons.

The EDT model estimates population size and productivity for fish species based on the amount and quality of habitat within a watershed. The model is also a diagnostic tool providing the user with information on key factors limiting population size and productivity within the watershed for each species.

Output from the Riverware and flow-to-habitat models provided input for the EDT flow and habitat attributes for each alternative. A more in-depth description of the EDT model can be found at Mobrand- Jones & Stokes website (http://www.mobrand.com/MBI/library.html).

To further assist the Service in determining the effects of the Black Rock and Wymer alternatives on bull trout and resident fish, the Service also utilized a draft *Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale* (Matrix). This tool uses over two-dozen pathways and indicators to analyze impacts to bull trout and bull trout habitat at the watershed level. The Matrix also enables the Service to uniformly and consistently determine the impacts resulting from a variety of projects. We used the pathways and indicators set forth in the Matrix to assess the existing condition of the Yakima River Basin and associated Project impacts resulting from the proposed implementation of the Black Rock and Wymer alternatives. This allows a direct comparison of the existing conditions and the effects to aquatic resources, specifically resident fish. Due to a lack of historical information for comparison, many of the baseline conditions and impacts from the Project must be qualitatively compared. Due to its status as a threatened species, the Service will predominantly focus its analysis on bull trout, however, we will not discount the importance of other resident fish species in examining the proposed alternatives. For this analysis, the Service used the following Matrix indicators in its examination of bull trout and resident fish in the Yakima River Basin: 1) water quality; 2) habitat access; 3) habitat elements; 4) channel condition and dynamics; 5) flow/hydrology; and 6) watershed conditions.

Effects from the No Action Alternative

In this section, we discuss changes to bull trout, resident fish, and their habitats if the proposed Black Rock or Wymer reservoirs were not constructed, that is, following the “no action alternative.” As noted above, current reservoir operations and instream flow regimes in the Yakima River Basin would be maintained without the implementation of the Black Rock or Wymer action alternatives.

Water Quality

The limiting factor that disqualifies most stream habitat as suitable for some species of resident fish and specifically bull trout spawning and rearing is temperature (McPhail and Murray 1979, Fraley and Shepard 1989, Goetz 1989, Rieman and McIntyre 1995). The threshold temperature for bull trout spawning is 9°C (McPhail and Baxter 1996), whereas it is 13°C for Pacific salmon and trout. McPhail and Murray (1979) demonstrated that survival of bull trout eggs was highest (80-95 percent) to hatching at temperatures of 2-4°C and dropped to 0-20 percent at temperatures of 8-10°C. Further, lower incubation temperatures resulted in larger fry; temperatures of 8 °C produced 22 millimeter (mm) fry while temperatures of 2°C produced 24.5 mm fry (McPhail and Murray 1979). The 8-10°C temperatures at which most bull trout eggs die are within the optimum range of temperatures (6°C to 13°C) for egg survival of all five Pacific salmon (Beacham and Murray 1987) indigenous to the West Coast. Goetz (1989) suggested optimum water temperatures for juvenile bull trout rearing were about 7° to 8°C (44 to 46 °F) and optimum water temperatures for egg incubation were 2° to 4°C (35° to 39°F). Fraley and Shepard (1989) found 28 tributaries of the Flathead River basin in which adfluvial bull trout spawn are all characterized by maximum summer temperatures less than 15 °C. Bonneau and Scarnecchia (1996) found juvenile bull trout, when offered a temperature gradient of 8° to 15°C in a natural stream, chose the coldest water available (8° - 9°C). Further, several studies found a negative correlation between juvenile bull trout densities for a stream and average stream temperature (Goetz 1994, Shepard *et al*. 1984).

The requirement for cold water during egg incubation has limited spawning distribution of bull trout to high elevations in areas where the summer climate is warm. Rieman and McIntyre (1995) found in the Boise River Basin that no juvenile bull trout were present in streams below 1613 m (5000 feet). Similarly, in the Sprague River basin of south-central Oregon, Ziller (1992) found in four streams with bull trout that “*numbers of bull trout increased and numbers of other trout species decreased as elevation increased. In those streams, bull trout were only found at elevations above 1774 m”* (5500 feet). Dambacher and Jones (1997) found in the Klamath and Columbia Basins of Oregon that bull trout occur in basins that ranged from 1,460 m to 2,320 m (4790 feet to 7610 feet) in elevation and averaged 30 km^2 in size. Goetz (1997) reported observations of juvenile bull trout in nine basins of the Oregon and Washington Cascade Mountains at elevations down to 2100 foot elevation, but eight of the nine basins were spring fed, and all had summer temperatures under 14 °C maximum.

Craig (1997) found that streams in the Yakima River Basin with more than 20 redds had a 7-day summer mean temperature below 12 °C, and no single day with a temperature > 14.8 °C. Within the Yakima River Basin, the lowest altitude tributaries that support bull trout are above Bureau of Reclamation reservoirs (Gold Creek entering Keechelus Lake and Box Canyon Creek entering

Kachess Lake). The low elevation watersheds of Gold and Box Canyon Creeks stand out as substantially different from other bull trout spawning areas in the Yakima River Basin. Both of these streams also have significant areas with degraded stream habitat, but most importantly, both have water temperatures that remain below 15 °C in the summer and drop below 8 °C in the early fall. According to Craig (1997), Gold Creek has a fish barrier falls located at km 11.4, and highest spawning densities are usually found in a spring-fed channel near km 6.6 and near the mouth of ephemeral Spring Creek. Both of these areas likely have upwelled ground water that provides a unique thermal setting for such low altitude. Goetz (1997) reported that juvenile bull trout were found in Gold Creek only above the pond, where temperatures average 10 to 12 °C. In contrast, Goetz (1997) found no juvenile bull trout in or below Gold Creek pond, and temperatures there ranged from 12 to 16.5 °C. Spawning in Box Canyon Creek is limited to the lower 2.5 km (1.6 miles) by a falls, and the suitable spawning sites within the accessible length are also limited (Craig 1997). Throughout the Yakima River Basin, waterbodies have been seriously impacted and temperatures elevated. Washington State has accepted a 12 ^{o}C threshold as the criteria for temperature for char. The 1998 303(d) lists indicate that numerous areas in the Basin exceed the criteria for temperature.

Habitat Access

Entrainment is the involuntary conveyance of fish through the facilities of a water delivery system resulting in permanent displacement, possible injury and often mortality. Entrainment of resident fish species, specifically bull trout, occurs at the unscreened outlet works of water storage facilities located in the Yakima River Basin.

Entrainment of bull trout at diversion dams is minimized through the use of fish screens. Although all Reclamation diversions associated with the proposed implementation of the Black Rock and Wymer alternatives have been fully screened since the mid-1980, fish have been observed in the irrigation canals behind the screens. This has been reported at the Roza Diversion Dam where adult salmonids have been found. Salmon and rainbow trout have been identified but numerous fish have not been identified (D. Bambrick, NOAA-Fisheries, 2002, *pers. comm.*; W. Larrick, Reclamation, 2003, *pers. comm.*.). No confirmed sightings of bull trout have been reported for Roza Diversion, although entrainment of small bull trout could be possible there. All diversions in the Yakima River Basin are screened to current NOAA-Fisheries criteria (Kale Gullett, NOAA-Fisheries, 2004, *pers. comm.*).

Entrainment of bull trout and other fish species in the unscreened outlet works of the storage dams in the Yakima River Basin often results in direct mortality or injury. At best it results in permanent displacement since none of these dams are equipped with upstream passage facilities. In an ongoing entrainment study conducted directly below Tieton Dam, 11,692 fish were captured in nets between August 27 and October 17, 2001 (James 2001). Although only four of these captures were bull trout, extrapolation based on tests of sampling efficiency indicated that between 46 and 87 bull trout were likely flushed from the reservoir. The four bull trout collected were sub-adults (107-195 mm total length) and all were dead. Also captured in the nets were 11,281 kokanee, the primary prey species for bull trout in the reservoir. Based on extrapolation of this number, between 130,409 and 242,733 kokanee were likely entrained. Over 80 percent of the kokanee captured were dead when collected.

During 2002, sampling was again conducted below Tieton Dam by crews under the supervision of Steve Hiebert (Reclamation 2003. *pers. comm.*). The sampling design featured continuous 48-hour sample periods to more evenly cover all periods of the day and night. It also was intensive in terms of hours sampled. The total catch of fish (all species) was 5,057. Of these, 4,923 (97.4 per cent) were kokanee and nine (0.17 per cent) were bull trout. The captured bull trout ranged in size from 150 – 410 mm total length; all but two were less than 200 mm. Bull trout of that size are considered to be sub-adults. Of the two bull trout longer than 200 mm, one was 217 mm in total length and would still be considered a sub-adult; the other was 410 mm in total length and would be considered an adult. Four of the bull trout were alive when collected from the nets but died shortly afterward when resuscitation attempts failed. Five bull trout were dead when pulled from the net. At least 80 per cent of the kokanee entrained were dead when collected from the nets. Hiebert calculated his own sampling efficiency numbers which were based on more rigorous testing using three sets of flow conditions—increasing releases, peak releases, and decreasing releases—and their corresponding durations. He then summed the number of fish captured during each period and used the corresponding efficiency to extrapolate fish numbers. By doing this he was able to derive not only a range but a single estimate as well. For bull trout, he estimated that 145 fish were entrained (range 60-900 individuals) and for kokanee he estimated that 88,445 were entrained (range 36,732-536,300) (S. Hiebert Reclamation 2003. *pers. comm*).

From these studies it appears that the number of bull trout and kokanee entrained is more positively correlated to release magnitude than to reservoir volume. The largest number of both species entrained occurred during the period between September 10 to16 (early in the flip-flop period). The annual "flip-flop" operation in the Yakima River Basin is defined by reducing flows in the upper arm of the Yakima River and increasing flows in the Naches River with increased water releases from Rimrock Reservoir. Reservoir volume during this period was still quite high, ranging from about 155,000 af on September 10 to 133,000 af on September 16; the total capacity of Rimrock Reservoir is 198,000 af. Releases from the dam during this period ranged from 1,963 to 2,216 cfs, the latter being the maximum release during the study period and for the season. Further, it appears that the initial period of high releases entrains the most fish as no bull trout were captured after September 19 and the number of kokanee captured dropped precipitously as well, despite release flows that exceeded 2,000 cfs for another week (S. Hiebert Reclamation 2003. *pers. comm*).

Mortality rates for kokanee and bull trout collected during both years of this study were very high. It is probable that some of these fish died as a result of impingement in the collection nets but the percentage of fish that met that fate is unknown. It is clear that extremely large numbers of kokanee are being evacuated from Rimrock Reservoir with much smaller, but still significant, numbers of bull trout exiting as well. Despite the fact that 100 percent of bull trout collected in the two years were dead or died shortly after capture, it is possible that some may survive. However, these individuals, as well as their kokanee prey, have been permanently removed from the population above the dam.

Fish entrainment has not been well documented at the other dams in the basin, however burbot (*Lota lota*) have been found below storage dams on two occasions. Burbot are a native lacustrine species which are present in all the reservoirs that were once natural lakes (Keechelus, Kachess, Cle Elum, and Bumping). In the autumn of 2000, a dead burbot about 200 mm (8 inches total length) was found by Service biologists directly below Cle Elum Dam (Jeff Thomas, USFWS, *pers. comm.*, 2003). On July 8, 2002, Reclamation dewatered the stilling basin directly below Kachess Dam to repair the outlet chute. During fish salvage operations, 24 live burbot were recovered (Walt Larrick, Reclamation, *pers. comm.*, 2003). Twelve of these fish measured 150-400 mm and twelve measured from 75 to 150 mm. The species has also been observed in other portions of the Yakima River, having been sporadically captured at the smolt collection facility at Chandler in the lower Yakima River (Mark Johnston, Yakama Nation fishery biologist, *pers. comm.*, 2001).

Although the burbot inhabits the Columbia River and could conceivably migrate up the Yakima River to the base of Cle Elum and Kachess dams, this is believed unlikely in this case. Both of these dams are 322 km (200 miles) or more from the mouth of the Yakima River and the journey would be rigorous. Given this, and the fact that these fish were found directly below the dams, it is much more likely that they were reservoir inhabitants that had been displaced through the outlet works. Another lacustrine species, the lake trout (*S. namaycush*) has been found below Cle Elum Dam. In October 2003, six to eight lake trout were observed by snorkelers in the stilling basin directly below the dam. Four of these fish were large (500-600 mm, 20-24 inches total length) with the others in the 200-300 mm (8-12 inch) size class (Walter Larrick, Reclamation, 2003. *pers. comm.*). Lake trout, which are not a native species, are believed to have been stocked in Cle Elum Lake, as well as Keechelus and Kachess Lakes, prior to 1933 (WDFW 1998). They are no longer believed to be present in Keechelus or Kachess but are believed to naturally reproduce in Cle Elum. The species' abundance in the lake is unknown but thought to be low.

Since none of the outlet works at the storage dams are screened, it is likely that other fish, including bull trout, are also being entrained at Kachess and Cle Elum Dams. It is also likely that entrainment is occurring to some degree at Bumping and Keechelus dams. However, the amount of entrainment at these four dams is probably not as high as it is at Tieton Dam due to the location of the outlet works there in the deepest area of Rimrock Reservoir.

Adult passage for adfluvial bull trout migrating from the storage reservoirs into their spawning streams can be a problem in years with below average snow pack and resulting low stream flows (Reclamation 2000). In years such as these, it is not uncommon for most of the storage reservoirs to fall short of full storage capacity. In addition, the dates when reservoir releases are needed to meet downstream irrigation demands (i.e., storage control) occur earlier than in average or better water years. As reservoir levels recede, the lower reaches of tributaries which are inundated at full pool are exposed and flow across the reservoir bed. The channels of these exposed tributaries change year-to-year and consist largely of unconsolidated reservoir sediments; they are unconfined and typically highly anastomosed. The combination of these channel conditions and low summer streamflows can result in difficult passage conditions for adult bull trout ranging from moderate to impossible. Although passage problems in any given year may be anticipated, it is difficult to predict their severity.

Box Canyon Creek, the primary bull trout spawning tributary to Lake Kachess, has experienced chronic passage problems. As an interim solution, Reclamation attempted to remedy the problem by constructing a rock structure in an attempt to increase flows in the remaining channel (Reclamation 2000, NPPC 2001, Reclamation 2003). However, this has proven ineffective as a permanent solution and in 2001 (a drought year) only 7 to 8 bull trout were observed in the creek as late as September 18 (Jeff Thomas, USFWS, *pers. comm.*, 2002). At low flow, the discharge in Box Canyon Creek was about 0.3-0.4 cubic meters per-second (12-14 cfs). However, at its confluence with Lake Kachess, Box Canyon Creek was effectively dry due to water percolating into the lake bed, resulting in a complete passage barrier. Passage was restored on Box Canyon Creek on September 18 by WDFW's Drought Contingency Planning Team. Shortly afterwards, bull trout ascended the creek and fourteen bull trout redds were observed, about the average count over the previous four years. This situation occurred again in September, 2003 (Service File 03-I-W0391).

Also in 2001, a similar condition was observed on Indian Creek, a tributary of Rimrock Lake. Although not identified as a chronic problem, passage of adult bull trout was impeded at the mouth of the creek where an extensive alluvial fan had formed. The channel flowing across this alluvial deposit was extensively braided with little flow in any single channel and relatively few adult bull trout had migrated into Indian Creek by mid-September when the spawning migration is typically concluded (James 2002); only 20 redds had been observed in the first two redd survey passes. Once again, passage was restored by the WDFW team and a total of 117 redds were counted on Indian Creek that year. To put this number into perspective, 226 bull trout redds had been observed the previous year.

At the mouth of the South Fork Tieton River (Rimrock Reservoir), a man-made waterfall becomes evident when the reservoir falls below 131,000 af. This condition was created in the early 1960's when the USFS re-routed the South Fork Tieton River through a channel blasted out of the bedrock in order to construct a bridge at the mouth of the river. This unnatural vertical falls is believed to be impassable to bull trout when the reservoir is lowered to approximately 127,000 af (Jeff Thomas, USFWS, *pers. comm.*. 2003). Although Rimrock Reservoir has been drafted below 10,000 af by the end of the irrigation season in some dry years, it has always been well above 131,000 af through the upstream migration period for adult bull trout in every year since 1981. During September and October, however, the reservoir is drafted heavily and these falls reach considerable height posing a potential hazard for post-spawn adults migrating back into the reservoir. In October 1999, two adult bull trout and two suckers (*Colostomies* spp.) were found dead at the base of these falls (Scott Craig, USFWS, 2001. *pers. comm.*). While it appears from recapture data that most adult bull trout survive the drop over the falls during post-spawning migrations (James 2002), there remains the potential for bull trout mortality at this site due to fluctuations in reservoir levels.

Habitat Elements

In general, both the quality and amount of habitat in the Yakima River Basin has diminished (YSF&WPB 2004). Dams, for instance, reduce large woody debris (LWD), remove riparian vegetation, fragment habitat, reduce vegetation regeneration, increase streambank erosion, alter width/depth ratios, reduce structural and functional diversity, change basin hydrology, increase water temperature, increase sedimentation, and reduce water velocity (YSF&WPB 2004). Locally, these conditions may restrict access to otherwise suitable habitat. Specifically, lower Yakima River habitat for bull trout has been eliminated or access curtailed by elevated temperatures, low flows, channel fill and alteration, non-native aquatic vegetation, and low water quality (YSF&WPB 2004). Tributaries to the lower Yakima River suffer from lack of habitat diversity, lack of LWD, altered sediment composition, and low flows (YSF&WPB 2004). The middle-elevation portions of the Yakima Basin suffer from radical degradation of habitat and loss of habitat diversity (YSF&WPB 2004). In general, both the quality and amount of habitat has also diminished (YSF&WPB 2004). Access to tributaries may be blocked by diversions, culverts, low flows, or sedimentation (YSF&WPB 2004). The upper Yakima River mainstem is highly confined, lacks diversity of habitat, and suffers from highly altered flow regimes (YSF&WPB 2004). Road density has increased throughout the Basin (YSF&WPB 2004).

Channel Condition and Dynamics

The maintenance of river ecosystem integrity requires biophysical linkage in three dimensions–longitudinal, vertical, and horizontal. The sum of upstream influences determines, in part, the structure and function of downstream reaches. Similarly, groundwater connectivity and annual inundation of the flood plain maintains vertical and horizontal connectivity.

Reaches associated with alluvial flood plains have been shown to be centers of biological productivity and ecological diversity in gravel bed rivers (Stanford and Ward 1988, Independent Scientific Group 1996, Stanford *et al.* 1996, 2002). Properly functioning flood plain reaches extend the functional width of the river well beyond the main channel. In turn, these reaches contribute to: base flows; thermal moderation; nutrient cycling; and food web production. They also provide off-channel habitat for cold-water fish which are vital to sustain healthy populations in gravel bed river systems such as the Yakima (Snyder and Stanford 2001).

Properly functioning flood plains capture flood flows, decreasing downstream flood damage to instream and out-of-stream resources. As overbank flow spreads and slows down on the flood plain, a portion of the water infiltrates into permeable flood plain alluvium, reducing peak flows and storing in the shallow aquifer oxygenated, thermally moderate water that later contributes to baseflow. The alluvial aquifer system associated with flood plain reaches has been said to function "*as the flywheel on an engine,*" sustaining streamflow through times of little precipitation and runoff (Kinnison and Sceva, 1963). Temperature is the key environmental variable for salmonids and associated organisms. By storing floodwaters in subsurface alluvium, insulated from the thermal influences of atmospheric and solar heating, flood plains moderate river temperature, both through bulk cooling and by creating localized thermal refugia at groundwater discharge areas.

Among the myriad habitat attributes of these flood plain ecosystems, off-channel areas provide complex, diverse habitats for cold-water fishes. Flood flows form and maintain the channel network including side channels. In turn, side channels and sloughs provide a large area of edge habitat and slower water velocities favored by early salmonid life stages (Pringle *et al.* 1988, Naiman *et al.* 1988, Stanford and Ward 1993, Arscott *et al.* 2001). Spring brooks receiving discharging groundwater provide low velocity, thermally moderate, food rich habitat for juvenile fish. For salmonids in the Yakima River Basin, these side channel complexes can help to increase productivity, carrying capacity, and life history diversity by providing suitable habitat for all life stages in close physical proximity (Ring and Watson 1999, Snyder and Stanford 2001).

Many factors have led to the disconnection of alluvial flood plain reaches and the loss of off-channel habitat in the Yakima River Basin, including: (1) revetments that isolate side-channel habitat; (2) de-watering associated with agricultural practices; (3) chemical and thermal pollution; and (4) extensive gravel mining that has severed extensive groundwater connectivity

(Stanford *et al.* 2002). Channelization has had significant negative impact to the extent of floodplain connectivity that remains (YSF&WPB 2004).

Recent research conducted by the Geography and Land Studies Department at Central Washington University indicates that significant flood plain encroachment has occurred. Using aerial photography and GIS, the percentage loss of functional flood plain in five alluvial reaches was estimated (see Snyder and Stanford 2001) from the turn of the century to the present. The results indicate that, on average, 66 percent of these five alluvial reaches have been physically disconnected (Eitemiller *et al.* 2000). In the upper Yakima River Basin, an average of 60 percent of the floodplain has been lost and from 57 to 85 percent of the floodplain in the lower Yakima River has been lost (Snyder and Stanford 2001). Specifically, the Cle Elum reach has lost 77 percent, the Union Gap Reach has lost 82 percent, and the Wapato Reach has lost 95 percent (Braatne and Jamison 2001 in YSF&WPB 2004). These encroachments have eliminated or isolated vast areas of side channels and sloughs. However, almost half of the historic floodplain remains and is potentially subject to the effects of the action under consultation (Reclamation 2003). For example, an analysis of a 27.19 km (16.9 mi) section of the river reach from Easton Lake to the Cle Elum River confluence indicated that at least 10 spring brooks and backwater channels had been disconnected (Johnson 1994). This area is strongly affected by flow modification and flood control activities implemented annually under the Project (NPPC 2001). Currently, only 41 per cent of the historic floodplain remains functional (Eitemiller *et al.* 2000) and remains potentially affected by current project operations.

What little functional flood plain that remains has been, and continues to be, affected by current operations in the Yakima River Basin. Proper flood plain function requires an appropriate flow regime interacting with accessible flood plains. River operations for irrigation and flood control alter the natural hydrograph by impounding high flow events. A common effect of these operations is a sharp reduction in the frequency with which high flow events recharge the alluvial flood plain aquifer. Truncation of flood peaks by capture in reservoirs also reduces the duration, magnitude, and spatial extent of flood plain inundation. This not only alters the quantity, quality, and timing of groundwater discharge to the river but also diminishes the availability, extent, and temporal duration of off-channel habitats. An indirect effect of these operations exacerbates the problem, as the size of the regulatory flood plain is functionally decreased, encouraging further commercial and residential development on the flood plain.

Flood plain disconnection combined with flow regulation (i.e., the inversion and truncation of the natural hydrograph) have dramatically reduced river flood plain interactions. The result has been a significant loss of horizontal and vertical connectivity, severely diminished habitat heterogeneity through the loss of off-channel habitat, and a general loss of ecosystem function. For these reasons, flood plain connectivity and off-channel habitat are currently functioning at significantly impaired levels for bull trout in the Yakima River Basin, especially those bull trout found in the Upper Yakima River mainstem as well as over wintering or migrating bull trout in the lower Yakima mainstem.

Flow/Hydrology

The operation of dams in the Yakima River Basin has had a profound effect on the flow regimes of the rivers in the basin, has reduced fish habitat quality, and has resulted in salmonid mortality

(Snyder and Stanford 2001, NPPC 2001). The loss of gradual changes in flow has resulted in the loss of habitat diversity (YSF&WPB 2004). For instance, flow alteration has reduced the extent of riparian communities significantly (YSF&WPB 2004). Conversely, short-term changes in flows due to irrigation have altered the food web composition, channel dynamics, and sediment loads (YSF&WPB 2004). By providing false attractant flows, current operations have reduced the prey-base for bull trout by reducing anadromous salmonid populations (YSF&WPB 2004). Altered flows have also increased temperatures, reduced LWD, and diminished riparian corridors (YSF&WPB 2004). Below the storage reservoirs, habitat degradation associated with flow regulation has likely adversely impacted bull trout. Several features of the regulated hydrographs for various river reaches in the Yakima River Basin stand out as highly unnatural. With the exception of the upper Naches River (above the Tieton River confluence), the magnitude of flows resulting from rain-on-snow events and snow-melt runoff has been significantly reduced as water is stored. Conversely, the magnitude of flows during the peak of the irrigation season from July through mid-September is greatly elevated in some areas of the basin, particularly in the upper Yakima River arm. During this same time period the Yakima River below the Sunnyside Diversion Dam continues to experience regulated flows which are well below those which would occur naturally**.**

Flow regulation during this late summer/early fall period may be most problematic for bull trout in the Yakima River Basin. This is due primarily to the operational procedure known as "flip-flop." Pursuant to a 1980 decision of the Federal District Court for the Eastern District of Washington, the Yakima River Basin is operated to ensure incubating spring Chinook salmon eggs and alevins in the upper Yakima River are not dewatered. The Yakima, Cle Elum, and Tieton rivers are operated as a conduit to deliver irrigation water from April through mid-October. Through early September, most irrigation water is released from the reservoirs on the Yakima River side of the basin (Keechelus, Kachess, and Cle Elum) with only minimal releases from the reservoirs on the Naches River side (Rimrock and Bumping).

The extreme flow modification in the Keechelus Dam to Easton Diversion Dam reach, beginning in late June and extending through September, likely has had an adverse effect on bull trout survival and reproduction**.** From 1981 through 2002, regulated flows have averaged 682, 918, and 440 cfs for the months of July, August, and September, respectively (source: Reclamation, Yakima Field Office, Hydromet database). These flows are 3.7, 9.3, and 4.7 times the average estimated unregulated discharge for those months, respectively. From 1997 through 2002, the average daily flow in September (a month when bull trout would be staging to spawn or possibly spawning) declined considerably to 83 cfs, very close to the flow, which would occur under unregulated conditions (93 cfs). This was done to accommodate the increasing numbers of spring Chinook spawning in the reach. However, average daily flows during July and August strayed further from natural unregulated flows in these years with an average daily discharge of 992 cfs in July (809 cfs over the average daily estimated unregulated flow of 183 cfs from 1981-2001) and 977 cfs in August (878 cfs over the average daily estimated unregulated flow of 99 cfs from 1981-2001).

For many years, flows in this reach were arbitrarily reduced following the irrigation season. As recently as 1992 this reach experienced periods when no water was released from Keechelus Dam at all. Although this condition has not occurred since, as recently as water year (WY) (October through September each year) 1995, flows in January and March averaged just 15 cfs daily. Since WY 1999 winter conditions have improved considerably. The winter minimum flow is set by the Reclamation Field Office manager after SOAC has reconnoitered the reach and provides a recommendation. Since spawning flows have been provided in the neighborhood of 80-100 cfs, winter minimum flows have generally been kept at 70 cfs or higher. With flood control releases made in normal or wetter years and some natural inflow occurring, recent average winter flows, while still well below the unregulated condition (average daily flow between 200 and 472 cfs), are not considered nearly as problematic as the summer conditions.

On or near September 10, this release pattern is switched and late season irrigation demands are met primarily from Rimrock Reservoir on the Naches River side for about 40 days. The effect of this operation is the complete inversion of the flow regimes on both sides of the basin. The high flows in the upper Yakima River which have been maintained since July are reduced to levels very close to those which would occur under unregulated conditions. On the Cle Elum River, the change is more profound as flows drop an order of magnitude in the fall.

In the Tieton River, the effect is the opposite as flows increase four to five times over the level at which they were held much of the summer. At the end of the irrigation season, usually around October 20, the Project shifts emphasis to water storage and flows in the Tieton River are often reduced below 0.6 cubic meters per second (20 cfs). Flows are usually reduced on the Yakima River side of the basin as well, sometimes by as much as 50 percent, but they must remain adequate to protect spring Chinook redds. On either side of the basin these unstable and abnormal flow patterns have likely had a negative impact on fluvial bull trout. Successful spawning under these conditions would be unlikely in the upper Yakima, Cle Elum and Tieton Rivers. Habitat stability for other life stages of bull trout and for other resident fish species in the aquatic community, including prey species, may also be seriously compromised under current operating conditions.

Flow regulation has led to the disconnection of alluvial floodplain reaches and the loss of off-channel habitat in the Yakima River Basin. While much of the historic floodplain has been isolated from the river by diking (revetment), channelization, wetland draining, gravel mining, and highway and railroad building, the functional floodplain that remains has been, and continues to be, affected by Project operations. Proper floodplain function requires an appropriate flow regime interacting with accessible floodplains. River operations for irrigation and flood control alter the natural hydrograph by impounding high flow events. A common effect of these developments is a sharp reduction in the frequency with which these events recharge the alluvial floodplain aquifer. Truncation of flood peaks by capture in reservoirs also reduces the duration, magnitude, and spatial extent of floodplain inundation. This not only alters the quantity, quality, and timing of groundwater discharge to the river but also diminishes the availability, extent, and temporal duration of off-channel habitats. An indirect effect of these operations exacerbates the problem, as the size of the floodplain is functionally decreased, encouraging further commercial and residential development on the floodplain.

Disconnecting river channels from their flood plain habitats by flow regulation and/or revetment can compromise the ecological integrity of riverine ecosystems (Sedell *et al.* 1990, Stanford and Hauer 1992, Ward and Stanford 1995a). Altering the runoff regime under which streams developed can produce channel forms that are dissimilar to the natural condition (Leopold *et al.* 1964), which can have corresponding detrimental effects to the organisms that co-evolved within the same river system (Vannote *et al.* 1980, Wallace *et al.*1982, Minshall *et al.* 1983). Furthermore, disruptions in the longitudinal, vertical, and horizontal connectivity of river systems can also negatively impact nutrient cycling (e.g., overbank flooding that provides flood plain nutrients) such that aquatic and riparian species are detrimentally affected (Newbold *et al.* 1981, 1982; Green and Kauffman 1989; Gibert *et al.* 1994; Stanford *et al.* 1994; Fisher *et al.* 1998). Finally, three-dimensional connectivity in alluvial rivers is also vital to supporting hyporheic (sub-surface) habitats that support myriad biophysical processes such as driving primary productivity and moderating water temperatures (Stanford and Ward 1988, 1993).

Floodplain disconnection combined with flow regulation (*i.e*., the inversion and truncation of the natural hydrograph) have dramatically reduced river floodplain interactions. The result has been a significant loss of horizontal and vertical connectivity, severely diminished habitat heterogeneity through the loss of off-channel habitat, and a general loss of ecosystem function (Stanford *et al.* 2002).

Water withdrawals from streams by irrigation diversions within the basin contribute to low flow conditions in some streams (i.e. Manastash, Taneum, Naneum, Ahtanum, and Cowiche Creeks and the Tieton River), and seasonal dewatering of others. Seven mainstem irrigation diversion dams (Easton, Town Ditch, Wapato, Sunnyside, Prosser, YTID, and Horn Rapids) have contributed to altered flow regimes within the basin (Snyder and Stanford 2001). Low flows can inhibit spawning migrations for bull trout and resident fish species, and specifically result in the stranding of juvenile bull trout in Ahtanum and Rattlesnake Creeks and Teanaway River (E. Anderson, WDFW, 2002a, *pers. comm.*). As noted previously, all diversions in the Yakima River Basin are screened to NMFS standards (Jeff Thomas, USFWS, 2003, *pers. comm.*, Kale Gullett, NMFS, 2004 *pers. comm.*).

Watershed Conditions

Riparian ecosystems are transitional zones between the riverine and adjacent terrestrial environment. Accordingly, the structure and function of riparian zones are among the most diverse, dynamic, and complex of all terrestrial ecosystems (Gregory *et al.* 1991, Naiman *et al.* 1993, Naiman and Décamps 1997, Hedin *et al.* 1998, Lyon and Sagers 1998). Riparian zones regulate the flow of energy and materials between terrestrial and aquatic environments along the river continuum (Vannote *et al.* 1980, Naiman *et al.* 1993, Naiman and Décamps 1997). Healthy riparian vegetation serves many important roles in the ecological health of a river, including the production of LWD, stabilizing riverbanks, and interacting with and contributing to aquatic foodwebs (Karr and Schlosser 1978, Gregory *et al.* 1991, Stanford *et al.* 1996, Naiman and Décamps 1997). Additionally, riparian vegetation intercepts and stores energy from solar radiation, which directly influences (moderates) stream temperature and serves as an energy source (detrital inputs) for adjacent and downstream aquatic biota (Gregory *et al.* 1991, Tabacchi *et al.* 1998, Poole and Berman 2001).

Healthy stream bank conditions are vitally important to the aquatic ecosystem in general and especially to salmonid species, including bull trout and resident fish species. Eroded stream banks contribute fine sediments that cover or embed clean gravels and cobbles that are necessary for maintaining healthy aquatic invertebrate populations and successful salmonid reproduction. Stanford *et al.* (2002) reported that bank erosion represents an approximately 40-year supply of sediments for the average stream in Basin.

Loss of riparian function reduces nutrient and food availability, decreases LWD recruitment, and diminishes shading which helps to lower stream water temperatures. Healthy riparian areas contribute to the amount of LWD in streams, to channel dynamics, to nutrient loads and, therefore, to community structure, and to lower water temperature; these factors can have far-reaching effects both upstream and downstream (Bolton and Shellberg 2001). For instance, each of the above factors plays a significant role in water quality through a combination of effects on pollutants, sediments, temperature, or nutrients. In turn, water quality may affect the composition of the biotic community and, by changing it, affect the prey-base for bull trout and resident fish, either by directly influencing aquatic invertebrates or indirectly by affecting the food of the aquatic vertebrates on which bull trout and resident fish preys. Historically, it has been estimated that, prior to 1905, riparian corridors and habitat covered 2 percent of the land area in the Yakima Basin and that it has decreased to 0.5 percent currently (Quigley and Arbelbide 1997 *in* YSF&WPB 2004).

Effects from the Black Rock and Wymer Alternatives

As mentioned previously, the proposed action alternative entails the construction and operation of the Black Rock or Wymer reservoirs. Due to the scope and magnitude of modeling analyses associated with the proposed implementation of the action alternatives and lack of appropriate time to consider these analyses, the Service will provide a cursory discussion of effects resulting from these alternatives. However, it is surmised that the proposed action alternatives shall consist of some level of benefit derived from additional water storage. In general, these benefits are anticipated to include reservoir and instream management operations to move the Yakima River Basin flow regime towards a more normative condition for fisheries. The following describes the anticipated effects of implementing the proposed action alternatives on bull trout and resident fish in the Yakima River Basin.

Water Quality

Water quality, specifically water temperature in the lower mainstem River, is elevated as a result of modifications to the natural floodplain connectivity. The major determinants of water temperature are depth, air temperature, and solar energy input (YSF&WPB 2004). In general, after a certain threshold (ratio of surface area of the water/air interface to the surface area of the water/channel interface), a greater flow equates to a lower temperature whereas a lower flow equates to a greater temperature (YSF&WPB 2004). By reducing flows in the lower Yakima River mainstem, Reclamation’s operations increase the temperatures in the lower Yakima River below Parker to a state detrimental to bull trout (YSF&WPB 2004). Above Union Gap, temperatures remain cooler than historical records indicate but those in the Tieton and Naches Rivers are higher than historical temperatures (YSF&WPB 2004).

Implementation of the proposed Black Rock Reservoir or Wymer reservoirs could increase water quality by shifting flow operations in the Yakima River Basin towards a more normative condition for bull trout and resident fish. Depending on which reservoir is constructed and operated, water temperatures are anticipated to decrease with the higher availability of water for the life history strategies for bull trout and resident fish during the spring, summer, and winter periods. The most significant benefit in terms of water quality would likely occur in the Wapato Reach of the Yakima River where average temperatures are higher than normal. An increased availability of colder water is anticipated to decrease the frequency of warm-water resident fish species.

Overall, the Service anticipates the implementation of the proposed action alternatives to have a low risk of creating additional effects to bull trout and resident fish for this Matrix indicator (Table 6).

Habitat Access

Implementation of the Black Rock or Wymer action alternatives has the potential to impede migratory movements of resident fish juvenile migrants and spawners above and below associated reservoirs of the Yakima River Basin. Effects may include downstream entrainment through reservoir dams, impeded passage into spawning tributaries located above applicable reservoirs in addition to unintended consequences of pumping Columbia River water into the Yakima River Basin

Specifically, entrainment of resident fish juvenile migrants downstream through reservoirs of the Yakima River Basin is likely to continue with the implementation of the proposed action alternatives (James 2001 and James 2002). Reservoir operation levels in the Yakima River Basin are likely to change as evidenced by information provided to the Service by the Reclamation. As such, associated rates of inflow into reservoirs of the Yakima River Basin in tandem with the magnitude of flow releases from these reservoirs will continue to result in entrainment levels that would need to be addressed in the future. As mentioned previously in the discussion of effects associated with the no action alternative, entrainment of bull trout and other fish species in the unscreened outlet works of the storage dams in the Yakima River Basin often results in direct mortality or injury. At best, it results in permanent displacement of individual fish since none of these dams are equipped with upstream passage facilities.

Also, these additional effects resulting from the implementation of the action alternatives may be evident during the spawning migrations of bull trout. Bull trout typically spawn from August to November during periods of decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). Access to these types of spawning habitats may be confounded in the Yakima River Basin due to the proposed implementation of the Black Rock and Wymer action alternatives. The implementation of these proposed alternatives may alter the rates of fill and refill of reservoirs in the Yakima River Basin. These rates may not be conducive to facilitating bull trout spawning in the tributaries of these reservoirs.

Kachess, Keechelus, and Rimrock reservoirs in the Yakima River Basin serve as examples of how access to important spawning grounds for resident fish may be impeded due to the scope and nature of the proposed project operations inherent to the proposed Black Rock and Wymer action alternatives. Information presented in the Reclamation's Decision Support System is applicable to examining this issue.

This type of effect can also be analyzed in terms of the amount of inflow and surface acreage volume for these three respective reservoirs. Data sets related to reservoir outmigration which were gathered in the field and used in the YRDSS model were compared and appear to be applicable to this analysis (J. Thomas, USFWS, 2007, *pers. comm.*). For example, passage of bull trout in the upper tributaries of Kachess Reservoir begins to decrease once inflow decreases below 200 cubic feet per second when the reservoir contains 95,000 acre feet of water. Similarly, passage of bull trout into the Gold Creek tributary of the Keechelus Reservoir becomes impeded once inflow into the reservoir drops below 400 cfs at a storage volume of 43,000 acre feet. Finally, tributary passage for bull trout in Rimrock Reservoir becomes impeded once inflow into the reservoir drops below 50 cfs at a storage volume of 130,000 acre feet. Implementation of the action alternatives may coincide with these surface acreage volumes periodically during spawning migrations of bull trout in the aforementioned reservoirs.

However, the final modeling output for the YRDSS suggest that implementation of the action alternatives may present a low risk of effects to species such as bull trout. For example, the number of inseason days that tributaries of the Kachess and Keechelus reservoirs would be impassable for species such as bull trout and other resident fish species from July 15 to September 15 would decrease by 2.0% and 1.5%, respectively, when compared to baseline conditions with implementation of the Wymer only alternative. Similarly, the number of inseason days passage into tributaries of Rimrock Reservoir would be considered impassable from July 1 to August 15 is reduced by 74.6% with the implementation of this alternative. Implementation of the Wymer plus alternative also results in a significant reduction in the percentage of inseason days tributaries would be considered impassable at Kachess, Keechelus, and Rimrock reservoirs. Finally, the Black Rock alternative exhibits a similar pattern in terms of tributary passage at the Kachess and Rimrock reservoirs, however, the number of inseason days in which tributaries would be considered impassable is increased by 0.5%. In essence, it appears that these respective reservoirs, Kachess, Keechelus, and Rimrock, would have greater flexibility in maintaining critical water elevations, thereby enabling more water to be available in the late summer and early fall, timeframes in which bull trout spawning migrations occur in tributaries located above these respective reservoirs.

Finally, migratory behavior patterns of bull trout and resident fish may be altered due to a potential mixing of Columbia River water and Yakima River Basin water through future operations resulting from the proposed Black Rock or Wymer reservoirs. This mixing of water within the Yakima River Basin could alter the recovery of bull trout in addition to the abundance and distribution of other resident fish species by delaying spawning migrations to discrete habitat zones and, in essence, lowering reproductive fitness.

Overall, the Service considers the implementation of the proposed action alternatives to have a medium level risk of creating additional effects to bull trout and resident fish for this Matrix indicator (Table 5).

Habitat Elements

We expect the proposed action alternatives to modify the future timing, volume, and magnitude of sediment movement in the Yakima River Basin through modification of the magnitude and timing of river flows. Suspended sediment is a naturally variable phenomenon in riverine ecosystems, and increased concentrations above background levels are most strongly correlated with erosional processes and elevated discharge observed during spring runoff, or discrete precipitation events. Heavy loads of suspended sediments directly impact salmonids through their avoidance of impacted habitats, mortality (in extreme cases), a skewed distribution of prey species within the habitat, reduced feeding and growth, and reduced tolerance to disease (Waters

1995). We expect the effects of suspended sediment to be evident on bull trout feeding, rearing, or spawning between Keechelus Dam and Easton Diversion Dam during operations outside of the irrigation season when releases from Keechelus Dam are reduced. However, from July to mid-September, bull trout in the Yakima River will be subjected to increased stress and reduced feeding and growth as a result of heightened suspended sediment.

We also expect the proposed action alternatives to achieve natural levels of large woody debris (LWD) by increasing future recruitment from the floodplain below the storage dams. This increased density of LWD is likely to perpetuate a higher prey-base for the bull trout in the upper Yakima River by increasing available habitat for aquatic invertebrates and increasing channel complexity which, in turn, provides habitat for both bull trout and prey fish. A multitude of LWD also adds escape cover for young bull trout, which is likely to decrease predation and increase the availability of "resting" or sheltering areas. This, in turn, increases the efficiency with which bull trout use their available energy reserves as well as increases the foraging efficiency of adult bull trout.

Depending on which action alternative is implemented, it is anticipated that the implementation of such alternative will continue to modify future ecosystem processes to some degree within the Yakima River Basin. This modification would resemble a reduction in the utility of the mainstem Yakima River to adult migrants in all below-dam sub-populations as well as to rearing juveniles and spawners in the Yakima River sub-population. This reduction in habitat quality is likely to translate to lower numbers, a more restricted distribution, and depressed reproductive output when compared to unregulated conditions. The long duration of the proposed alternatives increases the likelihood that this sub-population will be subject to an adverse stochastic event. The degraded condition of this sub-population caused by the proposed action will reduce its ability to survive such an event.

Specifically, implementation of the proposed action alternatives may affect the amount of suitable habitat area for bull trout and resident rainbow trout, depending on a specific life-history stage for these species. The Service has determined, through the use of the Reclamation's Decision Support System instream habitat data for the Yakima River Basin, that redd scour depth, spawning and incubation habitat, fry habitat, sub-yearling habitat (spring/summer), sub-yearling habitat (winter), and sub-adult habitat are the most applicable resource categories in which to compare the proposed action alternatives for resident fish species, specifically bull trout and resident rainbow trout. To account for the fragmented nature of some data sets inherent to the YRDSS, we will limit our discussion to the Easton, Kittitas, and Naches reaches of the Yakima River.

Table 3 specifies the percent change in instream habitat function from baseline conditions for resource categories applicable to bull trout. Most notably, maximum redd scour depth for bull trout increases 90.8% in the Easton Reach for the Wymer Only alternative. The implementation of the Wymer Only alternative also results in an 18.0% decrease in spawning and incubation habitat for bull trout in the Naches Reach. A significant increase in maximum redd scour depth and a decrease in spawning and incubation habitat are also exhibited for the Wymer Plus Pumped Storage alternative in the Easton and Naches Reaches, respectively. Maximum redd scour depth is further extenuated in the Easton Reach (+226.7%) with the implementation of the Black Rock alternative, however, the spawning and incubation habitat components for bull trout are improved in the Naches Reach (+47.4%).

A comparison of resource categories inherent to resident rainbow trout is also presented in Table 4 for each of the action alternatives. Maximum redd scour depth and spawning and incubation habitat components, respectively, appear to represent the most significant change in comparison to baseline conditions in the Easton (+51.8%) and Naches (-17.6%) reaches for the Wymer Only alternative. This pattern is not as significant for the Wymer Plus Pumped Storage alternative, yet it is still evident in the Easton and Naches reaches as maximum redd scour depth is +39.6% and -10.7%. The Black Rock alternative appears to present more benefits to resident rainbow trout even though redd scour depth is still evident (+32.0%). Sub-yearling habitat (spring/summer) increase in the Easton (+10.6%) and Kittitas (+28.9%) reaches while spawning and incubation habitat is also increased in the Naches Reach (+12.9%)

In summary, many or all of the habitat elements above where we determined adverse impacts would occur, we note these impacts will result from the future operations and maintenance of the Black Rock or Wymer reservoirs and, therefore, are effects of the proposed implementation of the alternatives. Overall, the Service has determined the Black Rock alternative may represent a medium risk of creating additional effects to bull trout and resident fish for this Matrix indicator while the Wymer Only and Wymer Plus Pumped Storage alternative appear to represent a high risk of creating additional effects to bull trout and resident fish.

TABLE 3. Summary **of Yakima River Decision Support System (YRDSS) resource categories (% change from baseline conditions for bull trout for each alternative for the Easton, Kittitas, and Naches reaches of the Yakima River (*source*: Reclamation flow to habitat information).**

RESOURCE CATEGORY	**Easton**	**Kittitas**	**Naches**
Maximum Redd Scour Depth (ft.)			
Wymer Only	+90.8%	-3.0%	0.0%
Wymer Plus	+101.1%	-3.5%	+9.7%
Black Rock	+227.6%	-0.9%	+6.4%
Spawning/Incubation Habitat			
Wymer Only	-1.1%	-8.5%	-18.0
Wymer Plus	-1.2%	-7.7%	-13.9%
Black Rock	-4.4%	-8.5%	+47.4%
Fry Habitat			
Wymer Only	-0.1%	-2.1%	+0.2%
Wymer Plus	0.0%	-2.5%	+0.2%
Black Rock	+0.2%	-4.1%	-1.6%
Sub-Yearling Habitat (spring/summer)			
Wymer Only	+1.8%	-1.0%	0.0%
Wymer Plus	+4.3%	-1.4%	-0.3%
Black Rock	+6.9%	-1.0%	+0.4%

Sub-Yearling Habitat (winter)			
Wymer Only	+0.4%	-2.0%	+1.7%
Wymer Plus	+0.6%	-2.4%	+1.8
Black Rock	-5.8%	-2.1%	-0.1%

TABLE 4. **Summary of Yakima River Decision Support System (YRDSS) resource categories (% change from baseline conditions for resident rainbow trout for each alternative for the Easton, Kittitas, and Naches reaches of the Yakima River (*source*: Reclamation flow to habitat information)**.

RESOURCE CATEGORY	**Easton**	**Kittitas**	**Naches**
Maximum Redd Scour Depth (ft.)			
Wymer Only	+51.8%	+0.4%	+5.0%
Wymer Plus	+39.6%	+1.3%	+0.2%
Black Rock	+32%	-1.4%	-5.9%
Spawning/Incubation Habitat			
Wymer Only	-1.3%	-5.1%	-17.6
Wymer Plus	-0.8%	-2.2%	-10.7%
Black Rock	-6.5%	-8.1%	+12.9%
Fry Habitat			
Wymer Only	+5.5%	-2.4%	+0.4%
Wymer Plus	+6.2%	-3.3%	+0.5%
Black Rock	+7.0%	-3.9%	-0.8%
Sub-Yearling Habitat (spring/summer)			
Wymer Only	+1.2%	+1.8%	0.0%
Wymer Plus	+4.9%	+2.9%	+0.1%
Black Rock	+10.6%	+28.9%	+2.9%
Sub-Yearling Habitat (winter)			
Wymer Only	+0.6%	-3.1%	+1.3%
Wymer Plus	+0.9%	-3.2%	+1.0%
Black Rock	-0.7%	-3.9%	-1.7%
Sub-Adult Habitat			
Wymer Only	+3.3%	-2.4%	+1.2%
Wymer Plus	+5.3%	-2.9%	+1.9%
Black Rock	+2.9%	-3.4%	-1.9%

Channel Condition and Dynamics

The proposed action alternatives are anticipated to contribute positively towards increased floodplain connectivity below Yakima River Basin storage dams. The scope and magnitude of this contribution is not specifically known at this time in the upper Yakima River Basin. Due to the proximity of the proposed Black Rock and Wymer reservoirs and increased water availability for instream flows, it is anticipated that this contribution would be higher in the lower Yakima River Basin. However, the operations of Keechelus, Kachess, and Cle Elum Dams, located in the upper Yakima River Basin, will likely display some level of reduction in the frequency with which high flow events recharge the alluvial flood plain aquifer in the upper Yakima River. Truncation of flood peaks by capture in reservoirs reduces the duration, magnitude, and spatial extent of flood plain inundation. This not only alters the quantity, quality, and timing of groundwater discharge to the river but also diminishes the availability, extent, and temporal duration of off-channel habitats for bull trout and their trout prey. Among the myriad habitat attributes of these flood plain ecosystems, off-channel areas provide complex, diverse habitats for cold water fishes. Flood flows form and maintain the channel network including side channels. In turn, side channels and sloughs provide a large area of edge habitat and slower water velocities favored by early salmonid life stages (Pringle *et al.* 1988, Naiman *et al.* 1988, Stanford and Ward 1993, Arscott *et al.* 2001). Spring brooks receiving discharging groundwater provide low velocity, thermally moderate, food rich habitat for juvenile fish. For salmonids in the Yakima River Basin, these side channel complexes will likely help to increase productivity, carrying capacity, and life history diversity by providing suitable habitat for all life stages in close physical proximity (Ring and Watson 1999, Snyder and Stanford 2001).

Even though the proposed implementation of the Black Rock Reservoir or Wymer Reservoir would likely contribute to increased floodplain connectivity, disruptions in the longitudinal, vertical, and horizontal connectivity of river systems such as the Yakima River Basin would likely continue to result in reduced nutrient cycling so that the health of aquatic and riparian species are detrimentally affected (Newbold *et al.* 1981, 1982; Green and Kauffman 1989; Gibert *et al.* 1994; Stanford *et al.* 1994; Fisher *et al.* 1998). This three-dimensional connectivity in alluvial rivers is also vital to supporting hyporheic (sub-surface) habitats that support myriad biophysical processes such as driving primary productivity and moderating water temperatures (Stanford and Ward 1988, 1993).

Overall, the Service has determined the implementation of the action alternatives will represent a low risk of creating additional effects to bull trout and resident fish for this Matrix indicator based upon existing available information (Table 6).

Flow/Hydrology

In general, flow augmentation and associated changes in base and peaks flows in the Yakima River Basin would likely benefit some resident fish and less so for others, depending on species, life history stage, and timing. The anticipated flow increase associated with the proposed Black Rock and Wymer action alternatives could be expected to increase the supply of instream cover for most species. Bull trout would also be expected to benefit from the increased flow since migration through the Yakima River Basin would be easier, for the same reasons inherent to anadromous salmonids.

In general, instream hydrologic function in the Yakima River Basin has been negatively modified for species such as bull trout. This modification is a result of the Reclamation's current operations which entail changes in base and peak flows. The proposed action alternatives likely represent an improvement upon existing conditions due the availability of additional flows which strive to achieve a more normative state in the Yakima River Basin. However, the Service anticipates effects will continue to persist in the Yakima River due to the regulated state of this river system. The Service provides a discussion of how these effects may persist by comparing critical areas of occupancy for bull trout and other resident fish species against projected hydrology for the proposed action alternatives.

Even though the proposed Black Rock and Wymer action alternatives entail increased water availability and the ultimate goal of achieving normative conditions for fish resources, we expect that foraging bull trout as well as other species of resident fish are likely to be affected to some degree by the continuation of regulated flow regimes (i.e., changes in base and peak flows) under the proposed action alternatives due to inherent seasonal fluctuations in the availability of low-velocity lateral areas of the upper Yakima River that provide preferred habitat for prey species (Hoffman *et al.* 2000). The degree of effects will differ depending on the respective action alternative and reach of the Yakima River Basin (Table 5). While the proposed action alternatives serve as an improvement over existing conditions, the types of fluctuations resulting from these alternatives may continue to negatively impact aquatic invertebrate habitat. Studies have shown reductions in EPT (Ephemeroptera, Plecoptera, and Trichoptera) in the upper Yakima River Basin, both in flowing waters and groundwater discharge (Stanford and Gonser 1998). Reductions in aquatic invertebrate numbers and aquatic community structure were documented in the upper Yakima River Basin as well as in the lower Columbia Basin ecoregion (Cuffney *et al.* 1997). Both presence of EPT and total taxa richness were lower in the lower mainstem Yakima River, below the storage dams (Cuffney *et al.* 1997). Cuffney *et al.* 1997 noted that, in higher elevation streams and the mainstem Yakima (as far downstream as Ellensburg), aquatic communities were "in decline" and were "significantly impaired". Small bull trout rely heavily on invertebrate prey (largely EPT) and adult bull trout also feed on invertebrates (Judy Delavergne, USFWS, 2003, *pers. comm.*). A reduction in invertebrate numbers or diversity will also reduce the numbers of fish species that feed upon invertebrates, resulting in a depressed prey-base for adult bull trout.

Future operations and maintenance linked to the proposed Black Rock and Wymer action alternatives are likely to continue to affect bull trout distribution, numbers, and reproduction in the Yakima River sub-population by altering the natural hydrology and, in turn, altering the ecological composition and vital stream processes within the Yakima River Basin. Even though the ultimate goal is to produce a more normative flow condition in the Yakima River, the proposed action alternatives will likely to produce periodic unnatural flow regimes if they were to be implemented. These flow regimes inhibit ecosystem processes (Poff *et al.* 1997) and limit the availability of bull trout spawning, rearing, foraging, and over wintering habitat. Flows in the upper Yakima River were determined to be functioning at an unacceptable level of risk to bull trout (USFS 1999). Reclamation proposes to use the Black Rock or Wymer action alternatives to augment flow in the Yakima River Basin, which we expect will represent an improvement based upon existing conditions. This flow augmentation will likely improve available habitat to a designated level and, therefore, increase the likelihood that populations within and outside the Yakima River Basin will interchange genetic material, improving the likelihood of both survival and recovery.

Depending on the selection of the proposed action alternatives and finalized flow allocations in the Yakima River Basin (Table 5), we expect that regulated flows as a result of such alternative may assist in maintaining degraded spawning, rearing, foraging, and over-wintering habitat conditions in the 18.4 km (11.5 mile) reach of the upper Yakima River. Proposed operations and maintenance are also likely to affect bull trout by producing a flow regime that either improves or degrades migrating, rearing, foraging, and over wintering habitat within the 186.4 km **(**116.5) miles of stream from the confluence of the Naches and Yakima Rivers to the confluence of the Yakima and Columbia Rivers. As noted in the previous *Habitat Elements* discussion, some of these habitat components may be improved or degraded depending on the action alternative being analyzed. The lower mainstem Yakima River is likely used by fluvial bull trout from the upper Yakima River and Naches River as winter rearing and foraging habitat (Judy Delavergne, USFWS, 2003, *pers. comm.*, Jeff Thomas, USFWS, 2003a, *pers. comm.*). Bull trout are regularly captured in the Yakima-Klickitat Fisheries Project (YKFP) spring Chinook brood stock collection facility at Roza Diversion Dam (RM 128) (Mark Johnston, Yakama Nation, 2003 *pers. comm.*) and have been reported as far downstream as Benton City (RM 34) (Reclamation 2000). Migration of bull trout throughout the lower Yakima River is feasible. Radio-tagged bull trout have migrated from the Methow River into the Entiat River and subsequently into the Wenatchee River via the Columbia River, a distance of several hundred miles in the course of two years (Judy Delavergne, USFWS, 2003, *pers. comm.)* Flow regulation as the result of flood control operations and irrigation water delivery has severely degraded, and continues to degrade, habitat in the lower mainstem Yakima River. If normative conditions for fish resources are achieved through the implementation of the proposed Black Rock or Wymer reservoirs, these conditions are likely to change for bull trout as well as other resident fish. However, the benefits of an increase in available water is likely to be more evident in the lower Yakima reaches rather than the upper reaches based upon forecasted flow regimes (Table 5) where abundant species such as resident rainbow trout and other resident fish species are present.

Due to the importance of the upper Yakima River Basin and other discrete areas throughout the basin for bull trout, it is appropriate to discuss potential flow-related impacts to this species resulting from the implementation of the proposed action alternatives. However, the Service does not discount the importance of these areas for other resident fish species. Reclamation's projected hydrographs for the Easton, Cle Elum, Umtanum, Parker, and Lower Naches reaches of the basin provide further insight into the effects of the proposed action alternatives.

Specifically, the uppermost reach of the Yakima River, commonly referred to as the Easton Reach, is approximately 18.4 km (11.5 miles) in length and is the only documented spawning area for the local bull trout population inhabiting the mainstem Yakima River. Flows in the reach are primarily provided by releases from Keechelus Dam with some natural accretion occurring in the Crystal Springs area about 1.6 km (1 mile) below the dam, at Stampede Creek about half way through the reach, and at Cabin Creek about 3.2 km (2 miles) from Easton. Currently, the regulated flow regime for the reach is highly altered from that which would occur naturally**.** It is anticipated that the proposed alternatives will attempt to lessen the impact of the current instream flow regime. Currently, the extreme modification beginning in late June and extending through September undoubtedly has an adverse effect on bull trout survival and reproduction. These abnormally high flows in July and August require juveniles to take refuge to avoid downstream displacement. Secondly, young bull trout do not have the swimming ability to feed effectively in these high water velocities that result and thus cannot meet their nutritional requirements to grow and survive the rigors which winter presents. Instead of building fat-reserves, juvenile bull trout must expend more energy fighting flows and less time foraging. This reduces the likelihood of overwinter survival and, therefore, reduces bull trout numbers. Thirdly, the rapid decline of flows in September likely disrupts adult bull trout staging to spawn and increases the likelihood that juveniles will be stranded in isolated pools and side channels. However, based upon existing information provided to the Service in the form of projected hydrographs for the action alternatives in the Easton Reach, it is anticipated that flow/hydrology impacts will not differ significantly from baseline conditions with the exception of decreased summer flow for all action alternatives (Table 5).

Another problem with the regulated flow regime in the Easton reach is winter flows which are much lower than would occur under natural conditions. Managed winter flows are lower with less natural fluctuation than unregulated flows in the Yakima River from Easton Diversion Dam to the Cle Elum River. Until recently (up to the mid-1990's), it was common for Reclamation to reduce spawning flows by 50 percent in late October under the assumption that this would protect incubating spring Chinook eggs. Beginning in the late 1990's Reclamation realized that a 50 percent reduction was excessive and leaving more water in the reach following spawning not only protected the eggs but also kept side-channels connected and maintained habitat complexity. Occasionally, Reclamation has made no flow reduction at all and when they did reduce the flows, it was generally in the neighborhood of a 15-20 percent. In general, the winter flow regime in this reach has improved in recent years and anticipated to remain the same over existing conditions with the implementation of the proposed alternative since additional water would be available for Reclamation operations (Table 5).

The projected hydrographs for the Cle Elum, Umtanum, Parker, and Lower Naches reaches of the Yakima River Basin also contribute to this discussion of flow/hydrology effects in relation to the proposed implementation of the action alternatives. The hydrology for these reaches appears to be significantly different in comparison to the hydrology projected for the Easton Reach.

Available hydrograph information shows us that summer flows would decrease for the Cle Elum Reach for all proposed action alternatives and spring flows would increase significantly for the Black Rock alternative only (Table 5). In general, winter flows would increase in comparison to baseline conditions for all action alternatives in this reach. The Umtanum Reach displays a similar projected hydrograph with the exception spring flows would increase for all proposed action alternatives. Considering that projected spring flows in these reaches are much lower than unregulated flows, this has long-term implications for channel morphology and downstream effects, as floodplains are no longer seasonally inundated to the extent they once were. However, in terms of direct effects on early life history stages of bull trout and other resident fish, the lower spring flows will likely not result in worse mainstem habitat conditions. Fry just emerging from the gravel at this time likely benefit from lower water velocities. Since projected summer flows are higher than those for an unregulated state in these respective reaches, it is anticipated that all action alternatives will not create additive hydrologic effects to resident fish species. Higher winter flows will also ensure a high level of incubation protection for bull trout and other resident fish species such as rainbow trout and cutthroat trout.

As one progresses downstream through the Yakima River Basin, projected hydrographs change depending on the proposed action alternative and reach of the Yakima River being discussed. Consistency is noted in that spring and summer flows increase for all proposed action alternatives in the Parker Reach, however, spring flows for the Wymer Only alternative would decrease in this reach (Table 5). Winter flows only increase significantly for the Black Rock alternative in the Parker Reach. Since the aforementioned spring flows do not approach an unregulated state in this reach, we anticipate persistent effects to hydrologic function in this reach will be evident. However, it is anticipated that the proposed action alternatives will not result in further degradation of hydrologic function for rainbow trout and cutthroat trout in this reach for summer and winter flows.

Finally, the Lower Naches Reach exhibits a pattern of increased spring flows which do not approach an unregulated state for all proposed action alternatives (Table 5). As discussed previously, spring flows which do not approach an unregulated state impair channel morphology and floodplain dynamics. The proposed action alternatives also display a consistent pattern of decreasing projected summer flows in this reach. In essence, projected winter flows do not significantly increase above baseline conditions. Overall, the projected flows in this reach are anticipated to maintain current hydrologic function for resident rainbow trout and abundant cutthroat trout.

Given the complex nature of current flow regimes in the Yakima River Basin and their associated effects, it is anticipated that the proposed implementation of the action alternatives will represent a medium risk in creating additional effects to bull trout and resident fish for this Matrix indicator (Table 6).

TABLE 5. Average flows (cubic feet per second) resulting from the implementation of the proposed alternatives in the Easton, Cle Elum, Umtanum, Parker, and Lower Naches reaches of the Yakima River (source: Reclamation preliminary hydrology information).

	FLOW (cubic feet per second)		
	Spring (March-June)	***Summer*** (July-October)	***Winter*** (November-February)
Easton Reach			
No Action	350	279	283
Wymer Only	349	220	280
Wymer Plus Exchange	354	220	280
Black Rock	423	220	287
Cle Elum			
No Action	845	1551	220
Wymer Only	768	1326	391
Wymer Plus Exchange	775	1246	391
Black Rock	992	1169	400

Umtanum Reach			
No Action	1924	2527	1178
Wymer Only	2564	2270	1338
Wymer Plus Exchange	2069	2156	1339
Black Rock	2840	1935	1355
Parker			
No Action	1874	527	2059
Wymer Only	1825	673	2011
Wymer Plus Exchange	2766	1495	2034
Black Rock	3704	1309	2214
Lower Naches			
No Action	1914	967	622
Wymer only	1922	958	626
Wymer plus exchange	1923	891	643
Black Rock	1973	819	635

Watershed Conditions

We expect the proposed implementation of the Black Rock or Wymer action alternatives to represent an improvement in habitat complexity when compared to existing degraded riparian zones by including a goal of a normative flow regime that facilitates the development and maintenance of riparian habitat. Riparian habitat provides critical connectivity between upland and aquatic habitats for plant and animal species (Mosconi and Hutto 1982, Gregory *et al.* 1991, Knopf and Samson 1994). Vegetative overhang provides fish food (in the form of detritus) and cover, and shades the water from solar radiation (Naiman and Décamps 1997). Loss of riparian function reduces nutrient and food availability, decreases LWD recruitment, and diminishes shading which helps to lower stream water temperatures. Healthy riparian areas contribute to the amount of LWD in streams, to channel dynamics, to nutrient loads and, therefore, to community structure, and to lower water temperature; these factors will likely have far-reaching effects both upstream and downstream (Bolton and Shellberg 2001). For instance, each of the above factors plays a significant role in water quality through a combination of effects on pollutants, sediments, temperature, or nutrients. In turn, water quality will likely affect the composition of the biotic community and, by changing it, affect the prey-base of bull trout and other resident fish species, either by directly influencing aquatic invertebrates or indirectly by affecting the food of the aquatic vertebrates on which bull trout and resident fish prey.

In summary, the impacts to watershed conditions we have described above are hypothesized to be less severe with the implementation of either the Black Rock or Wymer action alternatives, hence a low risk of creating additional effects to bull trout and resident fish for this Matrix indicator (Table 6).

TABLE 6. Overall evaluation of matrix indicators for the No Action, Black Rock, and Wymer alternatives using a high (H), medium (M), and low (L) scale for determining level of additional effects to bull trout and resident fish. All evaluations are qualitative.

PROJECT ALTERNATIVE	***Pathway Indicators***					
	Water Quality	Habitat Access	Habitat Elements	Channel Condition and Dynamics	Flow/ hydrology	Watershed Conditions
No Action	L	L	L	L	L	L
Wymer Only	L	M	H	L	M	L
Wymer Plus Exchange	L	M	H	L	M	L
Black Rock	L	M	M	L	M	L

III-2) Wildlife

Implementation of the three action alternatives would affect numerous species of wildlife and their habitats. Anticipated adverse effects would result from the loss of habitat, fragmentation and degradation of remaining habitat, barriers to wildlife movement and migration, and introduction of exotic and invasive species. Conversely, implementation of the action alternatives would likely benefit waterfowl and shorebirds by increasing open water habitat.

Specific examples of wildlife species that would be adversely affected by implementation of the three action alternatives include the Brewer's sparrow (see section II-5 below), sage sparrow, greater sage grouse (see section III-6), and loggerhead shrikes. Sage sparrows are closely associated with sagebrush-steppe plant communities (Braun et al. 1976, Wiens and Rotenberry 1981). Sage sparrows are sensitive to fragmentation of sage cover and are found more frequently in extensive areas of continuous sage (Knick and Rotenberry 1995, Vander Haegen et al. 2000). Availability of extensive sagebrush-steppe habitat is the primary factor limiting sage sparrow populations (Martin and Carlson 1998, Vander Haegen et al. 2000). This would indicate that implementation of any of the three action alternatives could have a negative affect on sage sparrow populations in the Affected Area. The loggerhead shrike is a Washington state candidate species that has shown decreases in population from historical densities and distribution (Morrison 1981, Fraser and Luukkonen 1986, Sauer et al. 1995, Case and Woods 1997). Loss of shrub-steppe habitat partially explains local declines of this species (Cade and Woods 1997). Management recommendations from the Washington Department of Fish and Wildlife have included leaving shrub-steppe communities reasonably undisturbed and minimizing fragmentation of these habitats (WDFW 2003). Implementation of any of the three of the storage alternatives would cause the loss and fragmentation of existing shrub-steppe communities, which would have a negative affect on loggerhead shrike populations in the Affected Area.

Large bodies of water may affect wildlife movement, particularly for big game species. Migration routes may be altered, therefore increasing migration distance and timing. In some situations, a body of water becomes a barrier that could prevent seasonal migration short of traditional wintering, breeding or summer grounds.

a) Black Rock Reservoir Alternative

Creation of a reservoir at the Black Rock site would inundate a large area of existing wildlife habitat, including approximately 3,539 acres of shrub-steppe habitat. In total, there are currently 8,657 acres combined of shrub-steppe, grassland, Conservation Reserve Program lands, riparian, cliff/canyon and agricultural lands that provide at least some value as wildlife habitat. Developed lands have little to no value, and were not considered here. These habitats would be partly or completely lost once the dam is completed and the reservoir and water conveyance system become operational. The Black Rock valley is an important corridor for greater sage grouse movement. Sage grouse typically need larger tracks of shrub-steppe and related habitats for movement and survival, which would be greatly reduced by creation of the reservoir. This area also provides important nesting habitat for burrowing owls, short-eared owls and long-billed curlews, that would be lost if the reservoir is constructed. Other species of wildlife known to utilize the existing habitats within this area that would be negatively impacted by the creation of this reservoir include Brewer's sparrows, black-tailed jackrabbits, white-tailed jackrabbits, Townsend's ground squirrels, mule deer, prairie falcons, golden eagles, and ferruginous hawks (Livingston, WDFW, pers. comm. 2007). Indirect impacts to these wildlife species may also occur in the areas adjacent to the reservoir from development, recreation and reservoir or dam operation and maintenance activities.

Elk and mule deer spend some time within the Affected Area associated with the Black Rock Reservoir site, but are generally moving between higher elevation habitats located to the north and south. Creation of Black Rock Reservoir, due to its large size may cause mule deer and elk to travel around the reservoir or possibly short stop their movement. The overall effect on mule deer and elk populations within the Affected Area from altering movement is uncertain. Presently, however, the lack of water within the Black Rock Valley is a potential limiting factor for mule deer populations in the area (Livingston, WDFW, pers. comm. 2007). Creation of the reservoir at this site could have a positive impact on the mule deer population in the immediate area.

b) Wymer Reservoir Alternative

Creation of a reservoir at the Wymer site would inundate a large area of existing wildlife habitat, including 1,055 acres of shrub-steppe habitat. There are currently 1,392 acres combined of shrub-steppe, grassland, riparian, cliff/canyon, wetland/closed depression and agricultural lands that provide at least some value as wildlife habitat. These habitats would be completely lost once the reservoir is in place. Ferruginous hawks and golden eagles have been known to nest within the footprint area of the potential Wymer Reservoir. This nesting habitat would be lost if the reservoir were to be constructed. Other species of wildlife known to utilize the habitats within the potential Wymer footprint, that would be negatively impacted, include bighorn sheep (*Ovis canadensis*) , mule deer, coyotes, Brewer's sparrows, greater sage grouse, sage sparrows, chukars (*Alectoris chukar*) and red-tailed hawks.

Mule deer and bighorn sheep utilize the area associated with the Wymer Reservoir site and surrounding disturbance buffer. WDFW (2006) identified the Wymer area as wintering and core habitat for bighorn sheep, and core habitat for mule deer. The construction of a reservoir on this site could eliminate or severely reduce this habitat. The creation of the Wymer Reservoir would affect mule deer and bighorn sheep movement, and possibly alter their migration patterns.

c) Wymer Reservoir with Pump Exchange Alternative

The Potential effects to wildlife with the implementation of the Wymer Reservoir (with pump exchange) alternative would be similar to those listed above, with some additional effects from the pump exchange system. The physical location of the pipeline that would convey water from near the mouth of the Yakima River, along with the associated pumping stations, could create a barrier to wildlife movement, and could lead to the fragmentation or degradation of wildlife habitat within its corridor.

d) No Action Alternative

There would be no direct effects to wildlife if the no action alternative were to be selected. Benefits to wildlife would include; continued restoration and enhancement activities, carried out by several agencies. Large tracts of shrub-steppe would be left available for greater sage grouse movement and use, as well as several other species of wildlife. No barriers to bighorn, mule deer and elk would be created as a result of the no action alternative. Continued water conservation measures, as identified in the Yakima River Basin Water Enhancement Program, could benefit various species of wildlife, by providing more water to the basin.

III-3) <u>Riparian and Wetland Resources</u>

As part of the Interagency Acquisition with Reclamation, the Service was tasked with evaluating the impacts on wetland distribution within the Yakima Basin based on implementation of the action alternatives, i.e.; Black Rock Reservoir, Wymer Reservoir, and Wymer Reservoir with pump exchange (Reclamation 2007a). A discussion of riparian and wetland resources in the Affected Area can be found in section III-3&4, above. Reclamation provided the Service with four target flow analyses that show the effect of the *"Black Rock, Wymer, Wymer Plus and No Action"* alternatives on flows and the hydrograph in four different stream reaches (Cle Elum, Wapato, Easton, and Umtanum) under *"dry, wet and average"* water years. Two of these stream reaches are located in the Affected Area: Cle Elum and Wapato (Reclamation 2007b). Additional water would augment water stored at the proposed reservoirs from the release of water at various Reclamation operated storage reservoirs upstream from the Affected Area. From a fish and wildlife perspective, the best flow scenario would be one that mimics the natural (unregulated hydrograph), however that is not an alternative under consideration by Reclamation.

a) Black Rock Reservoir Alternative

During an average water year, water releases associated with the proposed Black Rock alternative would increase flow and availability of water in the Yakima River (Wapato reach) during the mid-summer growing season. In some cases this would double or triple the flows available under existing operations, but not reaching the peak flows that occurred under the natural hydrograph. This flow scenario would probably result in the redistribution and a slight or moderate increase in area of PEM and PSS wetlands in the Wapato reach. There would be a minimal benefit to PFO class wetlands with the flow scenarios associated with the Black Rock alternative. Higher up in the Basin, in the Cle Elum reach, releases from Lake Cle Elum would be reduced under this alternative reducing scour of wetlands during the mid-summer growing season. PSS and PEM class wetlands would probably benefit from the implementation of this alternative (Reclamation 2007b).

The 0.9 acres of palustrine (POWHH) wetlands would be inundated by the proposed reservoir and permanently lost as habitat (Davidson et al. 2007). Seepage from Black Rock Reservoir and dam would provide subsurface and possible surface flows that would likely create a wetland plant community in the presently intermittent Dry Creek downstream from the dam. If not managed specifically for wildlife habitat (i.e. to provide a plant community with native plant species) this area will likely attract invasive plant species such as (*Elaeagnus angustifolia*) Russian olive and other non-native wetland vegetation with minimal habitat value. Fluctuation in the water level in Black Rock Reservoir would not be conducive to growth of water dependent shoreline plant community. Thus, no viable lacustrine habitat value can be expected around the perimeter of the reservoir.

b) Wymer Reservoir Alternative

Under the Wymer Reservoir alternative, flows in the Wapato reach would continue as under existing conditions. PEM and PSS class wetlands would not be affected, however, the degradation of PFO wetlands would continue due to the continuing lack of cottonwood recruitment. Eighty-three acres of palustrine (unclassified) wetlands would be inundated by the reservoir and permanently lost as habitat (Davidson et al. 2007). Seepage from Wymer Reservoir and dam would provide subsurface and possible surface flows that would likely expand the riparian and wetland plant community in Lmuma Creek downstream from the dam. If not managed specifically for wildlife habitat, i.e. to provide a plant community with native plant species, this area will likely attract invasive plant species such as Russian olive and other non-native wetland plants with minimal habitat value. Fluctuation in the water level in Wymer Reservoir would not be conducive to the growth of water dependent shoreline plant community. Thus, no viable lacustrine fringe habitat value can be expected around the perimeter of the reservoir, without the implementation of measures discussed in section IV, below.

c) Wymer Reservoir with Pump Exchange Alternative

Under the Wymer Reservoir with pump exchange alternative, up to twice the existing flow would be available during part of the growing season. This flow scenario would probably result in the redistribution and a slight increase in area of PEM and PSS wetlands in the Wapato reach. Similar to the Wymer Reservoir (without pump exchange alternative), 83 acres of palustrine (unclassified) wetlands would be inundated by the reservoir and lost (Davidson et al. 2007). Seepage from Wymer Reservoir and dam would provide subsurface and possible surface flows that would likely expand the riparian and wetland plant community in Lmuma Creek downstream from the dam. If not managed specifically for wildlife habitat (i.e. to provide a plant community with native plant species), this area will likely attract invasive plant species such as Russian olive and other non-native wetland plants not suitable for high value wildlife habitat. At present, overgrazing by livestock is the most detrimental effect to the riparian plant community. Fluctuation in the water level in Wymer Reservoir would not be conducive to the growth of water dependent shoreline plant community. Thus, no viable fringe habitat value can be expected around the perimeter of the reservoir, without the implementation of measures discussed in section IV, below.

d) No Action Alternative

In the event that this alternative is selected, water conservation measures would continue to be researched and implemented as part of the Yakima River Basin Water Enhancement Project authorized by Congress with Public Law 96-162 on December 28, 1979 (Reclamation 1996a). Water conservation measures may have a negative impact on existing wetlands in the Affected Area because as water delivery systems are made to be more efficient, wetlands that have been created by seepage from existing delivery systems would likely be reduced, or dry up all together. The riparian wetland plant community and associated habitat at the Wymer Reservoir site could be restored with the adoption of a reasonable mitigation effort. For example, livestock could be excluded from wetland areas to allow vegetation to regenerate naturally. In addition, native trees, shrubs, forbs, and grass could be planted if needed to facilitate restoration of wetlands in this area.

TABLE 7. Effects to Wetlands at Black Rock and Wymer Reservoir Sites

Wetland class (in acres)	Black Rock	Wymer	Wymer w/ Pump	No Action
PEM	unknown	unknown	unknown	No effect
PFO	unknown	unknown	unknown	No effect
PSS	unknown	unknown	unknown	No effect
Palustrine- (unclassified)	0.9 acres	83 acres	83 acres	No effect

TABLE 8. Effects to Wetlands in the Yakima River Floodplain

Wetland Class	Black Rock	Wymer	Wymer w/ Pump	No Action[18]
PEM	Moderate benefit	Moderate benefit	Moderate benefit	Moderate benefit
PFO	Minimal benefit	Minimal benefit	Minimal benefit	Minimal benefit
PSS	Moderate benefit	Moderate benefit	Moderate benefit	Moderate benefit

[18] The Service anticipates that if the No Action alternative is selected, then Reclamation will proceed with water conservation measures.

III-4) <u>Shrub-steppe</u>

It has been estimated that only 40% (4.2 million acres) remains of the roughly 10.4 million acres of shrub-steppe that existed in Washington State prior to the 1850s (Yakima Subbasin Plan 2004). In the Yakima Basin, maps indicate there has been a ~25% reduction in shrub-steppe habitat. Much of the remaining 75% is in the form of small, isolated parcels that are not useful to many shrub-steppe dependent species. Much of the remaining intact shrub-steppe habitat is degraded. The most significant cause of loss of this habitat is the large-scale conversion to agriculture which resulted from the modification of the historic hydrograph after the creation of the Yakima Basin Irrigation Projects. Other significant problems are invasive, alien plant species that compete with native plants, and large scale wildfires. Residential and urban development is a more recent cause of continued loss. The viability of remaining shrub-steppe is increasingly threatened by stresses to the ecosystem. These stresses include: 1) reduced plant diversity, 2) reduced extent and diversity of the microbiotic crust, 3) increase, decline or loss of shrubs, 4) reduced faunal diversity, and 5) isolation of species populations. Some of the sources of these stresses include increased fragmentation, invasive species encroachment, and altered fire regimes.

a) Black Rock Reservoir Alternative

The construction of a dam and the subsequent creation of a reservoir in the Black Rock Valley, along with construction of pumping facilities, pipe lines, State Highway 24 realignment, other related structures, and associated recreational development would have direct and indirect negative impacts to shrub-steppe habitat. Direct negative impacts that could be expected include loss of shrub-steppe, and fragmentation of remaining habitat. Indirect negative impacts include degradation of remaining habitat through introduction of non-native invasive plants, increased development in the areas adjacent to the proposed reservoir, increased fire danger, and the formation of barriers (e.g., large bodies of water and pipelines) that impede wildlife movement.

Currently, within what would be the footprint of the Black Rock Reservoir, there is approximately 3,539 acres of shrub-steppe, 113 acres of associated grasslands, 3771 acres of lands that have been put into the Conservation Reserve Program (CRP), which mostly consist of planted native bunchgrasses (i.e. crested wheatgrass, blue-bunch wheatgrass, etc…), 1,226 acres of agricultural/crop lands, 113 acres of developed lands and a few acres of other habitats (Davidson et al. 2007). To analyze potential effects of the alternatives, a cursory Habitat Evaluation Procedure (HEP) was performed for each potential reservoir site. HEP utilizes Habitat Units (HUs) as the currency for addressing ecological losses or gains associated with any project development and implementation. HUs for a given species are the product of habitat quantity (acres) and habitat quality estimates. Habitat quality estimates are provided by a Habitat Suitability Index (HSI). HSI values range from 0.0 to 1.0 and are a projection of a given habitat parcel’s ability to provide the life requisites of a given species. An HSI = 1.0 indicates essentially optimum habitat condition for the species in question. HSI values for a given species are determined on the basis of quantifiable habitat features (e.g., vegetation height, tree canopy cover, distance to water) which are known to be required for the success of that species. These HSI relationships are usually found in published HEP models (Bich et al. 1991). After conducting a HEP using Brewer’s sparrow as a model, it was determined that 1692 habitat units for the sparrow would be completely lost in the footprint of the reservoir and dam. It could be assumed, based on the GAP landcover data that Brewer's sparrow habitat of similar quality would be lost, fragmented or undergo degradation in the surrounding area within 0.31 miles (0.5 kilometers). The Brewer's sparrow typically needs shrub-steppe habitat blocks at least 0.46 acres (0.2 hectares) in size for breeding and nesting, and has shown population declines in areas of large scale reduction and fragmentation of sagebrush habitats (Nature Conservancy 1999). The HEP conducted for the Black Rock site is fully described in Appendix B.

b. Wymer Reservoir Alternative

The construction of a dam and the subsequent creation of a reservoir in the Lmuma Creek drainage, along with construction of pump houses, pipe lines and other related facilities, would have direct and indirect negative impacts to shrub-steppe habitat. Direct negative impacts that could be expected include loss of shrub-steppe, and fragmentation of remaining habitat. Indirect negative impacts include degradation of remaining habitat through introduction of non-native invasive plants, increased development in the areas adjacent to the proposed reservoir, increased fire danger, and the formation of barriers to wildlife movement. Currently, within the proposed footprint of the what would be the Wymer Reservoir, there are 1,055 acres of shrub-steppe habitat, 167 acres of grassland habitat, 62 acres that are considered barren, 50 acres of riparian habitat, 30 acres of cliff/canyon, 11 acres of crop/agriculture, 7 acres of developed land, 6 acres identified as forest habitat and 4 acres of wetland/closed depression habitat (Davidson et al. 2007). After conducting a Habitat Evaluation Procedure (HEP) using Brewer's sparrow as a model, it was determined that 378 habitat units for the sparro would be completely lost in the footprint of the reservoir and dam. It could be assumed, based on the GAP landcover data that Brewer's sparrow habitat of similar quality would be lost, fragmented or undergo degradation in the surrounding area within 0.31 miles (0.5 kilometers). The HEP conducted for the Wymer site is fully described in Appendix C.

c. Wymer Alternative with Pump Exchange Alternative

Depending on the physical location of the pump exchange system, including the pumping facility and pipelines, the effects to shrub-steppe should be similar to those listed in the Wymer Reservoir only alternative.

d. No Action Alternative

In the absence of the storage alternatives, no shrub-steppe habitat would be lost as a direct result of the no action alternative. Without the creation of the reservoirs, lands in these areas could possibly be candidates for restoration, protection, and enhancement of shrub-steppe habitats. A memorandum of understanding currently exists between federal and state agencies, as well as private conservation groups, whose purpose is to establish and describe a partnership that is dedicated to conserve the shrub-steppe/rangeland landscape in Benton, Yakima, Grant, and Kittitas Counties. Both the Black Rock and Wymer footprints fall within these counties. Partnerships such as this would have the ability to work with land owners in each area to protect existing shrub-steppe habitat, and restore areas that were historically shrub-steppe habitat. Within the Black Rock footprint and buffer there is currently 6,591 acres classified as shrub-steppe, which could be protected from future development or degradation. There is 5,059 acres of grassland and CRP that are mostly native bunch grasses, a key component of shrub-steppe habitat. These areas could be looked at for restoration to historic habitat types. Within the Wymer footprint and buffer area, there is 3,634 acres of shrub-steppe habitat that could be protected. There is 996 acres of grasslands that could be enhanced or restored into shrub-steppe habitat. Currently, grazing occurs within most of the Wymer footprint and buffer, which could lead to degradation of shrub-steppe habitat.

III-5) <u>Federally Listed Threatened and Endangered Species, Candidate Species and Species of Concern</u>.

In general, the creation of an open water body such as a reservoir may provide suitable foraging habitat for bald eagles, provided that other habitat components are present, such as perch sites. Reservoirs are habitat for fish and waterfowl which are the primary prey for bald eagles. Waterfowl would be attracted to a new reservoir and fish populations could be established through transplant programs. Perch sites adjacent to bald eagle foraging areas are important habitat components. They facilitate bald eagle foraging activities and allow full utilization of the habitat. Presently there are no perch sites available in the Black Rock area and only limited trees and snags in the Wymer area. There are opportunities in the short and long term to develop and provide bald eagle perches within the Black Rock and Wymer areas. Artificial poles could be installed and trees could be planted adjacent to reservoir to enhance yearlong foraging habitat. The habitat within Black Rock and Wymer areas is presently not suitable for bald eagle nesting. There are no large trees or snags adjacent to or within viewing distance of the reservoir. There may be opportunities in the long term to develop bald eagle nesting habitat by establishing stands of cottonwood trees adjacent to the reservoir.

<u>Ute ladies' tresses</u>: There are no known populations of Ute ladies' tresses in the Affected Area. A plant survey should be conducted to determine the presence of this species at the Wymer Reservoir site.

<u>Greater Sage Grouse</u>: The creation of a reservoir in shrub-steppe habitat would result in core habitat for this species being permanently lost and fragmented. Recent research involving radio-collared sage grouse has demonstrated that they move through the footprints of both proposed habitats, and throughout the surrounding lands, further indicating the importance of these areas to the continued their continued survival and population growth (WDFW 2007). Indirect effects would include those identified for the shrub-steppe habitat previously discussed. There would be a greater loss of sage grouse habitat resulting from the creation of the Black Rock than the Wymer Reservoir. The area which would contain the Black Rock Reservoir is also an important migration corridor for the sage grouse, and it would provide a significant barrier to their movement. Greater sage grouse cannot exist, or even safely pass through, a small remnant patch of habitat (WDFW 2007). This would severely hinder ongoing efforts to increase sage grouse population numbers in central and eastern Washington.

<u>Mardon skipper butterfly</u>: There is no documentation of the Mardon skipper butterfly occurring in the Affected Area (Johnson and Cassidy 1997). However, historic accounts indicate that the butterfly was found in similar habitats near the Black Rock area.

Basalt daisy: There are no known populations of the basalt daisy within the footprint of either potential reservoir. Spray drift from adjacent agriculture is a potential threat to this candidate species. Therefore, if additional irrigated agriculture fields are developed adjacent to the known basalt daisy population in the Yakima canyon due to the availability of water in the Wymer Reservoir the threat to the existing basalt daisy population from spray drift would increase.

Umtanum buckwheat: There is no documentation of the Umtanum desert buckwheat occurring in the Affected Area (WNHP 2007).

Columbia milk-vetch: The creation of the Black Rock Reservoir could negatively impact habitat where the Columbia milk-vetch might be found. Any populations that might exist within the disturbance area (0.31 miles) would be fragmented and populations within the reservoir would be permanently lost. Habitat conversions, including residential and orchard development have resulted in recent losses of Columbia milk-vetch habitat and populations. The Black Rock Reservoir would increase this threat to any adjacent Columbia milk-vetch populations and potential habitat in the surrounding area.

Suksdorf's monkey-flower: The creation of the Wymer Reservoir could negatively impact any Suksdorf's monkey-flower populations that might exist in the area. Any populations would be fragmented within the disturbance area and populations within the reservoir would be permanently lost. Livestock grazing and agriculture fields have resulted in recent losses of Suksdorf's monkey-flower habitat and populations. The Wymer Reservoir would increase this threat to any adjacent Suksdorf's monkey-flower population and potential habitat in the surrounding area.

IV RECOMMENDATIONS

During the process of formulating recommendations to mitigate for potential impacts associated with Reclamation's three proposed action alternatives described in this CAR, the Service relies on established Mitigation Policy (FWS Manual, 501 FW 2) (Policy). In accordance with this policy, the definition of mitigation includes: a) avoiding the impact altogether by not taking a certain action or parts of an action; b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and e) compensating for the impact by replacing or providing substitute resources or environments (40 CFR Part 1508.20(a-e)). The Service has also considered its responsibilities under Endangered Species Act, Migratory Bird Treaty Act, Bald Eagle Protection Act, and the National Environmental Policy Act (USFWS 1981).

The Service has numerous concerns regarding adverse effects to fish and wildlife resources associated with Reclamation's three action alternatives. Among these concerns are: (1) the continuing and cumulative loss of shrub-steppe habitat; (2) fragmentation and degradation of remaining upland habitat through introduction of non-native invasive plants; (3) likely development of the area (suitable for building) adjacent to the proposed reservoir sites (e.g., water based recreation facilities, access roads, housing); (4) increased fire danger associated with increased human use; (5) disruption of established migratory corridors for large and small mammals and other wildlife, especially the greater sage grouse, through the formation of barriers to wildlife movement, both during and after construction of the proposed facilities (e.g., large bodies of water, pipelines, access roads, construction activities); (6) disturbance of nesting migratory birds during construction and subsequent use of the proposed facilities; (7) Flow alteration in the Yakima River may change fish species composition; and (8) Augmentation of flows in the Yakima River utilizing Columbia River water may alter spawning behavior in bull trout.

The Service considers shrub-steppe habitat as meeting the criteria of Resource Category 2, that is; *"The habitat to be impacted is of high value for evaluation species and is scarce or becoming scarce on a national basis or in the ecoregion section."* Thus the Service's mitigation goal for this habitat type is *"No net loss of in-kind habitat value."* Furthermore, the Service *"will recommend ways to avoid or minimize losses . . ."* (USFWS 1981). Shrub-steppe habitat within the Black Rock valley, Rattlesnake Hills and Yakima Training center have been identified by the state of Washington as very important habitat for wildlife (Stinson et al. 2004, TNC 1999, WDFW 1996).

IV-1) <u>Service's Recommended Alternative</u>

After careful consideration of fish and wildlife resources analyzed in the CAR, the Service has determined that the most limited and endangered resource is shrub-steppe. All action alternatives, if implemented, would impact this resource. For that reason, based on our review and evaluation of the information acquired during preparation of the CAR, particularly the significant loss and/or fragmentation of shrub-steppe habitat, the Service recommends that the "No Action" alternative be selected with the following qualification: The Service further recommends that water conservation measures continue to be explored and implemented as a means to increase the availability of water for native aquatic species in the Yakima River corridor.

We recognize that there will likely be a net-loss of wetlands in the lower Basin as existing water delivery systems are made to be more efficient. To mitigate for any lost wetlands, the Service recommends that Reclamation consider reconnecting the floodplain and restore historic wetlands along the Yakima River.

IV-2) <u>Mitigation Recommendations: Action Alternatives</u>

If Reclamation proceeds with any of the three action alternatives, the Service recommends that the following mitigation measures be implemented:

Aquatic

The following Service recommendations to avoid or mitigate potential adverse impacts or enhance these resources are based on current information about the proposed alternatives. If these alternatives are subsequently modified, the Service may modify recommendations as appropriate.

> In the accompanying Environmental Impact Statement (EIS), analyze additional alternatives. These would include, but are not limited to, the Keechelus Lake to Kachess Lake Pipeline, commonly referred to as the K-K Pipeline. In addition, an analysis of

aquifer storage and water banking should also be considered in the EIS. These alternatives have the potential for benefits to bull trout and resident fish.

Conduct Instream Flow Incremental Methodology (IFIM) studies below Reclamation facilities to quantify changes in fish habitat resulting from the release of flow augmentation; compare results against existing model data.

Ensure Black Rock or Wymer Reservoir flow releases are compatible with migration, spawning, and rearing of resident fish that utilize the Yakima River Basin.

Investigate whether Columbia River water used for flow augmentation in the Yakima River Basin alters spawning behavior of anadromous fish, bull trout, and resident fish within the basin.

If the Black Rock or Wymer Reservoir is constructed, Reclamation should monitor flow augmentation releases from the reservoir and effects on riparian and wetland habitats in the Yakima River Basin.

Develop studies that examine the change in resident fish species distribution and abundance in the Yakima River Basin.

Maintain Yakima River Basin reservoirs at levels that enable adult bull trout to migrate into spawning tributaries.

Monitor entrainment of bull trout and resident fish in Yakima River Basin reservoirs and compare to flow augmentation regimes and accompanying reservoir levels.

Coordinate all bull trout and resident fish studies with the Service.

Wildlife

Wildlife Mitigation Common to the Three Action Alternatives

During construction, minimize or avoid all vegetation removal during avian nesting season to minimize the effect of the action on federally protected migratory birds. Typically nesting season in this part of Washington occurs between March and August each year.

Centralize any construction staging areas and locate them in areas that would provide minimal disturbance to wildlife and damage to shrub-steppe habitat. Existing degraded habitat may be the most suitable for this purpose.

Bury pipelines underground and restore native vegetation along the pipeline corridor. The Service would be willing to provide a list of native plants for this purpose. This measure would also require that Reclamation develop a vegetation maintenance and monitoring plan, performance criteria, and clear goals and objectives that would need to be met over a stipulated timeline, to ensure the success of this mitigation effort.

To compensate for the loss of shrub-steppe habitat, and also to ensure that residential, recreational and agricultural developments are compatible with Project resource mitigation objectives, an area equal to that lost to the project should be acquired around the periphery of the reservoir. Within the acquired land, agriculturally converted former shrub-steppe habitat and degraded shrub-steppe habitat should be fully restored. This would require a contiguous area of land for the purpose of providing habitat benefits for wildlife species displaced by the proposed action. The Service would be willing to assist Reclamation in identifying suitable sites as well as provide a list of native plants for this purpose. This measure would also require that Reclamation develop a vegetation maintenance and monitoring plan, performance criteria, and clear goals and objectives that would need to be met over a stipulated timeline, to ensure the success or this mitigation effort.

If a suitable area for shrub-steppe restoration cannot be found in the immediate project area, then another location will need to be selected in the Affected Area and evaluated in the CAR for the three action alternatives. If a suitable area for shrub-steppe restoration cannot be found in the Affected Area, then Reclamation should work with the Service to find a mutually agreeable location in the mid-Columbia area.

There are currently several state and federal agencies, as well several private organizations and public groups, that have signed a South Central Washington Shrub steppe/rangeland Conservation Partnership Memorandum of Understanding, which created a partnership dedicated to the protection and preservation of shrub-steppe habitat. Reclamation should work with that group to identify areas of shrub-steppe habitat that could be protected or restored as mitigation for any shrub-steppe lost during the creation of the selected reservoir.

Unregulated cattle grazing would continue to degrade wildlife habitat and would also impede development or enhancement of riparian, wetland, and upland habitats. Cattle should be excluded from all wildlife mitigation lands including restored shrub-steppe habitats, created wetland/riparian habitats, and acquired mitigation lands.

Human activities may displace wildlife from high value habitats to less suitable habitat. New recreation facilities should be located away from important wildlife areas including wildlife mitigation lands. The Service would be willing to work with Reclamation to identify appropriate sites for new recreation facilities.

Mitigation for each Action Alternative

Black Rock Reservoir Site

Although there is currently limited wetland and riparian habitat identified within the Black Rock footprint, the creation of the reservoir could provide the potential for creation of at least low quality wetland and riparian habitats. This would attract species that utilize these habitats. Based on this, the Service recommends that Reclamation construct dikes in shallow water areas within the reservoir, and if necessary pump water into these areas to maintain adequate water levels for the production of wetland/riparian vegetation. The Service would be willing assist Reclamation in identifying suitable sites as well as provide a list of native plants for this purpose. The north boundary and upper end of the reservoir likely contain suitable sites for dike construction and wetland and riparian habitat development. This measure would also require that Reclamation develop a vegetation maintenance and monitoring plan, performance criteria, and clear goals and objectives that would need to be met over a stipulated timeline, to ensure the success of this mitigation effort.

Based on the significant loss of wildlife habitat that would occur with the creation of this reservoir, the Service recommends that Reclamation work to establish a wildlife management area adjacent to the reservoir in areas that would be able to provide suitable wildlife habitat. This would likely attract some replacement species associated with open waterbodies, such as shorebirds and waterfowl. The northern boundary of the Black Rock footprint falls near the southern end of the U.S. Army's Yakima Training Center. Reclamation could inquire as to the availability of any lands that could be protected to further protect that adjacent area.

Based on the continuing loss, degradation and fragmentation of shrub-steppe habitat within eastern Washington, the Service recommends that Reclamation consider the construction of a smaller reservoir at this site, in order to reduce the amount of lost shrub-steppe habitat.

Although there are currently no existing trees or snags within the footprint of the Black Rock Reservoir, this site is an important area for several raptor species. The creation of the reservoir could bring in other raptor species (i.e. bald eagle, osprey), especially if a fishery were to be established. Large trees and snags are used by raptors and many other birds as perches for foraging and roosting. Artificial perches should be installed on selected areas adjacent to the new reservoir to provide perches for raptors. These structures would significantly enhance the habitat for raptors and other birds within the Black Rock Affected Area. The Service would be willing to work with Reclamation to identify appropriate sites and specifications for artificial perches.

to production of a similar number of habitat units, elsewhere within the Yakima River Basin.

Plant surveys should be conducted for Columbia milk-vetch (federal species of concern), prior to final selection of this alternative, in any habitats that are suitable for its existence within the Black Rock Reservoir Affected Area. The Service would be willing to assist Reclamation in the completion of plant surveys.

Protect any discovered populations of Columbia milk-vetch that are located adjacent to the Black Rock Reservoir from recreation, residential and agriculture field development, grazing, and invasion of non-native plants. Protection measures may include obtaining a conservation easement for the land containing the population or acquiring the land. The area could be fenced to exclude livestock and a weed control program developed to prevent invasion of non-native plants.

Wymer Reservoir Site

The creation of the Wymer Reservoir would result in the loss of existing large trees and snags within the footprint of the reservoir. Large trees and snags are used by raptors and many other birds as perches for foraging and roosting. Artificial perches should be installed on selected areas adjacent to the new reservoir to provide perches for bald eagles, osprey and other raptors. These structures would, in the short term, replace trees and snags that would be lost due to the creation of the Wymer Reservoir. The Service would be willing to work with Reclamation to identify appropriate sites and specifications for artificial perches.

Based on HEP analyses conducted within the potential Wymer Reservoir footprint, the Service determined that 378 average annual habitat units for the brewer's sparrow would be lost if the reservoir were created. The Service recommends that Reclamation work to create, restore and/or protect the amount of shrub-steppe habitat that would lead to production of a similar number of habitat units, elsewhere within the Yakima River Basin.

Plant surveys should be conducted for the Sukdorf's monkey-flower (federal species of concern), prior to final selection of this alternative, in any habitats that are suitable for its existence within the Wymer Reservoir Affected Area. The Service would be willing to work with Reclamation in completion of plant surveys.

Protect any discovered populations of Suksdorf's monkey-flower that are located adjacent to the Wymer Reservoir from recreation, residential and agriculture field development, grazing, invasion of non-native plants and possible spray drift from adjacent agriculture fields. Protection measures may include obtaining a conservation easement for the land containing the population or acquiring the land. The area could be fenced to exclude livestock and a weed control program developed to prevent invasion of non-native plants.

Plant surveys should be conducted for basalt daisy (federal Candidate species), prior to final selection of this alternative, in any habitats that are suitable for its existence within the Wymer Reservoir Affected Area. The Service would be willing to work with Reclamation in completion of plant surveys.

Protect any basalt daisy populations, discovered during new surveys that are located adjacent to the Wymer Reservoir from recreation, residential and agriculture field development, grazing, invasion of non-native plants and possible spray drift from adjacent agriculture fields. Protection measures may include obtaining a conservation easement for the land containing the population or acquiring the land. The area could be fenced to exclude livestock and a weed control program developed to prevent invasion of non-native plants.

Based on the significant loss of wildlife habitat that would occur with the creation of this reservoir, the Service recommends that Reclamation work to establish a wildlife management area adjacent to the reservoir in areas that would provide suitable wildlife habitat. This would likely attract some replacement species associated with open water bodies, such as shorebirds and waterfowl. The U.S. Army's Yakima Training Center owns property along the extreme eastern end of the potential reservoir footprint. Reclamation could inquire as to the availability of any lands that could be protected to further protect that adjacent area.

Wymer Reservoir with the Yakima River Pump Exchange

Bury pipelines underground and restore native vegetation along the pipeline corridor. The Service would be willing to provide a list of native plants for this purpose. This measure would also require that Reclamation develop a vegetation maintenance and monitoring plan, performance criteria, and clear goals and objectives that would need to be met over a stipulated timeline, to ensure the success of this mitigation effort.

any barriers to, or fragmentation of movement corridors, loss of habitat, degradation of remaining habitat, and invasion of exotic species.

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APPENDIX A

Wildlife Species potentially inhabiting the Affected Areas of the Yakima River Basin

Mammals

Mule deer (*Odocoileus hemionus*)
bighorn sheep (*Ovis Canadensis*)
coyote (*Canus latrans*)
black-tailed jackrabbit (*Lepus californicus*)
bobcat (*Lynx rufus*)
northern grasshopper mouse (*Onychomys leucogaster*)
Merriam shrew (*Sorex merriami*)
mink (*Mustela vison*)
muskrat (*Ondatra zibethicus*)
cottontail rabbit (*Lepus sylvaticus*)
river otter (*Lutra canadensis*)
black bear (*Ursus americanus*)
deer mouse (*Peromyscus maniculatus*)
Pacific mole (*Scapanus orarius*),
Small-footed myotis (*Myotis subulatus*)
elk (*Cervus canadensis*)
Townsend ground squirrel (*Citellus townsendi*)
badger (*Taxidea taxus*)
white-tailed jackrabbit (*Lepus townsendii*)
Washington ground squirrel (*Spermophilus washingtoni*)
Ord's kangaroo rat (*Dipodomys ordii*)
beaver (*Castor canadensis*)
raccoon (*Procyon lotor*)
striped skunk (*Mephitis mephitis*)
w. harvest mouse (*Reithrodontomys megalotis*)
long-tailed vole (*Microtus longicaudus*)
Great Basin pocket mouse (*Parognathus parvus*)
northern pocket gopher (*Thomomys talpoides*)
pallid bat (*Antrozous pallidus*)

Birds

burrowing owl (*Athene cunicularia*)
chukar (*Alectoris chukar*)
common nighthawk (*Chordeiles minor*)
rock wren (*Salpinctes obsoletus*)
loggerhead shrike (*Lanius ludovicianus*)
western meadowlark (*Sturnella neglecta*)
green-tailed towhee (*Pipilo chlorurus*)
vesper sparrow (*Pooecetes gramineus*)
Brewer's sparrow (*Spizella breweri*)
sage sparrow (*Amphispiza belli*)
osprey (*Pandion halietus*)
Cooper's hawk (*Accipiter cooperi*)
Swainson's hawk (*Buteo swainsoni*)
Ferruginous hawk (*Buteo regalis*)
Western screech owl (*Megascops kennecotti*)
great blue heron (*Ardea herodias*)
bank swallow (*Riparia riparia*)
red-winged blackbird (*Agelaius phoeniceus*)
black swift (*Cypseloides niger*)
Wilson's phalarope (*Phalaropus tricolor*)
sora rail (*Porzana carolinus*)
American avocet (*Recurvirosta americana*)
black-crowned night-heron (*Nycticorax nycticorax*)
common snipe (*Gallinago gallinago*)
common yellowthroat (*Geothlypis trichas*)
dipper (*Cinclus mexicanus*)
peregrine falcon (*Falco peregrinus*)
California quail (*Callipepla californica*)
ruffed grouse (*Bonasa umbellus*)
American crow (*corvus brachyrhynchos*)
red-breasted sapsucker (*Sphyrapicus ruber*)
long-billed curlew (*Numenius madagascariensis*)
greater sage grouse (*Centrocerus urophasianus*)
common poorwill (*Phalaenoptilus nuttallii*)
horned lark (*Eremophila alpestris*)
sage thrasher (*Oreoscoptes montanus*)
mourning dove (*Zenaida macroura*)
western kingbird (*Tyrannus verticalis*)
black-throated sparrow (*Amphispiza bilineata*)
lark sparrow (*Chondestes grammacus*)
golden eagle (*Aquila chrysaetos*)
bald eagle (*Haliaeetus leucocephalus*)
sharp-shinned hawk (*Accipiter striatus*)
American kestrel (*Falco sparverius*)
short-eared owl (*Asio flammeus*)
great horned owl (*Bubo virginianus*)
great egret (*Ardea alba*)
barn swallow (*Hirundo rustica*)
yellow-headed blackbird (*Xanthocephalus xanthocephalus*)
spotted sandpiper (*Actitis macularia*)
American coot (*Fulica americana*)
lesser yellowlegs (*Tringa flavipes*)
black-necked stilt (*Himantopus mexicanus*)
American bittern (*Botarus lentiginosus*)
bobolink (*Dolichonyx oryzivorus*)
marsh wren (*Cistothorus palustris*)
belted kingfisher (*Megaceryle alcyon*)
northern harrier (*Circus cyaneus*)
ring-necked pheasant (*Phasianus colchicus*)
killdeer (*Charadrius vociferous*)
red-naped sapsucker (*Sphyrapicus nuchalis*)
Vaux's swift (*Chaetura vauxi*)

rufous hummingbird (*Selasphorus rufus*)
Pacific-slope flycatcher (*Empidonax difficilis*)
dusky flycatcher (*Empidonax oberholseri*)
Swainson's thrush (*Catharus ustulatus*)
solitary vireo (*Vireo solitarius*)
fox sparrow (*Passerella iliaca*)
black-headed grosbeak (*Pheucticus melanocephalus*)
Northern oriole (*Icterus galbula galbula*)
Northern flicker (*Colaptes auratus*)
hairy woodpecker (*Picoides villosus*)
ash-throated flycatcher (*Myiarchus cinerascens*)
American goldfinch (*Carduelis tristis*)
yellow warbler (*Dendroica petechia*)
pie-billed grebe (*Podilymbus podiceps*)
common merganser (*Mergus merganser*)
gadwall (*Anas strepera*)
cinnamon teal (*Anas cyanoptera*)
American wigeon (*Anas americana*)
Canada geese (*Branta canadensis*)
mourning doves (*Zenaida macroura*)
rock dove (*Columba livia*)
brown-headed cowbird (*Molothrus ater*)
savannah sparrow (*Passerculus sandwichensis*)
calliope hummingbird (*Stellula calliope*)
Hammond's flycatcher (*Empidonax hammondii*)
veery (*Catharus fuscescens*)
western tanager (*Piranga ludoviciana*)
MacGillivary's warbler (*Oporornis tolmiei*)
red-breasted nuthatch (*Sitta canadensis*)
gray catbird (*Dumetella carolinensis*)
Eastern kingbird (*Tyrannus tyrannus*)
downy woodpecker (*Picoides pubescens*)
Lewis' woodpecker (*Melanerpes lewis*)
Lincoln's sparrow (*Melospiza lincolnii*)
Cassin's finch (*Carpodacus Cassinii*
mallard (*Anas platyrhynchos*)
white-crowned sparrow (*Zonotrichia leucophrys*)
Brewer's blackbird (*Euphagus cyanocephalus*)
blue-winged teal (*Anas discors*)
redhead (*Aythya americana*)
northern shoveler (*Anas clypeata*)
American robin (*Turdus migratorius*)
turkey vulture (*Cathartes aura*)
black-billed magpie (*Pica hudsonia*),
western bluebird (*Sialia mexicana*)

<u>Reptiles and Amphibians</u>

western rattlesnake (*Crotalus virdis*)
Great Basin spadefoot toad (*Spea intermontana*)
northern sagebrush lizard (*Sceloporus graciosus*)
spotted frog (*Rana pretiosa*)
bullfrog (*Rana catesbeiana*)
gopher snakes (*Pituophis melanoleuces*)
striped whipsnake (*Masticophis taeniatus*)
short-horned lizard (*Phrynosoma douglasii*)
western painted turtle (*Chrysemys picta*)
Cascade frog (*Rana cascadae*)
tailed frog (*Ascaphus montanus*)
garter snake (*Thamnophis sirtalis*)

APPENDIX B

Results of HEP modeling for the Black Rock Alternative

In an effort to determine the extent and quality of the shrub-steppe habitat available, a Habitat Evaluation Procedures (HEP) for the site was undertaken. After a literature search of the Habitat Suitability Index models was conducted, the Brewer's sparrow was selected as the species for which habitat variables would be measured (Short, H. L. 1984). The Brewers sparrow nests within certain evergreen shrubland and evergreen shrub savannah habitats "from southwestern Yukon, northwestern and interior British Columbia, west-central and southern Alberta, southwestern Saskatchewan and southwestern North Dakota south, generally east of the Cascades and the coast ranges, to eastern and Southern California…, southern Nevada, central Arizona, northwestern New Mexico, central Colorado, southwestern Kansas, northwestern Nebraska, and southwestern South Dakota" (American Ornithologists' Union 1983:701). Invertebrates comprise most of the diet of nestling sparrows and the bulk of the adult's diet during late spring and early summer. The Brewer's sparrow occupies a variety of steppe and desert cover types following the late spring – early summer breeding season. Grass and forb seeds were an important component of the diet in these cover types, especially from late autumn to early spring (Cody 1971). The Brewer's sparrow is dependent on a shrub-dominated plant community that provides cover, song perches, and nest sites (Johnsgard and Rickard 1957). This species nests in sagebrush throughout the range of this common shrub and in a variety of other suitable shrubs when sagebrush is not available. HEP analysis for this species of sparrow relies on collection of data for six variables. These variables include; size of the habitat block being measured, slope of the terrain, general soil types at the site, species of shrubs present, percent of the canopy cover of the shrubs, and average height of the shrubs. For the Brewer's sparrow, they prefer habitat blocks of at least 0.2 hectares (0.46 acres), slopes equal to or less than 30%, terrain that comprises 30% or less of rock, shrub communities that consist mostly of big sagebrush, a canopy cover of 30% or more, and an average shrub height between 50 and 70 centimeters. To measure these variables at each of the sites, the Service personnel chose to use a combination of Geographic Information Systems (GIS), a clinometer, a gps unit, and to use the point intercept method of measuring the shrubs on the site. The point intercept method involves using a measuring tape and laying out a transect of a specified distance (100 meters in this case), and measuring the distance of the tape that is covered by the canopy of each individual shrub. Each shrub is identified to species, and the height of each shrub is approximated. This information is recorded on a datasheet and then entered into a spreadsheet.

Thirty random points were identified, using GIS, throughout the footprint of the proposed reservoir, from which a subset would be identified as suitable habitat to run point intercept surveys. The subset of points was based on habitat available at each site, as well as whether or not permission was granted from the current landowner. The results of these transects would provide information that would help establish baseline conditions in the area, from which future conditions could be modeled using the Habitat Workshop software © 2007 (All Rights Reserved), created by USGS Fort Collins Science Center, Adrian Farmer, author. After receiving landowner permission, transects were established at sixteen sites. Upon completion of the transects, the data was entered into a spreadsheet, and then the Brewer's sparrow model (described above) was used to determine the representative Habitat Suitability Index (HIS) number for each variable. These HIS numbers were then entered into the Habitat Workshop program, and a baseline was created for the Black Rock site. The resultant baseline was found to be approximately 1692 habitat units for the Brewers sparrow. If the reservoir were to be constructed on this site, there would be a net loss of 1692 habitat units for the Brewers sparrow. This HEP analysis only deals with the direct impact that would occur, due to loss of habitat from inundation. The potential impacts of the reservoir on the Brewer's sparrow would be assumed to be greater than this, due to indirect impacts, including further loss of habitat to construction of support facilities and development, further habitat degradation, and habitat fragmentation.

APPENDIX C

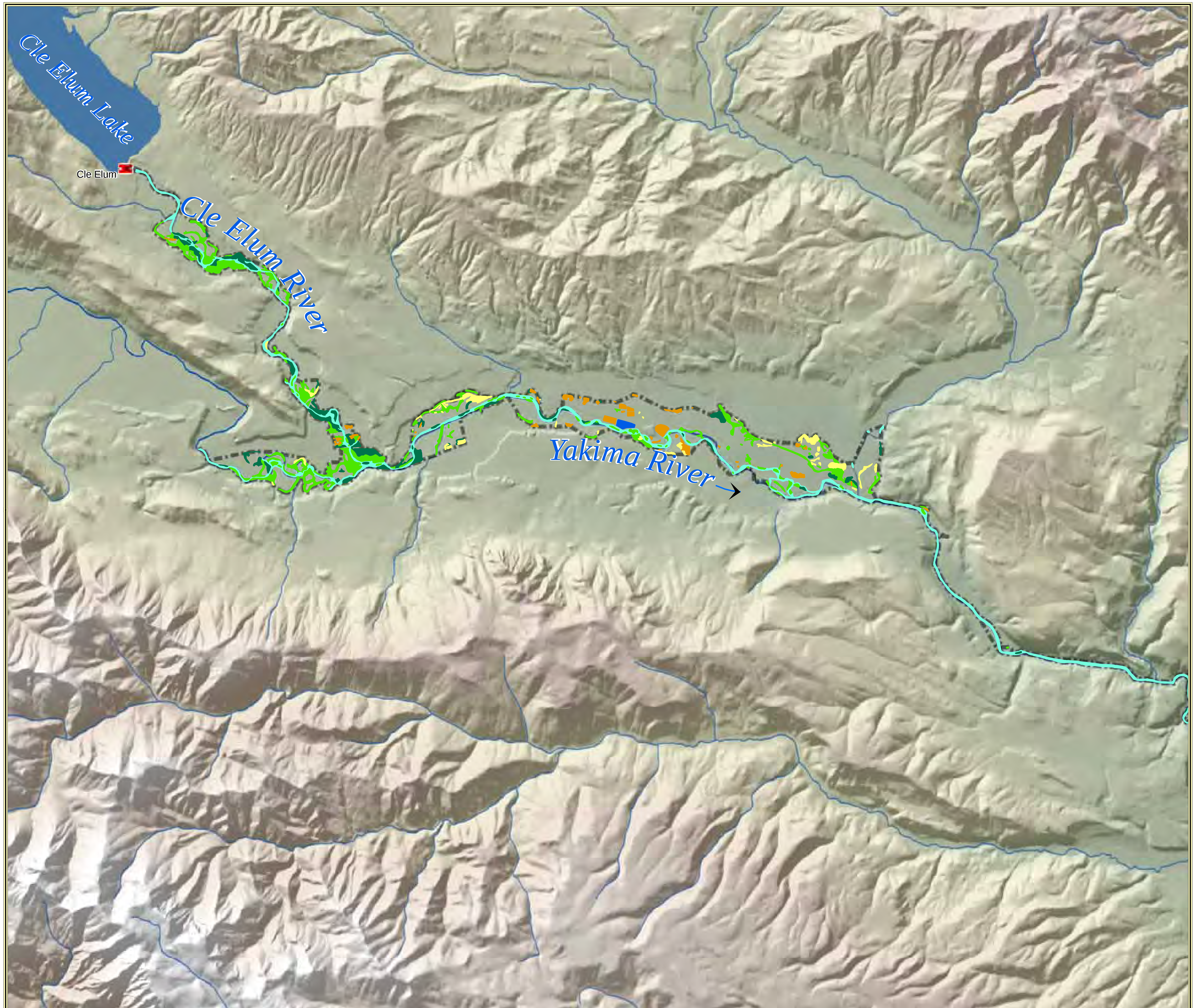
Results of HEP modeling for the Wymer Alternatives

In an effort to determine the extent and quality of the shrub-steppe habitat available, a HEP for the site was undertaken. The Brewer's sparrow was also chosen for this site, and the procedures followed were the same as those described in the Black Rock HEP section above. Twenty random points were identified throughout the footprint of the proposed reservoir, from which it was determined that fifteen sites could be accessed and were suitable for analysis. Twenty random points were identified, using GIS, throughout the footprint of the proposed reservoir, from which a subset of fifteen were identified as having suitable access and habitat to run point intercept surveys. The results of these transects would provide information that would help establish baseline conditions in the area, from which future conditions could be modeled using the Habitat Workshop software © 2007 (All Rights Reserved), created by USGS Fort Collins Science Center, Adrian Farmer, author. Upon completion of the transects, the data was entered into a spreadsheet, and then the Brewer's sparrow model (described above) was used to determine the representative Habitat Suitability Index (HIS) number for each variable. These HIS numbers were then entered into the Habitat Workshop program and a baseline were created for the Wymer site. The resultant baseline was found to be approximately 378 habitat units for the Brewers sparrow. If the reservoir were to be constructed on this site, there would be a net loss of 378 habitat units for the Brewers sparrow. This HEP analysis only deals with the direct impact that would occur, due to loss of habitat from inundation. The potential impacts of the reservoir on the Brewer's sparrow would be assumed to be greater than this, due to indirect impacts, including further loss of habitat to construction of support facilities and development, further habitat degradation, and habitat fragmentation.

APPENDIX D

Department of the Interior
U.S. Fish & Wildlife Service
Yakima River Basin Storage Project

Wetlands in the Affected Area (National Wetlands Inventory)



N

0 2.5 5 Miles

1:100,000

Dams

Affected Area

Wetland Habitat in Affected Area

Palustrine Emergent (PEM)

Palustrine Scrub Shrub (PSS)

Palustrine Forested (PFO)

Other Palustrine

Riverine

Lacustrine

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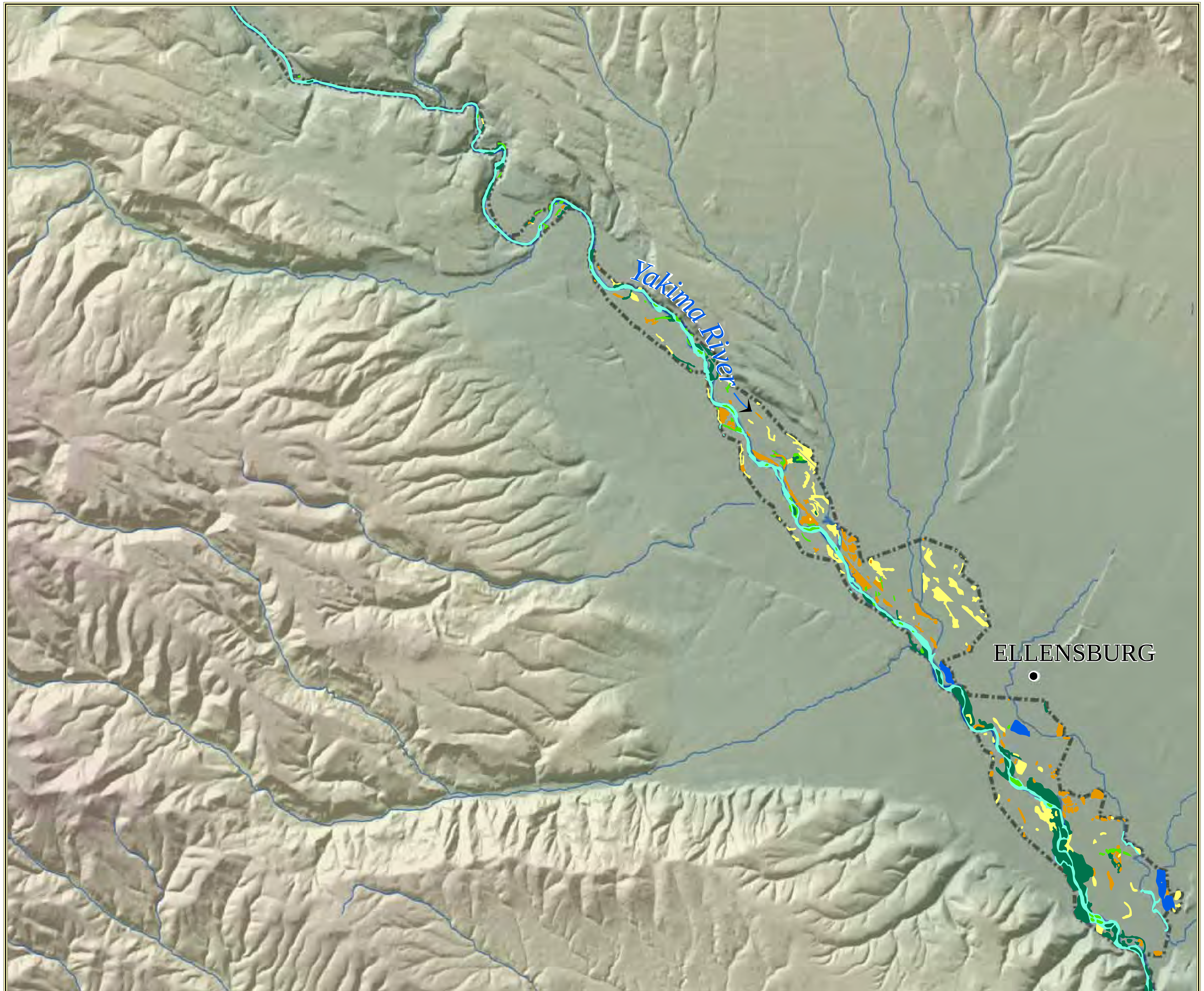
1 of 11 Wetland Maps



Department of the Interior
U.S. Fish & Wildlife Service
Yakima River Basin Storage Project

Wetlands in the Affected Area (National Wetlands Inventory)

N

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Affected Area

Wetland Habitat in Affected Area

- Palustrine Emergent (PEM)
- Palustrine Scrub Shrub (PSS)
- Palustrine Forested (PFO)
- Other Palustrine
- Riverine
- Lacustrine

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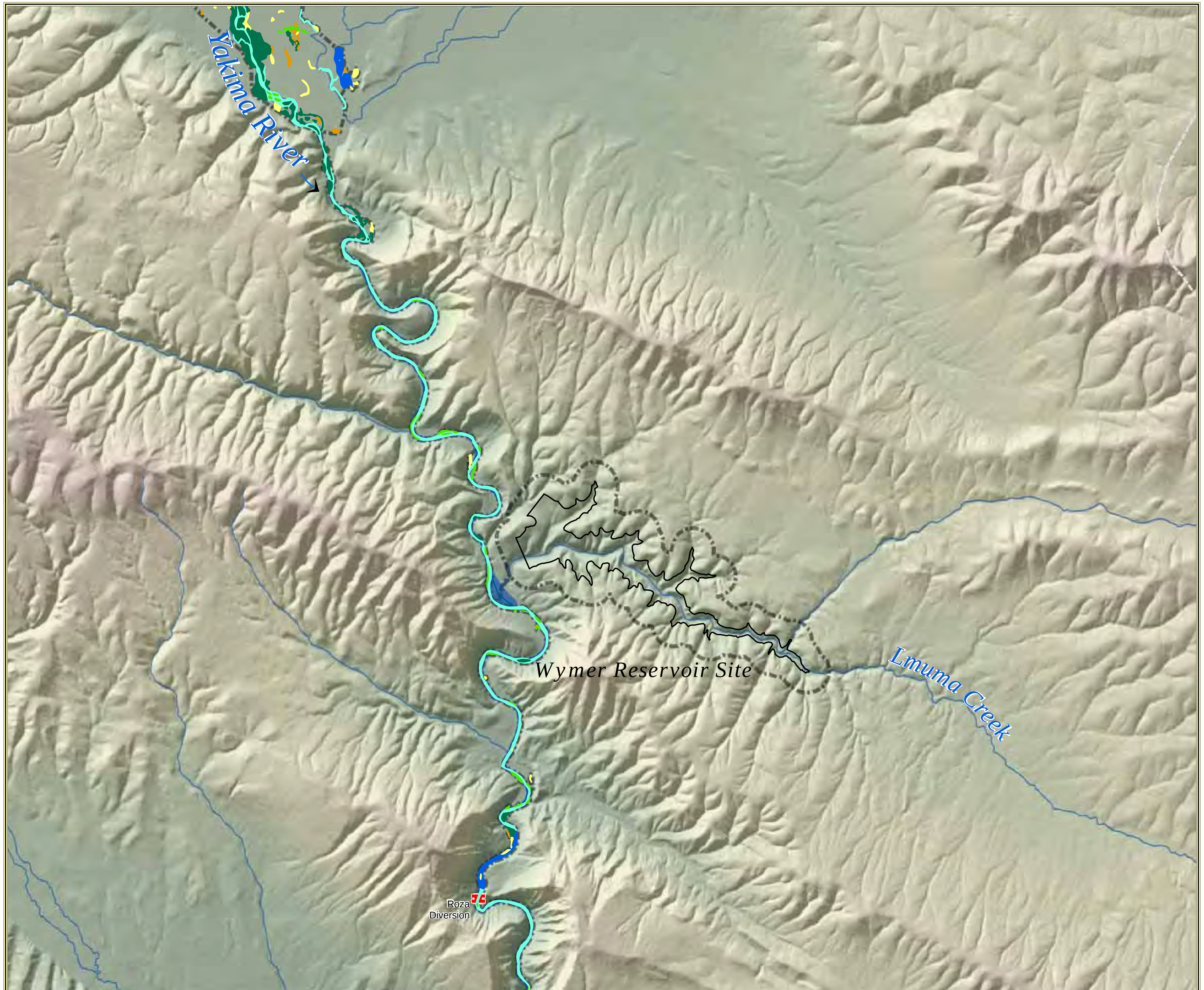

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Yakima River Basin Storage Project

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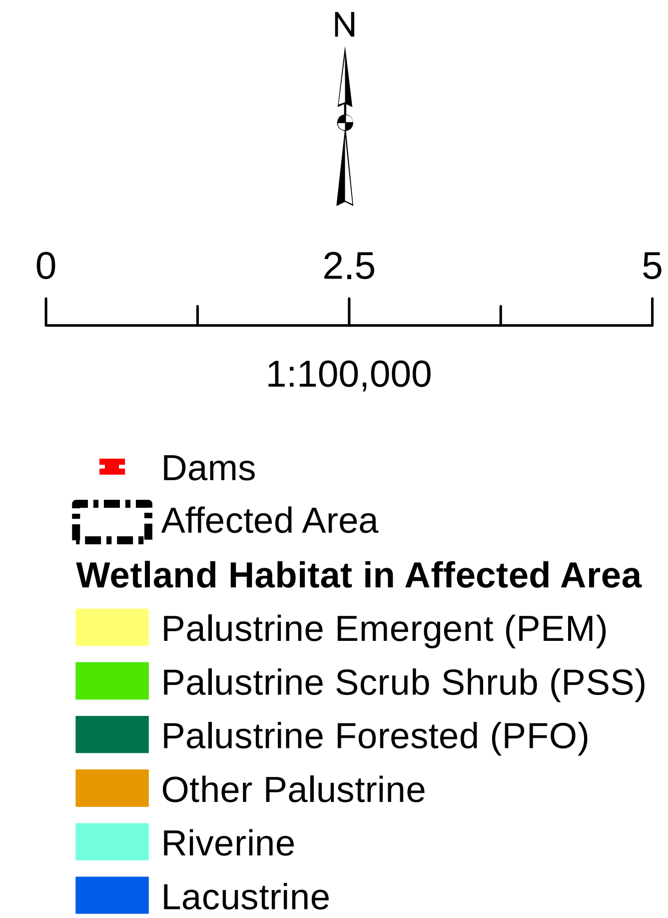

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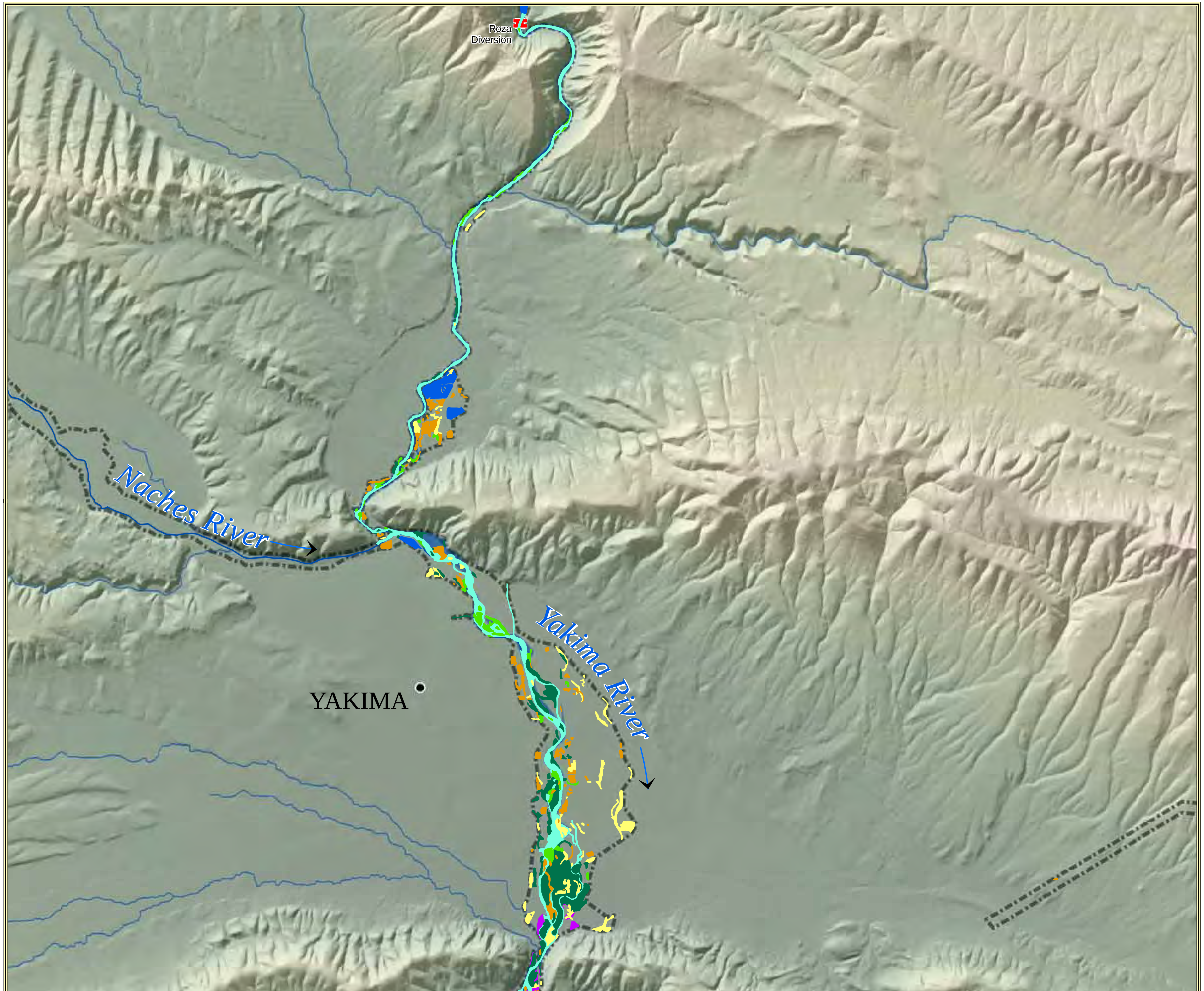

Department of the Interior
U.S. Fish & Wildlife Service
Yakima River Basin Storage Project

Wetlands in the Affected Area (National Wetlands Inventory)

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- Dams
- Affected Area

Wetland Habitat Within Affected Area

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- Riverine
- Lacustrine
- Upland Cottonwood Stands*

*NWI data clipped to data digitized by the Yakama Nation Wildlife Program & Natural Resource Department in 2006.

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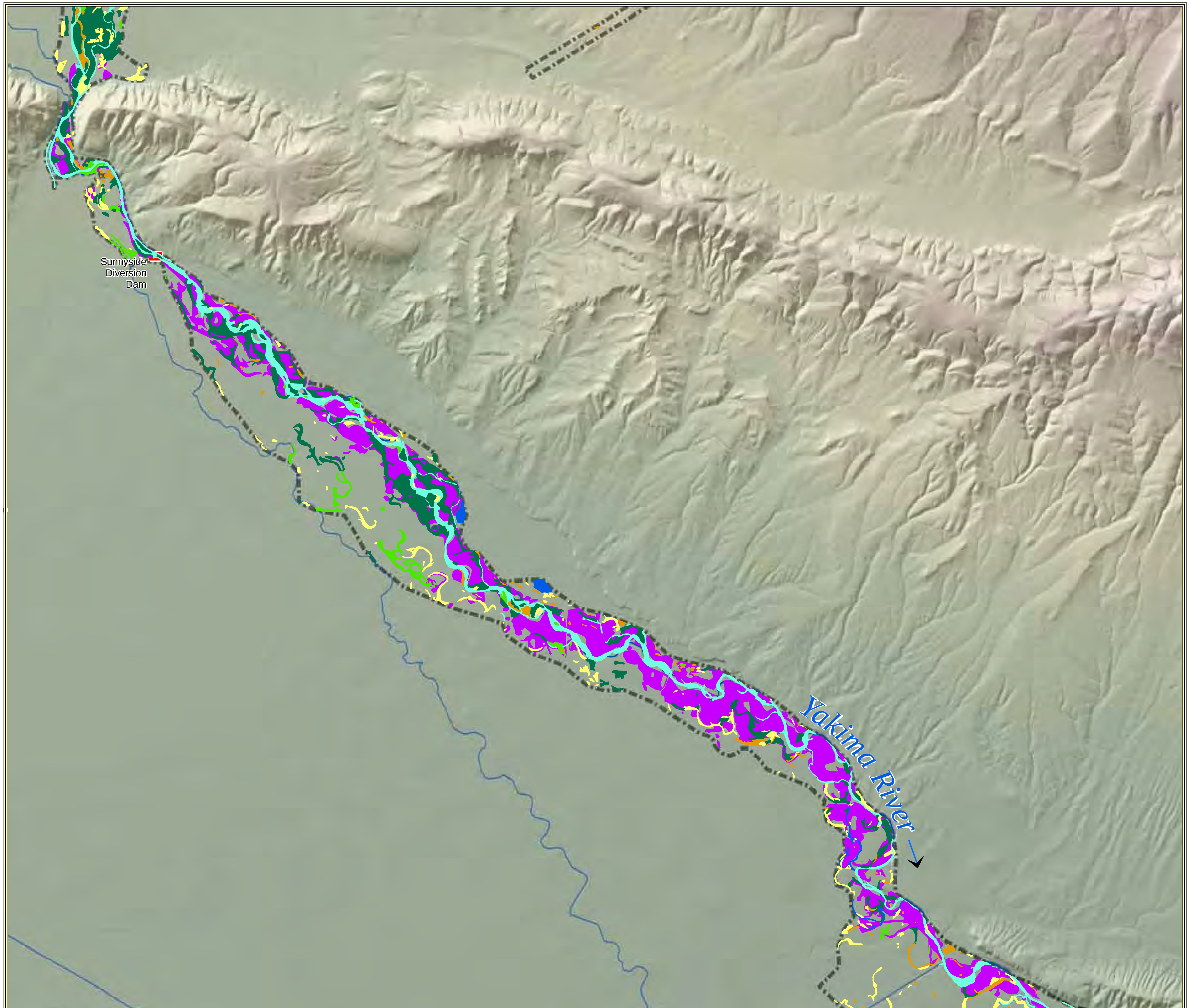

Department of the Interior
U.S. Fish & Wildlife Service
Yakima River Basin Storage Project

Wetlands in the Affected Area (National Wetlands Inventory)

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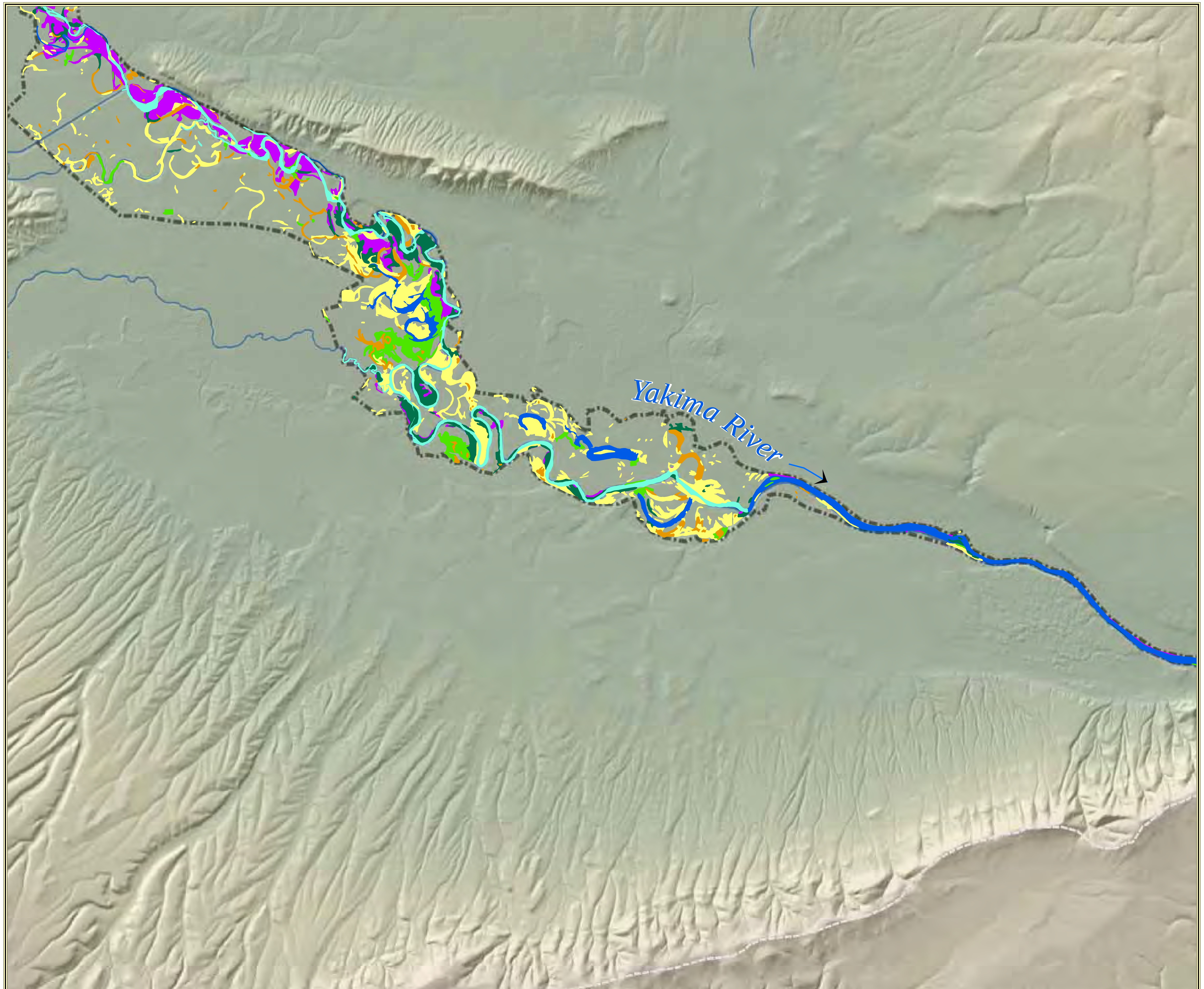

Department of the Interior
U.S. Fish & Wildlife Service
Yakima River Basin Storage Project

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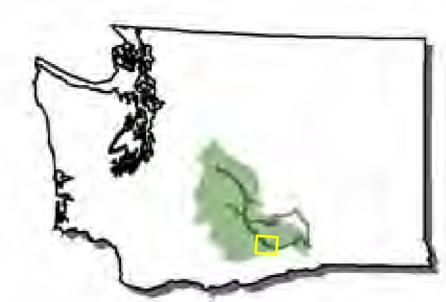

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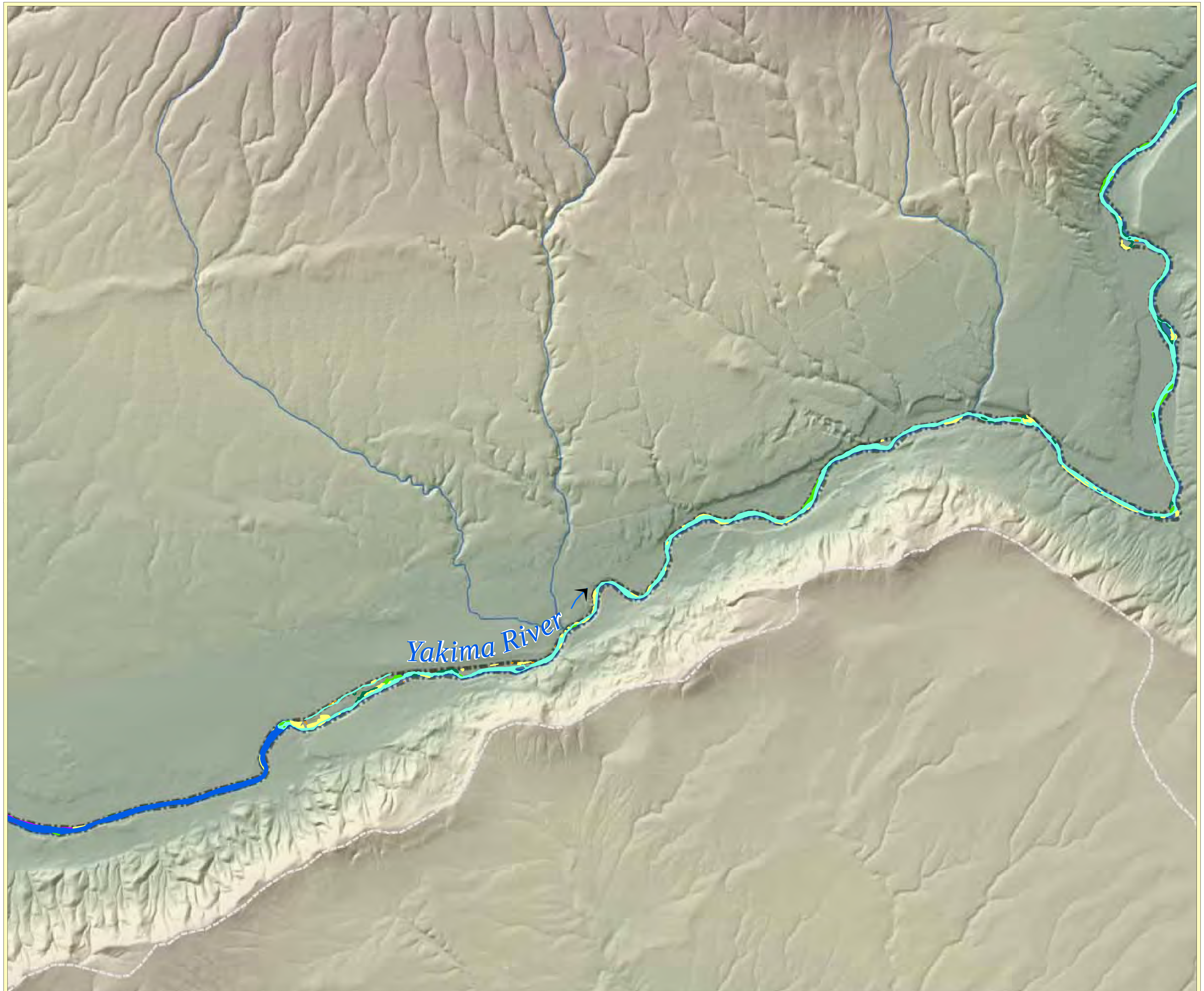

Department of the Interior
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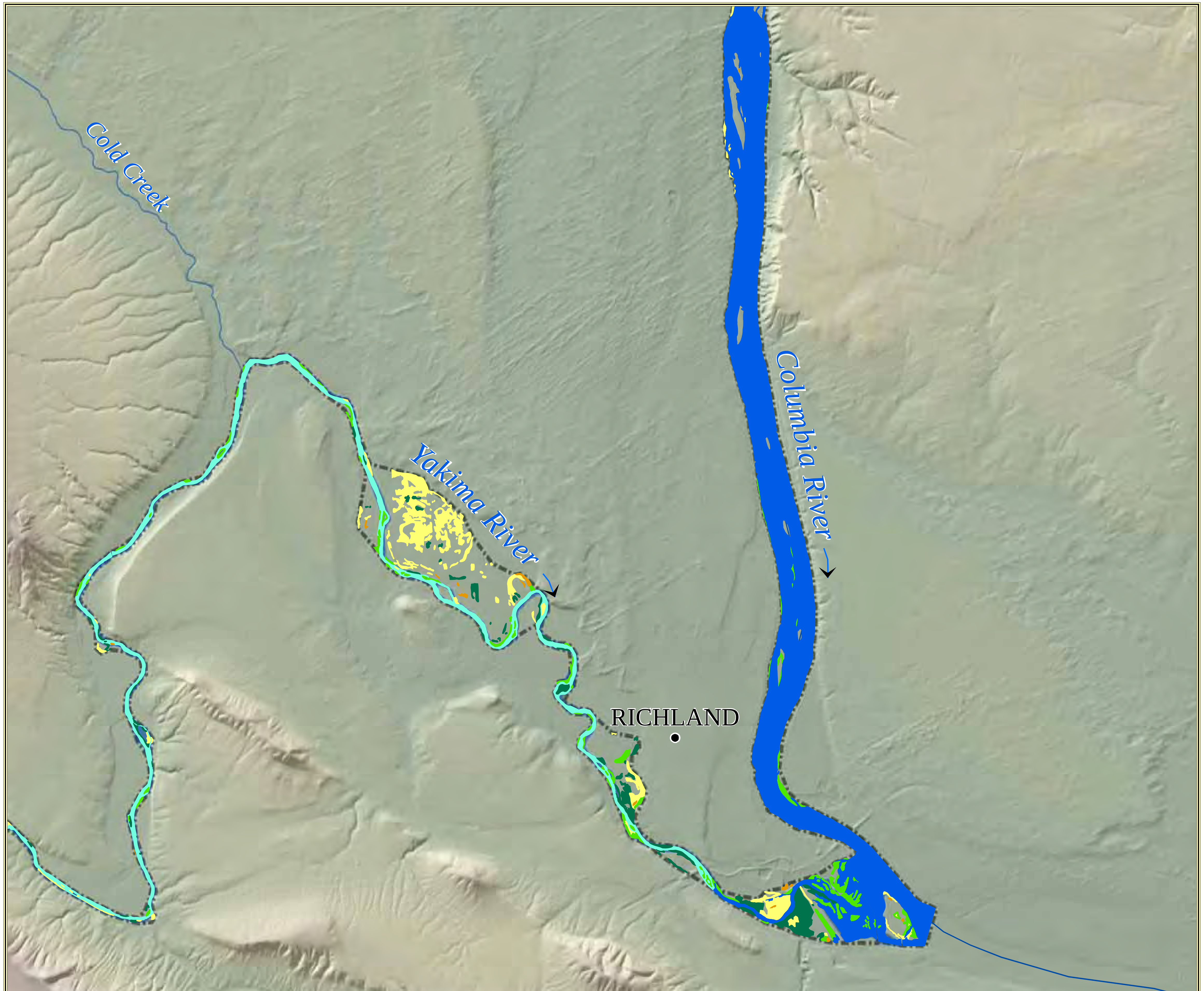

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Affected Area

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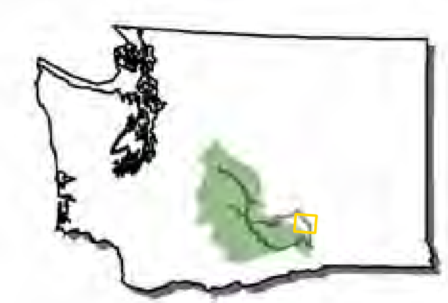

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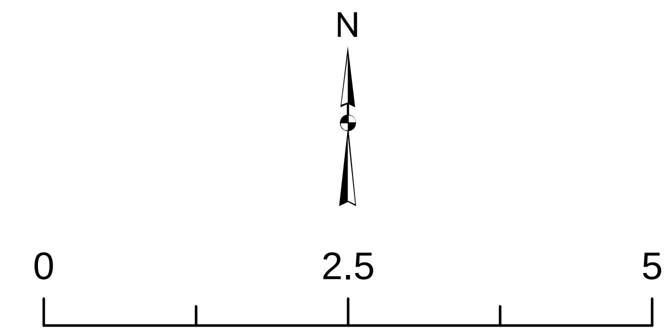

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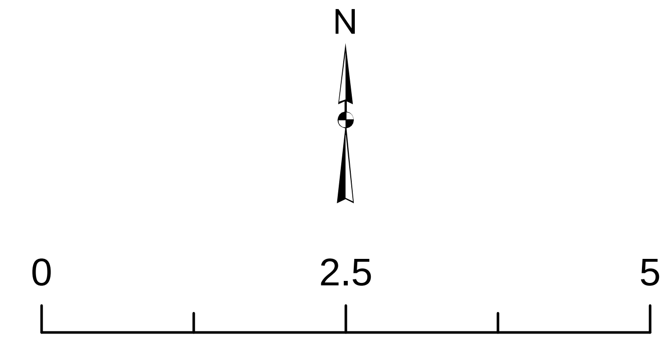
Department of the Interior
U.S. Fish & Wildlife Service
Yakima River Basin Storage Project

Wetlands in the Affected Area (National Wetlands Inventory)



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APPENDIX E

State of Washington
DEPARTMENT OF FISH AND WILDLIFE
2620 N. Commercial Ave, Pasco, WA 99301

DATE: 24 September 2007

TO: Mark Synder, US Fish and Wildlife Service

FROM: Mike Livingston, District Wildlife Biologist
Ken Bevis, Area Habitat Biologist
Mark Teske, Habitat Biologist

SUBJECT: Comments on Preliminary Draft Coordination Act Report, Yakima River Basin Water Storage Project

WDFW has reviewed the draft document and would like to offer the following input. We strongly agree with the FWS' recommended alternative of "No Action". Shrub steppe loss in the Yakima Basin, and across Washington, has been significant and continues to this day. We are concerned about the long-term protection of these habitats, and the species dependent upon them. Fortunately, there are large ownerships of shrub steppe remaining in the Columbia Basin, however, human land use continues to stress their ecological integrity. Connectivity of these large blocks of habitat is critical to protect their functionality for shrub steppe obligate species.

Construction of one or the other reservoirs, and the associated land uses, will significantly reduce the functionality of these lands for landscape dependent species such as greater sage-grouse. Immediate recovery of this species in the Yakima Basin is dependent upon proper management within the boundaries of the Yakima Training Center (YTC). However, long-term recovery requires the maintenance and enhancement of existing habitat corridors that link YTC with the Hanford Reach National Monument, the Yakama Reservation and WDFW Wildlife Areas. The proposed projects and related development would impose significant barriers to movement by greater sage-grouse and a host of other shrub steppe obligate species. Recent research involving radio-collared sage-grouse has demonstrated that they move through the footprints of both proposed reservoirs and throughout the surrounding lands.

If the BOR decides to move forward with either reservoir we provide the following additional recommendations to your discussion on mitigation. Emphasize that if either reservoir is developed the remaining surrounding habitat will become increasingly more critical for protection.

- We strongly urge you remove any mention of ratios for habitat replacement such as your suggestion of "an area equal (to that lost to the project)". Instead we recommend emphasizing the need for functional corridors of shrub steppe to maintain linkage between YTC, Hanford, the Reservation and WDFW Wildlife Areas.
- The only way to accomplish the above is to protect remaining shrub steppe lands to the east and west of Blackrock, and on top of Rattlesnake Ridge. The important point here is to emphasize the need for habitat connectivity to the east to the Hanford Monument and to the west to the Yakama Reservation. In the case of Wymer, we recommend the protection of a corridor across the length of the Yakima Canyon to the north and south of the reservoir. Emphasize the importance that large blocks are needed to preserve the ecological integrity of shrub steppe habitat. A species like sage-grouse can not exist, or even safely pass through, a small remnant patch of habitat.
- Protection of key parcels could be accomplished through fee title purchase. In addition, we suggest you include a recommendation that conservation lands could be protected through conservation easements that would preclude the following habitat degrading activities: wind power development, oil or gas development, housing development, irrigated agriculture, and inappropriate livestock grazing.
- Though we agree that restoration is an important tool for improving habitat, we recommend deemphasizing it in the report. Instead focus on the need to protect existing shrub steppe and steppe habitats.
- We also suggest you include recommendations that sufficient operating and maintenance funds be provided to manage any purchased lands.

Below are specific comments related to the report.

- Page 7, Section 3 Wildlife, 1st paragraph -- Include Ferruginous Hawk in list of birds.
- Page 9, Section 3, Under Candidate Species Greater Sage-Grouse – The highest point on YTC is ~4,000 feet. Sage-grouse occupied range on YTC ranges between 1,000 and 4,000 feet. In other states, they do occur at higher elevations.
- Page 12, Section 5, Shrub Steppe Habitat – Remove reference to "Agropyron" species since the only current species in this genus is crested wheatgrass, an introduced exotic. You correctly mention bluebunch wheatgrass (*Pseudoroegneria spicata*) as the dominant native bunchgrass (it formerly was named *Agropyron spicata)*.
- Page 24, second paragraph, include sage-grouse as a species known to use the area that will be negatively impacted by reservoir development.
- Page 26, 1st paragraph, #(5) add "especially sage-grouse" between "wildlife" and "through".
- Page 26, 2nd to last paragraph – Include a reference to the plans that have recognized the Blackrock/Rattlesnake Hills/YTC as important habitat for wildlife. Reports include Washington State Recovery Plan for the Greater Sage-Grouse (Stinson et al. 2004), Columbia Plateau Ecoregional Assessment (TNC 1999), Yakima Subbasin Plan, and Washington State recovery Plan for the Ferruginous Hawk (WDFW 1996).

RECLAMATION'S RESPONSE TO U.S. FISH AND WILDLIFE SERVICE RECOMMENDATIONS

IV-1) **<u>Service's Recommended Alternative</u>**

After careful consideration of fish and wildlife resources analyzed in the CAR, the Service has determined that the most limited and endangered resource is shrub-steppe. All action alternatives, if implemented, would impact this resource. For that reason, based on our review and evaluation of the information acquired during preparation of the CAR, particularly the significant loss and/or fragmentation of shrub-steppe habitat, the Service recommends that the "No Action" alternative be selected with the following qualification: The Service further recommends that water conservation measures continue to be explored and implemented as a means to increase the availability of water for native aquatic species in the Yakima River corridor.

We recognize that there will likely be a net-loss of wetlands in the lower Basin as existing water delivery systems are made to be more efficient. To mitigate for any lost wetlands, the Service recommends that Reclamation consider reconnecting the floodplain and restore historic wetlands along the Yakima River.

> Reclamation will continue to restore floodplains and riparian areas through the Yakima River Basin Water Enhancement Project (YRBWEP). This program has purchased land along the Yakima, Naches, and Teanaway Rivers for this purpose.

In the accompanying Environmental Impact Statement (EIS), analyze additional alternatives. These would include, but are not limited to, the Keechelus Lake to Kachess Lake Pipeline, commonly referred to as the K-K Pipeline. In addition, an analysis of aquifer storage and water banking should also be considered in the EIS. These alternatives have the potential for benefits to bull trout and resident fish.

> The K-K pipeline was analyzed as part of the planning study but eliminated from further consideration as outlined in the draft PR/EIS. Aquifer storage and water banking or water acquisition are analyzed in the draft PR/EIS as State alternative.

Conduct Instream Flow Incremental Methodology (IFIM) studies below Reclamation facilities to quantify changes in fish habitat resulting from the release of flow augmentation; compare results against existing model data.

> Should an action alternative be selected, further modeling would likely occur.

Examine the effect of Black Rock or Wymer Reservoir flow releases on water quality in the Yakima River Basin.

> Water quality of Black Rock or Wymer Reservoir flow releases has been analyzed in the Draft PR/EIS.

Ensure Black Rock or Wymer Reservoir flow releases are compatible with migration, spawning, and rearing of resident fish that utilize the Yakima River Basin.

> Releases from Black Rock Reservoir will be to the Roza and Sunnyside Division canals. As such they would not affect migration, spawning or rearing of resident fish. Releases from Wymer Reservoir in all but low water years will be for fish enhancement purposes. While specific operational details of the proposed reservoirs have not been developed yet the proposed releases from Wymer Reservoir assessed in the draft PR/EIS provide benefits for resident fish.

Investigate whether Columbia River water used for flow augmentation in the Yakima River Basin alters spawning behavior of anadromous fish, bull trout, and resident fish within the basin.

> This issue is addressed in the draft PR/EIS, no effect to spawning behavior should occur.

If the Black Rock or Wymer Reservoir is constructed, Reclamation should monitor flow augmentation releases from the reservoir and effects on riparian and wetland habitats in the Yakima River Basin.

> This may be accomplished as a part of other studies in the basin.

Develop studies that examine the change in resident fish species distribution and abundance in the Yakima River Basin.

- Reclamation is not a fishery manager and would not likely undertake such a study.

Maintain Yakima River Basin reservoirs at levels that enable adult bull trout to migrate into spawning tributaries.

> It is unclear what reservoir elevations are needed to enable bull trout migration. This appears to involve a complex interaction involving stream discharge, reservoir elevation, migration run timing and perhaps other variables. Operation details of the proposed reservoirs have not been developed yet, but consultation with fish biologists will occur prior to implementation to assure the best operations scenario for fish. This scenarios will have to balance a variety of needs and tradeoff between competing needs, such as spring migration flows and end of season reservoir elevations may be necessary. The operations outlined in the draft PR/EIS generally benefited bull trout migration from the reservoirs.

Monitor entrainment of bull trout and resident fish in Yakima River Basin reservoirs and compare to flow augmentation regimes and accompanying reservoir levels.

- Currently such studies are not planned as part of this project.

Coordinate all bull trout and resident fish studies with the Service.

> Should such studies be conducted they will be coordinated with the Service and other appropriate parties.

Wildlife

Wildlife Mitigation Common to the Three Action Alternatives

During construction, minimize or avoid all vegetation removal during avian nesting season to minimize the effect of the action on federally protected migratory birds. Typically nesting season in this part of Washington occurs between March and August each year.

> Reclamation will work with the Service and other agencies to minimize impacts from construction activities. The period outlined, however is the prime construction season and can not likely be avoided.

Centralize any construction staging areas and locate them in areas that would provide minimal disturbance to wildlife and damage to shrub-steppe habitat. Existing degraded habitat may be the most suitable for this purpose.

> Staging areas will be designated prior to construction. For large facilities like the dams and reservoirs they will likely be located in the reservoir.

Bury pipelines underground and restore native vegetation along the pipeline corridor. The Service would be willing to provide a list of native plants for this purpose. This measure would also require that Reclamation develop a vegetation maintenance and monitoring plan, performance criteria, and clear goals and objectives that would need to be met over a stipulated timeline, to ensure the success of this mitigation effort.

To compensate for the loss of shrub-steppe habitat, and also to ensure that residential, recreational and agricultural developments are compatible with Project resource mitigation objectives, an area equal to that lost to the project should be acquired around the periphery of the reservoir. Within the acquired land, agriculturally converted former shrub-steppe habitat and degraded shrub-steppe habitat should be fully restored. This would require a contiguous area of land for the purpose of providing habitat benefits for wildlife species displaced by the proposed action. The Service would be willing to assist Reclamation in identifying suitable sites as well as provide a list of native plants for this purpose. This measure would also require that Reclamation develop a vegetation maintenance and monitoring plan, performance criteria, and clear goals and objectives that would need to be met over a stipulated timeline, to ensure the success or this mitigation effort.

> The Service conducted a HEP analysis for the project and mitigation lands should be evaluated similarly. This may result in more or less acreage required to mitigate for impacts of the project. This recommendation will be implemented as budget and land availability, allow.

If a suitable area for shrub-steppe restoration cannot be found in the immediate project area, then another location will need to be selected in the Affected Area and evaluated in the CAR for the three action alternatives. If a suitable area for shrub-steppe restoration cannot be found in the Affected Area, then Reclamation should work with the Service to find a mutually agreeable location in the mid-Columbia area.

> Reclamation will look for shrub-steppe mitigation in the areas outlined above.

There are currently several state and federal agencies, as well several private organizations and public groups, that have signed a South Central Washington Shrub steppe/rangeland Conservation Partnership Memorandum of Understanding, which created a partnership dedicated to the protection and preservation of shrub-steppe habitat. Reclamation should work with that group to identify areas of shrub-steppe habitat that could be protected or restored as mitigation for any shrub-steppe lost during the creation of the selected reservoir.

> Should an action alternative be selected, we would work with all parties interested in preserving and protecting shrub-steppe.

Unregulated cattle grazing would continue to degrade wildlife habitat and would also impede development or enhancement of riparian, wetland, and upland habitats. Cattle should be excluded from all wildlife mitigation lands including restored shrub-steppe habitats, created wetland/riparian habitats, and acquired mitigation lands.

- We concur.

Human activities may displace wildlife from high value habitats to less suitable habitat. New recreation facilities should be located away from important wildlife areas including wildlife mitigation lands. The Service would be willing to work with Reclamation to identify appropriate sites for new recreation facilities.

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The Service recommends that Reclamation work with the Washington Natural Heritage Program to identify and protect any existing federal and state threatened and endangered, candidate, federal species of concern, and state sensitive plant species and their associated habitats, that may occur within the Affected Area.

- To the extent practicable we will undertake this action should an action alternative be selected.

Mitigation for each Action Alternative

Black Rock Reservoir Site

Although there is currently limited wetland and riparian habitat identified within the Black Rock footprint, the creation of the reservoir could provide the potential for creation of at least low quality wetland and riparian habitats. This would attract species that utilize these habitats. Based on this, the Service recommends that Reclamation construct dikes in shallow water areas within the reservoir, and if necessary pump water into these areas to maintain adequate water levels for the production of wetland/riparian vegetation. The Service would be willing assist Reclamation in identifying suitable sites as well as provide a list of native plants for this purpose. The north boundary and upper end of the reservoir likely contain suitable sites for dike construction and wetland and riparian habitat development. This measure would also require that Reclamation develop a vegetation maintenance and monitoring plan, performance criteria, and clear goals and objectives that would need to be met over a stipulated timeline, to ensure the success of this mitigation effort.

The draft PR/EIS concludes that some vegetation will naturally establish in the upper end of the reservoir. If this area can be expanded with the use of low dikes, it will be considered.

Based on the significant loss of wildlife habitat that would occur with the creation of this reservoir, the Service recommends that Reclamation work to establish a wildlife management area adjacent to the reservoir in areas that would be able to provide suitable wildlife habitat. This would likely attract some replacement species associated with open waterbodies, such as shorebirds and waterfowl. The northern boundary of the Black Rock footprint falls near the southern end of the U.S. Army's Yakima Training Center. Reclamation could inquire as to the availability of any lands that could be protected to further protect that adjacent area.

- As outlined above Reclamation will mitigate for impacts to wildlife with the focus initially being at the reservoir site.

Based on the continuing loss, degradation and fragmentation of shrub-steppe habitat within eastern Washington, the Service recommends that Reclamation consider the construction of a smaller reservoir at this site, in order to reduce the amount of lost shrub-steppe habitat.

- The reservoir was sized to meet the three goals of study.

Although there are currently no existing trees or snags within the footprint of the Black Rock Reservoir, this site is an important area for several raptor species. The creation of the reservoir could bring in other raptor species (i.e. bald eagle, osprey), especially if a fishery were to be established. Large trees and snags are used by raptors and many other birds as perches for foraging and roosting. Artificial perches should be installed on selected areas adjacent to the new reservoir to provide perches for raptors. These structures would significantly enhance the habitat for raptors and other birds within the Black Rock Affected Area. The Service would be willing to work with Reclamation to identify appropriate sites and specifications for artificial perches.

–

Based on HEP analyses conducted within the potential Black Rock Reservoir footprint, the Service determined that 1692 average annual habitat units for the brewer's sparrow would be lost if the reservoir were created. The Service recommends that Reclamation work to create, restore and/or protect the amount of shrub-steppe habitat that would lead to production of a similar number of habitat units, elsewhere within the Yakima River Basin.

> As outlined above we concur that using HEP is the appropriate way to assess mitigation needs.

Plant surveys should be conducted for Columbia milk-vetch (federal species of concern), prior to final selection of this alternative, in any habitats that are suitable for its existence within the Black Rock Reservoir Affected Area. The Service would be willing to assist Reclamation in the completion of plant surveys.

> Should an action alternative be selected, this recommendation will be implemented.

Protect any discovered populations of Columbia milk-vetch that are located adjacent to the Black Rock Reservoir from recreation, residential and agriculture field development, grazing, and invasion of non-native plants. Protection measures may include obtaining a conservation easement for the land containing the population or acquiring the land. The area could be fenced to exclude livestock and a weed control program developed to prevent invasion of non-native plants.

> Populations of Columbia milk-vetch could be included in and mitigation lands acquired, depending upon the value of the lands for mitigation and the availability of the lands for acquisition. A land management plan would need to be developed for acquired lands to address issues like weed control.

Wymer Reservoir Site

The creation of a reservoir at the Wymer site would result in the loss of sixty acres of wetland, riparian and cottonwood forest habitat. Based on the loss of this habitat, the Service recommends that Reclamation design the new reservoir to include construction of dikes in shallow water areas within the reservoir, and if necessary pump water into these areas to maintain adequate water levels for the production of wetland/riparian vegetation. If a similar number of acres cannot be replaced on site, Reclamation should replace the same number of wetland and riparian acres by identifying, creating or restoring similar habitats elsewhere in the Affected Area. The Service would be willing assist Reclamation in identifying suitable sites as well as provide a list of native plants for this purpose. The upper end of the reservoir likely contains suitable sites for dike construction and wetland and riparian habitat development. This measure would also require that Reclamation develop a vegetation maintenance and monitoring plan, performance criteria, and clear goals and objectives that would need to be met over a stipulated timeline, to ensure the success or this mitigation effort.

> The lands included in the Wymer Reservoir site are generally very steep and not conducive to impoundment by diking. While opportunities may exist they would likely be quite small. Some vegetation may develop along Lumuma Creek below the reservoir that could mitigate for losses at the site. Some areas along the reservoir shoreline may also develop wetland and riparian vegetation. Finally, depending upon which alternative is chosen that includes a Wymer Reservoir, wetland and riparian vegetation may be enhanced along the Yakima and Naches Rivers as a result of the project. At this point it is premature to identify additional wetland and riparian mitigation that may be necessary.

The creation of the Wymer Reservoir would result in the loss of existing large trees and snags within the footprint of the reservoir. Large trees and snags are used by raptors and many other birds as perches for foraging and roosting. Artificial perches should be installed on selected areas adjacent to the new reservoir to provide perches for bald eagles, osprey and other raptors. These structures would, in the short term, replace trees and snags that would be lost due to the creation of the Wymer Reservoir. The Service would be willing to work with Reclamation to identify appropriate sites and specifications for artificial perches.

> Should it appear that the development of artificial perches successfully enhance the area for raptors we would work with the Service and others to site and install the perches.

Based on HEP analyses conducted within the potential Wymer Reservoir footprint, the Service determined that 378 average annual habitat units for the brewer's sparrow would be lost if the reservoir were created. The Service recommends that Reclamation work to create, restore and/or protect the amount of shrub-steppe habitat that would lead to production of a similar number of habitat units, elsewhere within the Yakima River Basin.

Plant surveys should be conducted for the Sukdorf's monkey-flower (federal species of concern), prior to final selection of this alternative, in any habitats that are suitable for its existence within the Wymer Reservoir Affected Area. The Service would be willing to work with Reclamation in completion of plant surveys.

Should an action alternative involving Wymer Reservoir be selected, this recommendation will be implemented.

Protect any discovered populations of Suksdorf's monkey-flower that are located adjacent to the Wymer Reservoir from recreation, residential and agriculture field development, grazing, invasion of non-native plants and possible spray drift from adjacent agriculture fields. Protection measures may include obtaining a conservation easement for the land containing the population or acquiring the land. The area could be fenced to exclude livestock and a weed control program developed to prevent invasion of non-native plants.

Populations of Suksdorf's monkey-flower could be included in and mitigation lands acquired, depending upon the value of the lands for mitigation and the availability of the lands for acquisition. A land management plan would need to be developed for acquired lands to address issues like weed control.

Plant surveys should be conducted for basalt daisy (federal Candidate species), prior to final selection of this alternative, in any habitats that are suitable for its existence within the Wymer Reservoir Affected Area. The Service would be willing to work with Reclamation in completion of plant surveys.

Should an action alternative involving Wymer Reservoir be selected, this recommendation will be implemented.

Protect any basalt daisy populations, discovered during new surveys that are located adjacent to the Wymer Reservoir from recreation, residential and agriculture field development, grazing, invasion of non-native plants and possible spray drift from adjacent agriculture fields. Protection measures may include obtaining a conservation easement for the land containing the population or acquiring the land. The area could be fenced to exclude livestock and a weed control program developed to prevent invasion of non-native plants.

– Populations of basalt daisy could be included in and mitigation lands acquired, depending upon the value of the lands for mitigation and the availability of the lands for acquisition. A land management plan would need to be developed for acquired lands to address issues like weed control.

Based on the significant loss of wildlife habitat that would occur with the creation of this reservoir, the Service recommends that Reclamation work to establish a wildlife management area adjacent to the reservoir in areas that would provide suitable wildlife habitat. This would likely attract some replacement species associated with open water bodies, such as shorebirds and waterfowl. The U.S. Army's Yakima Training Center owns property along the extreme eastern end of the potential reservoir footprint. Reclamation could inquire as to the availability of any lands that could be protected to further protect that adjacent area.

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Wymer Reservoir with the Yakima River Pump Exchange

Bury pipelines underground and restore native vegetation along the pipeline corridor. The Service would be willing to provide a list of native plants for this purpose. This measure would also require that Reclamation develop a vegetation maintenance and monitoring plan, performance criteria, and clear goals and objectives that would need to be met over a stipulated timeline, to ensure the success of this mitigation effort.

> Most of the pipeline corridor would be on private land for which Reclamation would seek an easement but not fee title ownership. We will have to work with the involved land owner on any revegetation plans and meet their needs as well. Large portions of the corridor would be on developed lands including agricultural, rural and urban uses. Revegetation with native species would not be appropriate in most of these locations.

Locate any above ground structures in areas that would cause minimal disturbance to wildlife and associated habitats. Potential disturbances to be avoided include; creation of any barriers to, or fragmentation of movement corridors, loss of habitat, degradation of remaining habitat, and invasion of exotic species.

> As noted above large portions of the corridor would be in developed areas including lands being used for agricultural, rural and urban uses. Impacts to wildlife along the corridor are not expected to be significant. Where valuable habitat for wildlife is present they would be avoid to the extent practicable.