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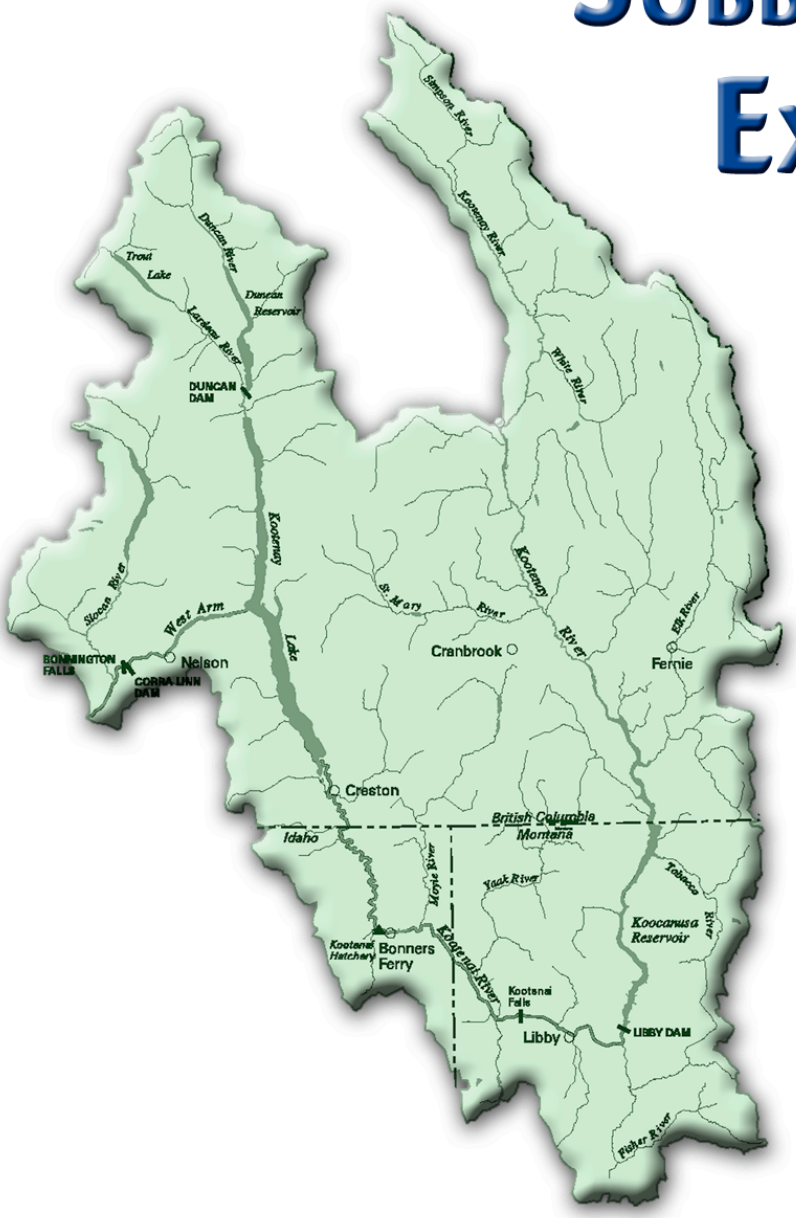
Kootenai River Subbasin Executive Summary



A report prepared by KTOI and MFWP for the Northwest Power and Conservaton Council

A summary of the Kootenai Subbasin Assessment, Inventory, and Management Plan

Reservation of Rights

A number of governments and agencies participated in the development of this Kootenai Subbasin Plan, Part I (Assessment Volume), Part II (Inventory Volume), and Part III (Management Plan Volume), its appendices, and electronically linked references and information (hereafter Plan). The primary purpose of the Plan is to help direct Northwest Power Planning Council funding of projects that respond to impacts from the development and operation of the Columbia River hydropower system.

Nothing in this Plan, or the participation in its development, is intended to, and shall not be interpreted to, compromise, influence, or preclude any government or agency from carrying out any past, present, or future duty or responsibility which it bears or may bear under any authority.

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Table of Contents

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Executive Summary

Subbasin Assessment

What is the Assessment?

The primary purpose of the assessment is to bring together and synthesize technical information so that it can be used to develop the biological objectives that form the foundation of the management plan. The assessment begins with an overview of the subbasin environment. It examines in some detail the major biomes found in the subbasin—aquatic, riparian/wetland, grassland, and coniferous forest. Each of these biomes is evaluated in terms of ecological function and process and how human activities have affected those functions and processes. For each biome we also describe the current condition and several reference conditions. The assessment also examines the status of six aquatic focal species (bull trout, westslope cutthroat trout, Columbia River redband trout, kokanee, burbot, and white sturgeon) and the status of the environment for target wildlife species. The assessment also includes a detailed aquatic evaluation of each 6th-field HUC in the subbasin and a terrestrial assessment of various units and subunits within each of five terrestrial biomes. It includes a ranking of the restoration potential and protection value of each 6th field HUC and each subunit. The last chapter is an interpretation and synthesis of the findings, and that sets the stage for the objectives that make up the bulk of the management plan, which is part III of the subbasin plan. A brief summary of each of the major sections of the assessment follows.

Overview

The Kootenai River Subbasin is situated between 48° and 51° north latitude and 115° and 118° west longitude and includes within its boundaries parts of southeastern British Columbia, northern Idaho, and northwestern Montana. It measures 238 miles by 153 miles and has an area 16,180 sq miles. Nearly two-thirds of the Kootenai River's 485-mile-long channel and almost 70 percent of its watershed area, is located within the province of British Columbia. The Montana part of the subbasin makes up about 23 percent of the watershed, while the Idaho portion is about 6.5 percent (Knudson 1994). The primary focus of this assessment is on that part of the subbasin that falls within the U.S.; those parts of the subbasin upstream and downstream in British Columbia are covered in less detail.

The Upper Kootenai River watershed (all of the Montana portion of the

subbasin except the Fisher and Yaak watersheds) encompasses 2,290 square miles (1,465,600 acres). Land ownership is 78.5 percent U.S. Forest Service, 1.7 percent State of Montana, and 19.8 private and other public entities. The Fisher River watershed encompasses 817 square miles (522,880 acres). Ownership in the Fisher watershed is 36.5 percent U.S. Forest Service, 4.1 percent State of Montana, and 59.4 percent private and other public entities. The Yaak River watershed encompasses 611 square miles (391,040 acres), 96.4 percent of which is managed by the U.S. Forest Service. Another 3.6 percent is in private ownership or managed by other public entities. The Lower Kootenai (all of the Idaho portion of the subbasin except the Moyie watersheds) encompasses 889 square miles (568,800 acres), of which 76.7 percent is managed by the U.S. Forest Service. Another 23.3 percent is in private ownership or is managed by other public entities. The Moyie River encompasses 208 square miles (133,120 acres). Land ownership in the Moyie is 99.7 percent U.S. Forest Service and 0.3 percent private and other public entities.

Climate

The Kootenai River Subbasin's climate is affected by both modified maritime and continental influences. Maritime influences are dominant in the winter and result in rain or snow. Continental influences are generally dominant in the summer. Winters are neither as wet nor as warm as Pacific coastal areas, but are generally warmer and wetter than areas to the east. The dominant maritime influence gives way to continental influences as one moves eastward through the subbasin. Weather patterns are complex, with local variations stemming from differences in elevation.

Geology

Mountain ranges trending north to northwest separated by long straight valleys characterize the subbasin. Except for the relatively broad, flat valleys in these trenches where the terrain is moderate; the area is typified by narrow valleys and rugged steep slopes with frequent rock outcroppings. Bedrock is chiefly folded and faulted crustal blocks of metamorphosed, sedimentary rock materials of the Precambrian Belt series—erosion-resistant siliceous argillites, quartzites, and impure limestones that have been subjected to low-grade metamorphism. Granitic intrusions (sills, stocks, and batholiths) occur throughout the subbasin.

Hydrology

The Kootenai River has a mean annual discharge of nine million acre-feet and a flow rate at its mouth of just under 30,650 cubic feet per second. Mountains in the subbasin receive about 70 to 80 percent of their precipitation as snow. The melting of this snowpack during the spring and summer months produces a characteristic "snowmelt hydrograph" in which peak runoff occurs between April and June.

Under the terms of the Columbia River Treaty, the U.S. Army Corps of Engineers built Libby Dam in 1973, creating Koocanusa Reservoir (known also as Koocanusa Lake or Libby Reservoir), which spans the Canada-USA border. Koocanusa Reservoir is a 90-mile-long storage reservoir with a surface area of 188 km^2 (46,500 acres) at full pool. It is located upstream from the Fisher River confluence and east of Libby, Montana. The dam has a usable storage of approximately 4,930,000 acre feet and gross storage of 5,890,000 acre feet. The primary benefit of the project is power production. With the five units currently installed, the electrical generation capacity is 525,000 kW. The maximum discharge with all 5 units in operations is about 26,000 cfs. An additional 1,000 cfs can be passed over the spillway without causing dissolved gas supersaturation problems (USACE 2002). The surface elevation of Koocanusa Reservoir ranges from 2,287 feet to 2,459 feet at full pool. Presently, operations are dictated by a combination of power production, flood control, recreation, and special operations for the recovery of ESA-listed species, including Kootenai River white sturgeon and bull trout and salmon in the lower Columbia River.

Along with the Libby Dam/Koocanusa Reservoir complex, smaller dams are located on the Elk, Bull, and Goat Rivers on the Canadian side and on the Moyie River and Smith and Lake Creeks in the U.S.

When Kootenay Lake was impounded, the water level increased 7.8 feet, and now the annual drawdown is 9.8 feet. Kootenay Lake stretches 66.4 miles from the tip of its North Arm, near Lardeau, to the tip of its South Arm, near Creston and has a 28 mile-long West Arm jutting from Balfour to Nelson. The total lake covers 150.5 square miles. On average, its depth is 308 feet, and its width 2.3 miles. A total of 56 percent of the inflow to the lake is regulated by dams. The outflow from the West Arm, near Nelson, is regulated by the Corra Linn Dam (Living Landscapes 2003).

Vegetation

Vegetation of the Kootenai Subbasin is typical of the Northern Rocky Mountain Forest-Steppe-Coniferous Forest-Alpine Meadow Province (Bailey et al. 1994). Engelmann spruce, subalpine fir, and lodgepole grow at higher elevations, giving

way to forests of mostly Douglas-fir, lodgepole, and western larch, at mid to low elevations. Other common tree species include mountain hemlock, western hemlock, western redcedar, grand fir, ponderosa pine, western white pine, and grand fir. Some areas, like the Selkirk Mountains and portions of the Purcells and Rockies, also support whitebark pine, which is declining due to a combination of diseases, insect infestations and fire suppression. On river floodplains there is ponderosa pine, Douglas-fir, black cottonwood, aspen, paper birch, willow, chokecherry, serviceberry, alder, dogwood, rose, and snowberry. Willows, alder, aspen, dogwood, cattails, meadow grasses, and sedges dominate wetlands. Much of the valley bottom in the flood plain along the river from Bonners Ferry to Kootenay Lake has been converted to crop production.

Species at Risk

The Federal government has classified nine species of plant and animals that occur within the Kootenai River Subbasin as threatened (T) or endangered (E) under the Endangered Species Act. They include the gray wolf (T), woodland caribou (E), grizzly bear (T), Canada lynx (T), bald eagle (T), bull trout (T), white sturgeon (E), water howellia (T), and Spalding's catchfly (T). The peregrine falcon was formerly listed as Endangered but was delisted in 1999. It is now considered recovered subject to five years of monitoring.

Focal and Target Species

As part of this assessment, fish and wildlife managers in the subbasin were asked to develop a subset of fish and wildlife species that will be used to characterize the status, functions and management actions in the subbasin. Members of the Kootenai Subbasin Technical Team selected bull trout, westslope cutthroat trout, Columbia River redband trout, kokanee, burbot, and white sturgeon as the aquatic focal species. The Team selected these species based upon their population status and their ecological and cultural significance.

For the terrestrial environment, the Technical Team took a multi-species approach as opposed to identifying individual focal species. The team identified 78 terrestrial species, which we call target species. These were chosen because: (1) they have been designated as a Federal endangered or threatened species or have been otherwise designated a priority species for conservation action, (2) they play an important ecological role in the subbasin (for example as a functional specialist or as a critical functional link species), or (3) they possess economic or cultural significance to the people of the Kootenai Subbasin.

Characterization of Biomes

For the purposes of this assessment, we divided the subbasin into six biomes: aquatic, riparian, wetland, grassland/shrub, xeric forest, and mesic forest. We describe the critical functional processes that occur in each of these biomes and how humans have altered those processes. We also describe four reference conditions: presettlement (1850), present (2004), future potential (2050), and future no action (2050 with no change in current management).

Aquatic Biome

During presettlement times aquatic and hydrologic processes and functions were intact. Dams, dikes, diversions, groundwater withdrawls, roading, channelization, logging, agricultural and grazing practices, the introduction of exotic species, developments, and other human activities have altered these functions and processes. Consequently, water quality, streamflows, streambank stability, sedimentation, channel diversity and other habitat attributes have been degraded, and native fish species have declined. The magnitude and persistence of these impacts varies widely.

In its assessment of the entire Kootenai River Subbasin, the Pacific Watershed Institute (1999) characterized tributary aquatic habitat conditions as ranging from moderately altered to highly altered. This conclusion was based on qualitative observations. In 2002, the Kootenai National Forest finished its assessment of the Upper Kootenai in Montana (defined as the 2,250 square mile Kootenai River drainage extending from the Canadian border south-southwest to the Idaho border, but excluding the Fisher and Yaak watersheds). The assessment rated the watershed condition or integrity of sixty-two 6th-field HUCs and found that six HUCs (10%) had high integrity, twenty-three (37%) moderate integrity, and thirty-three (53%) low integrity.

In a review and synthesis of Kootenai River mainstem studies, the Pacific Watershed Institute identified the following changes as the most significant to the sustainability of aquatic life in the basin: loss of fisheries habitat structure and area; a broad swing in nutrient levels, alteration of flow by the operation of Libby Dam, alteration of temperature and discharge from Libby Dam, and heavy metals contamination and effects of sublethal amounts on aquatic life cycles. Other significant changes include: the introduction of nonnative species and stocks that compete for similar foodbase and habitat or contaminate the native gene pool; reduced availability and overall quality of habitat in the mainstem and tributary streams; and the lack of recovery from large fisheries harvest levels of the mid-century.

Riparian/Wetland Biome

A number of human activities have caused significant losses in riparian and wetland acres or substantially impaired riparian function. Some of the most serious impacts have come from water impoundment and diversion, river diking, stream channel straightening, wetland draining, livestock grazing, urban and suburban development, land clearing for agriculture, road development, heavy recreational demand, fires that burn outside the range of natural variability, the elimination or reduction of populations of native organisms such as beavers, the introduction of exotic species, and overall watershed degradation. Wetlands and riparian areas have also been impacted by the development of surrounding uplands (especially cabins and rural subdivisions along shorelines), contaminants, invasion of nonnative and noxious plants, introduction of nonnative animals, livestock grazing, and disturbance from increasing recreational use (NWPPC 2000).

Grasslands

During presettlement times, natural fire frequencies cleared organic debris, encouraged perennial grasses, and played key thermal and nutrient cycling roles. Over the past one hundred years fires have been mostly excluded, there have been invasions of woody and exotic plant species. Areas have been overgrazed and converted to cropland or other uses. Soils crusts have been disturbed, adversely affecting the rates of nitrogen fixation and soil stability, fertility, structure, and water infiltration. Native plant species have been significantly reduced as has the value of grasslands to native wildlife.

Coniferous Forest

During presettlement times, low-elevation dry forests were characterized by large, widely spaced ponderosa pine trees maintained by frequent, low-intensity fires. At mid and higher elevations, cool, moist sites supported fire-dependent, seral old growth trees. Wildlife easily moved across large habitat blocks. Over the last 100 years, large trees have been harvested and fires have been excluded. Shade tolerant species, more prone to disease and lethal fires have increased. Habitats have been roaded. Now, stands tend to be overstocked compared to historic conditions, especially on drier sites. Fire regimes have shifted to more lethal fires. Patch sizes are smaller, and the amount of interior habitat is less than historic conditions. Existing forests are more fragmented.

Focal Species Descriptions

Bull Trout

In the final ESA listing rule for bull trout, five subpopulations were recognized within the Kootenai River Subbasin (USFWS 1998). These included three portions of the mainstem system: (1) Upper—upstream from Libby Dam, (2) Middle—from Libby Dam downstream to Kootenai Falls, and (3) Lower— downstream from Kootenai Falls through Idaho to the United States/Canada border. The two disconnected subpopulations (referred to as disjunct by the Montana Bull Trout Scientific Group), in Bull Lake (MBTSG 1996b) and Sophie Lake (MBTSG 1996c), were considered separate subpopulations. At the time of listing, all Kootenai River bull trout subpopulations were considered to have unknown status and population trend, and the Sophie Lake subpopulation was considered to be at risk of stochastic extirpation due to its single spawning stream and small population size.

In the HUC-by-HUC assessment of all Kootenai Subbasin 6th-field HUCs, the technical team concluded that of the habitat attributes considered most important to bull trout (when averaged across all the HUCs) are high temperature, riparian condition, channel stability, and fine sediment, in that order. In the regulated mainstem, they are altered flows, riparian condition, fine sediment, and channel stability. In streams in the B.C. portion they are channel stability, fine sediment, riparian condition, and habitat diversity. In reservoirs they are migratory obstructions, volumetric turnover rates, hydraulic regime, and trophic status. The rankings vary at the HUC-4 scale. This phase of the HUC assessment considered only habitat factors.

Major impacts affecting bull trout stem from dams, past forest practices, grazing, agricultural practices, roads, mining, residential development, and past fish fisheries management activities.

Westslope Cutthroat Trout

Westslope cutthroat occur in about 1,440 linear miles of stream habitat in the U.S. portion of the Kootenai River Subbasin. Abundance data are available for 1,051 of those stream miles. Approximately 70 percent of those have stocks that are considered abundant. Data for the Montana portion of the Kootenai from the Interior Columbia Basin Ecosystem Management Project indicate westslope cutthroat trout stocks are strong or predicted strong in 15 HUCs, depressed or predicted depressed in 159 HUCs, and absent or predicted absent in the remaining 11 HUCs. In the Idaho portion of the Kootenai River drainage, westslope cutthroat trout presence is known or predicted in 41 HUCs and absent in two.

Westslope cutthroat trout status is known or predicted strong in four HUCs and known or predicted depressed in 37 HUCs.

Shepard and others (2003) reported that among the streams surveyed in the U.S. portion of the Kootenai Subbasin, stocks of unintrogressed cutthroat trout occupied 142.5 miles; stocks that are less than 10% introgressed occupied 29.5 miles; stocks between 25% and 10% introgressed occupied 86.3 miles; and stocks greater than 25% introgressed occupied 576.5 miles. Westslope cutthroat trout stocks inhabiting 197.1 miles of stream are suspected to be unintrogressed (with no record of stocking or contaminating species present), and stocks inhabiting 1,498 miles are potentially altered (potentially hybridized with records of contaminating species being stocked or occurring in stream).

The Montana Chapter of the American Fisheries Society (MTAFS) identified the following four factors as the primary reasons for the decline of westslope cutthroat trout in Montana: over exploitation, genetic introgression and competition from nonnative fish species, and habitat degradation.

In a HUC-by-HUC assessment of all Kootenai Subbasin 6th field HUCs in the U.S., our technical team concluded that of the habitat attributes considered most important to resident salmonids, the most limiting for westslope cutthroat trout when averaged across all the HUCs in the U.S. portion of the subbasin are riparian condition, fine sediment channel stability, and habitat diversity, in that order. In the B.C. portion of the subbasin they are riparian condition, habitat diversity, channel stability, and fine sediment. This phase of the HUC assessment considered only habitat factors.

Columbia River redband trout

The status of Columbia River redband trout populations in Montana is presumed to be stable (J. Dunnigan, MFWP, pers. comm. 2004). On the Idaho Panhandle National Forest, little is known about the status of Kootenai-drainage Columbia River redband trout populations. In all but five of the 6-field HUCs in the Idaho portion of the Kootenai, the Columbia River redband trout status is described by the USFS as "presence unknown". In three HUCs, redbands are known to be present but their population status is unknown, and in two they are present but depressed. PWI (1999) reports that the rainbow trout population in the lower Kootenai River itself (downstream of Kootenai Falls) may be the strongest stock of all the salmonids, but that the genetic integrity of the native interior redband has been significantly compromised through stocking of non-native rainbow strains and hybridization with cutthroat trout.

In an assessment of Kootenai Subbasin 6th field HUCs, we concluded the most limiting habitat attributes for Columbia River redband trout in U.S.

tributaries are riparian condition, fine sediment, high temperature, and channel stability, in that order. In the mainstem, the most limiting were altered hydrograph due to Libby Dam, riparian condition, low temperature, and fine sediment. In the B.C. portion of the subbasin the most limiting habitat attributes include riparian condition, channel stability, fine sediment, and habitat diversity. The rankings vary at the HUC-4 scale. Biological limiting factors in U. S. tributaries include non-native species, system productivity, and connectivity between the mainstem and tributaries. Biological limiting factors in the U. S. mainstem include non-native species and system productivity. In lakes the most limiting attributes are hydraulic regime, migratory obstructions, shoreline condition, and temperature.

Kokanee

From a Subbasin perspective, most kokanee populations appear relatively stable and abundant, bearing in mind that the impacts of the Duncan and Libby dams were never fully assessed. Therefore pre-dam population levels are unknown. Abundance is a relative term, with today's observations of abundance most likely considered sparse by previous generations of Native Americans and early Europeans. There are currently six populations of kokanee in the Kootenai River Subbasin in Idaho, Montana, and British Columbia.

Native kokanee salmon runs in lower Kootenai River tributaries in Idaho have experienced dramatic population declines during the past several decades (Ashley and Thompson 1993; Partridge 1983). The kokanee that historically spawned in these tributaries inhabited the South Arm of Kootenay Lake in British Columbia. Native kokanee are considered an important prey item for white sturgeon and also provided an important fishery in the tributaries of the lower Kootenai River (Partridge 1983; Hammond, J., B.C. MELP, per. comm. 2000). Kokanee runs into North Idaho tributaries of the Kootenai River that numbered into the thousands of fish as recently as the early 1980s have now become "functionally extinct" (Anders 1993; KTOI, unpublished data). Since 1996, visual observations and redd counts in five tributaries found no spawners returning to Trout, Smith, and Parker Creeks, while Long Canyon and Boundary Creeks had very few kokanee returns.

In a HUC-by-HUC assessment of all Kootenai Subbasin 6th field HUCs in the U.S., the technical team concluded that of the habitat attributes considered most important to resident salmonids, the most limiting for kokanee, when averaged across all the HUCs in the U.S. portion of the subbasin, were low flow, channel stability, high flow, and fine sediment, in that order. In the B.C. portion of the subbasin they were channel stability, fine sediment, riparian condition,

habitat diversity. In the lakes assessed, the limiting factors were hydraulic regime, volumetric turnover rates, migratory obstructions, and trophic status.

Burbot

Significant adult burbot populations in the Kootenai Subbasin currently exist in Koocanusa Reservoir and Trout Lake, with remnant populations between Libby Dam and Kootenai Falls and in the South Arm of Kootenay Lake. Populations thought to have been functionally extirpated existed in the riverine portion of the Kootenai Subbasin and in the West Arm of Kootenay Lake. Very few burbot remain in the Kootenai River Subbasin between Kootenay Lake and Kootenai Falls. In this reach of the Subbasin, the greatest concentration occurs near and in the Goat River in B.C., and even there the numbers are quite small.

No single factor appears responsible for the collapse of burbot in the Kootenai River Subbasin. Rather, a combination of overharvest, habitat alteration, and ecosystem degradation appears to be the cause (KRBCC 2002). Possible linkages may exist (or have existed) among many of the following interrelated hypotheses of burbot collapse:

- Increased winter water flow
- Increased winter water temperature
- Environmental degradation
- Changes in primary and secondary productivity
- Kootenay lake flood control
- Altered ecological community composition.

White Sturgeon

On September 6, 1994, the U.S. Fish and Wildlife Service listed the Kootenai River population of white sturgeon as an endangered species *(59* FR 45989) under the authority of the Endangered Species Act of 1973, as amended. The global heritage status rank for the Kootenai River white sturgeon is T1 (critically imperiled) because of the fishes limited range in the Kootenai River of British Columbia, Idaho, and Montana; the population is isolated and small; there has been very limited reproduction since 1977 (figures 4.22 and 4.23); and the population has been negatively impacted by river regulation and probably other habitat alterations. The state/province heritage rank for Idaho, Montana, and B.C. is S1 (critically imperiled).

Empirical demographic modeling during 2002 revealed increasingly imperiled demographic status for the endangered Kootenai River white sturgeon population. Modeling suggested 90, 75, and 72 percent reductions in population abundance, biomass, and annually available spawners, respectively, during the past 22 years (1980-2002), and a current population "halving time" of 7.4 years. Recruitment failures continue to drive the decline of the Kootenai sturgeon population. No significant recruitment of juvenile sturgeon has occurred since at least 1974 and consistent recruitment has not occurred since at least 1965. A few wild juveniles are periodically captured (0-11 annually). Of 659 recently captured juveniles, 620 were hatchery-reared and 39 (~6 percent) were wild, confirming very low natural recruitment. Managed (augmented) flows have not stimulated recruitment to date as hoped. Thus, prospects for restoring natural production remain uncertain. Furthermore, this population may be currently or intermittently stock-limited (Anders et al. 2002).

A series of factors appear to be limiting natural recruitment in the Kootenai River white sturgeon population. These factors fall into two general categories: demographic stock limitation and post-spawning early life mortality factors. Among the early life mortality factors are unfertilized eggs; egg suffocation; egg predation; fry, fingerling predation; food limitations; and first overwinter mortality.

External Environmental Conditions Impacting the Subbasin Focal Species

The primary external factors impacting the Kootenai Subbasin fish and wildlife resources come from the mainstem Columbia River federal hydropower operations, which profoundly influence dam operations as far upstream as headwater reservoirs. Dam operations affect environmental conditions in the reservoirs upstream and rivers downstream from Libby Dam. The abundance, productivity and diversity of fish and wildlife species inhabiting the subbasin are dependent on their immediate environment that ebbs and flows with river management. Mainstem Columbia River operations affect native fish and wildlife in the following ways:

- Unnaturally high flows during summer and winter negatively impact resident fish.

- Summer flow augmentation causes reservoirs to be drafted during the biologically productive summer months. This impacts productivity in the reservoirs.

- Drafting the reservoirs too much prior to receiving the January 1 inflow forecast places the reservoirs at a disadvantage for reservoir refill. This is especially important during less-than-average water years.

- Flow fluctuations caused by power, flood control or fish flows create a wide varial zone in the river, which becomes biologically unproductive.

- The planned reservoir-refill date in the NOAA Fisheries BiOp of June 30, will cause the dam to spill in roughly the highest 30 percent of water years. This is because inflows remain above turbine capacity into July on high years. That means the reservoirs fill and have no remaining capacity to control spill, which causes gas super saturation problems.

- Flow fluctuations caused by power, flood control or fish flows cause sediments to build up in river cobbles. Before dams were built, these sediments normally deposited themselves in floodplain zones that provided the seedbeds necessary for establishment of willow, cottonwood, and other riparian plant communities. Young cottonwood stands are needed to replace mature stands that are being lost to natural stand aging as well as adverse human activities such as hardwood logging and land clearing.

Target Species

The heart of our terrestrial target species assessment is focused on the condition of target species habitats, specifically the target biomes within each 4th-field HUC. We developed and employed a spreadsheet tool called Terrestrial Biome Assessment (TBA) that utilizes existing data and the knowledge of professional biologists who have worked in the subbasin for many years to assess the current condition of subbasin terrestrial habitats. In addition to rating the current condition of specific geographical areas (biome subunits), this process identified the major impacts affecting each biome. On the regulated mainstem, the chief impacts limiting wildlife populations in the Wetland and Riparian Biomes are altered hydrographs and diking. The chief impacts limiting wildlife populations in the Wetland Biome on a subbasin scale are roads, land conversion, overgrazing, forest management, impoundments, and reductions in nutrients/productivity. The impacts limiting populations in the Riparian Biome on a subbasin scale are forest management, land conversion, exotic species, human/wildlife conflicts, impoundments, and reductions in nutrients/productivity. In the Grassland/Shrub

Biome, the impacts are forest encroachment, land conversion, overgrazing, human developments, and exotic species. In the Xeric (Ponderosa Pine) Forest Biome, the chief limiting factors are fire exclusion, forest management, and exotics. In the Mesic Forest Biome the chief impacts are forest management, fire exclusion, exotic species (noxious weeds), roads, and forest insects and diseases.

HUC/Unit Classification

Technical team members from the Kootenai Subbasin used a spreadsheet tool called Qualitative Habitat Assessment (QHA) to assess the current condition of each stream in the subbasin (at roughly the HUC-6 scale) and its value to each of our focal species. The version of QHA that we used considered both habitat and nonhabitat parameters. We then used the habitat scores derived from QHA to group streams into a classification scheme based on the level of degradation in the watershed and the streams protection value. The team also evaluated selected lakes and reservoirs based on the level of degradation of the watershed, the natural capability of the waterbody, and species interactions. Class 1 waters are the most intact with high protection values for a given focal species. Class 2 waters have low to moderate levels of degradation and high to moderate protection value. Class 2.5 waters have a high restoration priority driven by the ESA needs or the needs of species of concern. Class 3 waters have a moderate to high degree of degradation and low protection value. Class 3.5 waters have a high degree of degradation and low protection value.

Interpretation and Synthesis

The assessment estimates that the abundance and productivity of bull trout is currently at about 60 percent of what it was historically. The abundance and productivity of westslope cutthroat trout is currently at about 20 percent of what it was historically. The abundance of Columbia River redband trout is estimated at 10 percent of historic, while kokanee are at about 40 to 50 percent of historic. White sturgeon and burbot are both estimated to be at about 0 to 10% of historic. Target wildlife species are estimated to be at about 50 to 70 percent of what they were historically.

Working Hypothesis

Resident Salmonids

We developed the following four-part working hypothesis for resident salmonids at the subbasin scale in the U.S. portion of the subbasin:

1. The primary habitat factors limiting resident salmonids in the regulated mainstem portion of the subbasin are an altered hydrograph, riparian condition, turbidity and fine sediments, connectivity, and an altered thermal regime. Reduced nutrient loading to the Kootenai River downstream of Libby Dam (due to Koocanusa Reservoir acting as a nutrient sink) is also a primary factor limiting productivity of native species.

2. Habitat factors limiting resident salmonids in headwater and tributary streams on a subbasin scale are degraded riparian areas, channel stability, fine sediment, an altered thermal regime, and habitat diversity.

3. In lakes and reservoirs, the primary habitat factors for resident salmonids on a subbasin scale are hydraulic regime, migratory obstructions, shoreline conditions, and volumetric turnover rates.

4. The presence of nonnative species is a primary biological factor limiting resident salmonids on a subbasin scale.

Burbot

We developed the following working primary (numbers) and secondary (letters) hypotheses to explain limitation for burbot at the subbasin level in the Kootenai River Subbasin:

1. Recent, ongoing recruitment failure is the main external driver of extinction for burbot in the Kootenai River basin.

2. Past overharvest (contributing to current recruitment failures), and post-development physical and biological changes in the Kootenai River ecosystem during the past 75 years have reduced the size and recruitment frequencies of burbot in the Kootenai River Subbasin.

    a. Currently used spawning and rearing habitats are altered and degraded, and along with the loss of large-river floodplain ecosystem functions and dynamics, appears to be an important external driver of extinction.

3. The current demographic conditions of riverine burbot populations, as well as post-development and post-hydro may have reduced success of spawning and spawning migrations.

a. Reduced system productivity, altered thermographs and hydrographs in the post-dam system, and indirect reverberating ecological responses to system change contribute to burbot extinction risk.

White Sturgeon

We developed the following working primary (numbers) and secondary (letters) hypotheses to explain limitation for white sturgeon at the Subbasin level in the Kootenai River subbasin:

1. Recent decadal recruitment failure is the main external driver of extinction for white sturgeon in the Kootenai River basin.

2. Current effects of post-development physical and biological changes in the Kootenai River ecosystem during the past 75 years have reduced the size and all but eliminated natural recruitment of the wild Kootenai River white sturgeon population.

    a. Currently used spawning and rearing habitats are altered and degraded, and along with the loss of large-river floodplain ecosystem functions and dynamics, appears to be an important external driver of extinction.

3. The current demographic condition of the population (n~600, 7.4 yr mean halving time) appears to be the acute internal driver of extinction.

    a. Reduced system productivity, predation on and suffocation of early life stages, and indirect reverberating ecological responses to primary system change contribute to extinction risk.

Wildlife

For the terrestrial system at the subbasin scale, we have developed the following working hypotheses:

1. The chief impacts limiting wildlife populations in the Mesic Forest Biome on a subbasin scale are forest management, fire exclusion, exotic species (noxious weeds), roads, and forest insects and diseases.

2. The chief impacts limiting wildlife populations in the Grassland/Shrub Biome on a subbasin scale are forest encroachment, land conversion, overgrazing, human developments, and exotic species.

3. On the regulated mainstem, the chief impacts limiting wildlife populations in the Riparian Biome are altered hydrographs and diking.

4. The chief impacts limiting wildlife populations in the Riparian Biome on a subbasin scale are forest management, land conversion, exotic species, human/wildlife conflicts, impoundments, and reductions in nutrients/productivity.

5. On the regulated mainstem, the chief impacts limiting wildlife populations in the Wetland Biome are altered hydrographs and diking.

6. The chief impacts limiting wildlife populations in the Wetland Biome on a subbasin scale are roads, land conversion, overgrazing, forest management, impoundments, and reductions in nutrients/productivity.

7. In the Xeric (Ponderosa Pine) Forest Biome, the chief limiting factors are fire exclusion, forest management, and exotics.

Near-term Opportunities for Protection and Restoration

Class 1 and Class 2 waters for bull trout and westslope cutthroat trout and Class 1 and Class 2 terrestrial subunits are considered near-term opportunities for protection (Class 1) and restoration (Class 2).

Subbasin Inventory

What is the Inventory?

The purpose of the inventory, which is Part II of the Subbasin Plan, is to determine what work is being done for fish and wildlife in the subbasin and how well that work is addressing limiting factors identified in the Assessment. The inventory describes past (within the last five years) and present management plans and restoration and conservation plans, programs, and projects and then assesses how well the various on-the-ground projects are addressing the factors limiting fish and wildlife productivity and abundance.

Existing Protections

Protections for fish and wildlife habitats in the Kootenai Subbasin come in many forms and can include Federal Wilderness designations, wildlife management and conservation areas, natural areas, or various special fisheries or wildlife designations.

Existing Plans and Management Programs

As might be expected, federal, state, tribal and provincial agencies have a broad range of planning documents in place in the Subbasin. They range from general resource management plans like those in place for the Kootenai and Idaho Panhandle National Forests, to ESA-recovery plans for listed species, to fish and wildlife mitigation plans, wetland/riparian area restoration and conservation plans, TMDL plans, and plans for the management of individual species such as elk and black bears. Similarly, there are a broad range of management programs that oversee fish and wildlife management in the subbasin. They operate at the federal, state, tribal, provincial, county, and nongovernmental level, and their activities and responsibilities vary dramatically.

Restoration and Conservation Projects

The following BPA projects are ongoing in the subbasin:

- Project Number 200200200: Assess Surface-Water Flow And Feasibility of Enhancing White Sturgeon Spawning Substrate Habitat, Kootenai R., Idaho.

- Project Number 200200800: Determine the Feasibility of Reconnecting Floodplain Slough Habitat to the Kootenai River

- Project Number 200201100: Implement Floodplain Operational Loss Assessment, Protection, Mitigation and Rehabilitation on the Lower Kootenai River Watershed Ecosystem

- Project Number 198806500: Kootenai River Fisheries Recovery Investigations

- Project Number 199500400: Mitigation For The Construction And Operation Of Libby Dam

- Project Number 200000400: Monitor and Protect Bull Trout for Koocanusa Reservoir

- Project Number 199608702: Focus Watershed Coordination in the Kootenai River Watershed

- Project Number 199404900: Improve the Kootenai River Ecosystem

- Project Number 198806400: Kootenai River White Sturgeon Studies and Conservation Aquaculture

- Project Number 200204400: Purchase Conservation Easement From Plum Creek Timber Company (PCT) Along the Fisher River

In addition, we identified 111 other fish and wildlife restoration and conservation projects funded by BPA and a variety of other agencies and programs. The projects range from removing fish-passage barriers to restoring degraded riparian areas. They include projects as minor as providing an off-stream stockwater development to major reconstruction projects designed to restore stream segments critical to spawning native trout. Some include protecting important habitat through conservation easements and acquisitions, others involve prescribed burning to restore wildlife habitat.

Project Assessment

This part of the assessment examines how effective these various projects have been at addressing the limiting factors identified in the Assessment. Projects were

grouped according to the limiting factor they were intended to address, and these clusters of projects were then evaluated based on how effective they have been. Project effectiveness varied widely depending on the type of project, on the type of habitat it was implemented on, and the species it was intended to benefit.

Subbasin Management Plan

What is the Management Plan?

The Management Plan sets forth desired direction for the subbasin, using a hierarchical approach and taking into account the science, local conditions, concerns, treaty and other reserved rights, and applicable law and policy. The hierarchical approach begins with a vision for the subbasin, then outlines biological objectives and strategies to achieve the objectives. It also includes a monitoring and evaluation plan for the strategies that may be implemented. This plan has a 10-15 year horizon, recognizing that additional information and analysis may indicate the need for periodic refinement.

Vision for the Kootenai River Subbasin

The vision for the Kootenai River Subbasin is the establishment and maintenance of a healthy ecosystem characterized by healthy, harvestable fish and wildlife populations, normative and/or natural physical and biological conditions, and sustainable human communities. Achievement of the Kootenai Subbasin Vision is supported and guided by the following scientific principles of the Fish and Wildlife Program and the guiding principles for the subbasin.

Scientific Framework

Kootenai River Subbasin Planners developed a hierarchical, multi-scale scientific framework to address primary and secondary limiting factors through a series of objectives and strategies. The approach addresses issues at several levels, from broad, basin-wide mitigation requirements to site-specific actions.

Preventing the types of impacts that reduce the overall health of the Subbasin is a major priority. Modifications to dam operation are a basin-wide mitigation requirement because of the far-reaching influence that dam operations have on the environmental conditions of reservoirs and rivers throughout the Columbia River basin. Preventing the introduction and spread of invasive non-native species (aquatic nuisance species or ANS) is another priority.

Onsite mitigation addresses fish and wildlife habitat degradation; fish passage and wildlife-migration barriers; genetic introgression in pure, native fish stocks; and negative interactions between native and non-native fish and wildlife species. Much of the altered habitat can be addressed using techniques that do not require changes in reservoir or river management. Objectives and strategies

also address riparian and floodplain habitat degradation, major sediment and nutrient sources, channel and bank instability, and impacts caused by non-native fish introductions.

Offsite mitigation presents opportunities to create genetic reserves to conserve native species and to increase hunting and fishing opportunities. Complete mitigation of the documented fish and wildlife losses is not currently possible on-site given the state of the science and the degraded state of many of the habitats in the Subbasin. Therefore, off-site mitigation is necessary to achieve acceptable levels of restoration.

Subbasin Objectives

In our assessment, we identified three primary aquatic limiting factors in the Kootenai River Subbasin: (1) impoundment and hydro operations, (2) physical habitat alteration (in addition to impoundments and hydro operations), and (3) the introduction of non-native species. These three aquatic primary limiting factors have resulted in at least 18 important secondary aquatic limiting factors that negatively affect habitat, fish, and wildlife (figure 1). Aquatic objectives and strategies were developed to address all of these limiting factors (table 1).

Our assessment also identified terrestrial limiting factors, and we developed objectives and strategies for each (table 2).

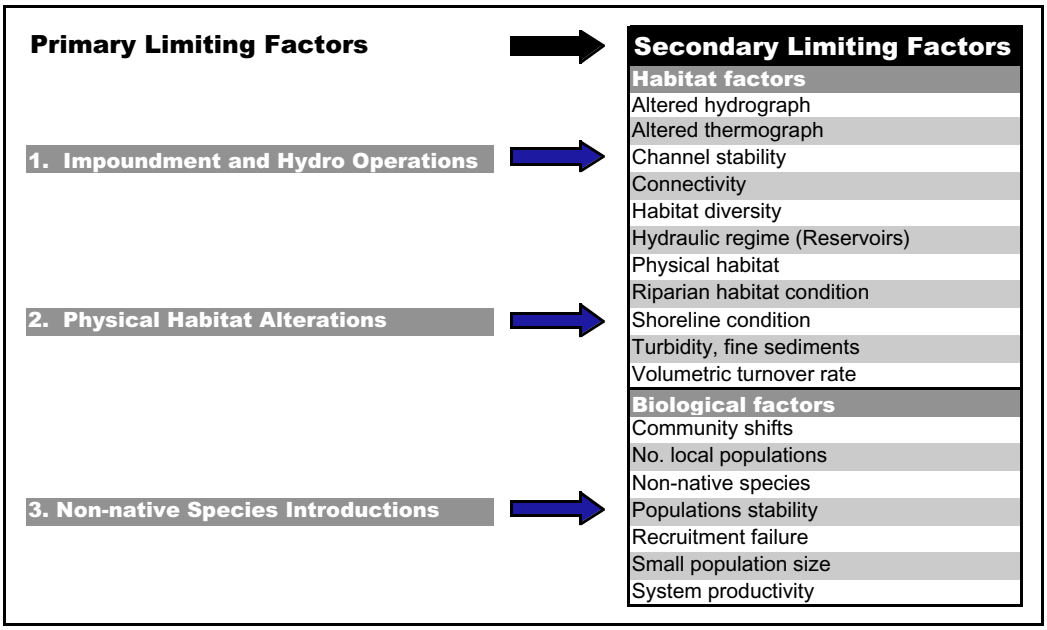

Figure 1. Primary and secondary aquatic limiting factor linkage in the Kootenai River Subbasin.

Table 1. Linkage of secondary aquatic limiting factors and remedial management objectives by habitat type and focal species in the Kootenai River Subbasin. Each objective is supported by multiple management strategies that are described in the series of tables immediately following this section.

Secondary	Habitat Types			Focal Species					
Limiting Factors	Mainstem	Tribs	Reser.	Bull Trout	Sturgeon	Burbot	Kokanee	Redband	WCT
Habitat Factors									
Altered hydrograph	M1	T7		M1, T7	M1	M1, T7	M1, T7	M1, T7	M1, T7
Altered thermograph	M4	T5		M4, T5	M4, T5	M4, T5	M4, T5	M4, T5	M4, T5
Channel stability	M6	T4		M6, T4	M6	M6, T4	M6, T4	M6, T4	M6, T4
Connectivity		T8		T8	T8	T8	T8	T8	T8
Habitat diversity	M5	T6		M5, T6	M5	M5, T6	M5, T6	M5, T6	M5, T6
Hydraulic regime			R3	R3	R3	R3	R3	R3	R3
Class 1 habitat protection		T1		T1		T1	T1	T1	T1
Shoreline condition			R2	R2	R2	R2	R2	R2	R2
Riparian condition	M2	T2		M2, T2	M2, T2	M2, T2	M2, T2	M2, T2	M2, T2
Turbidity, fine sediments	M3	T3		M3, T3	M3, T3	M3, T3	M3, T3	M3, T3	M3, T3
Volumetric turnover rate			R1	R1	R1	R1	R1	R1	R1
Biological Factors									
Community shifts	KOK2, BUR2	KOK2, BUR2	KOK2, BUR2			BUR2	KOK2		
No. local populations	BT1, WCT1	BT1, WCT1	BT1, WCT1	BT1				RBT1	WCT1
Non-native species	BT4	BT4	BT4	BT4				BT4	BT4
Populations stability	BT3	BT3	BT3	BT3					
Recruitment failure	WST2, BUR3	WST2, BUR3	WST2, BUR3		WST2	BR3			
Small population size	BT2, WCT1, KOK3, WST3, BUR4	BT2, WCT1, KOK3	BT2, WCT1, KOK3, WST3, BUR4	BT2	WST3	BUR4	KOK3	RBT2	WCT2
System productivity	BT5, KOK1, WST1, BUR1	KOK1	BT5, KOK1, WST1, BUR1	BT5	WST1	BUR1	KOK1		

Table 10.2. Linkage of terrestrial limiting factors and remedial management objectives, by biome. Each objective is supported by multiple management strategies.

Limiting Factor	Biome					
	Regulated Mainstem	Wetland	Riparian	Grassland/ Shrub	Xeric Forest	Mesic Forest
Altered Hydrograph	WB1 WB2		RP1 RP2			
Diking	WB1 WB2		RP1 RP2			
Land Conversion		WB3	RP3	GS1		
Forest Management		WB3	RP4		XF2	MF2
Human/Wildlife Conflicts			RP3			
Exotics			RP5	GS3	XF3	MF4
Forest Encroachment				GS2		
Overgrazing		WB3		GS4		
Fire Exclusion					XF1	MF1
Roads		WB3				MF3
Human Developments				GS1		
Insects and Disease						MF5

Research, Monitoring and Evaluation (RM&E) Program

The RM&E program provides a framework for monitoring and evaluation of activities implemented under the Plan. Kootenai Subbasin planners are aware of regional (Columbia Basin scale) efforts to standardize monitoring in state federal, and tribal salmon programs. To the extent appropriate, planners will coordinate with the Pacific Northwest Aquatic Monitoring Partnership (Partnership), and will incorporate recommendations for coordinating state, federal, and tribal monitoring practices, as presented in the partnership plan.

Determination of RM&E needs

The Technical and Planning Team determined research and monitoring needs for the Kootenai River Subbasin using Qualitative Habitat Assessment (QHA) and Terrestrial Biome Assessment (TBA) scores and their best collective scientific knowledge. After reviewing outputs from QHA and TBA, the Technical Team used the scores to identify the habitat attributes currently limiting fish and wildlife productivity and abundance in the subbasin. The planning team developed objectives and strategies to address those limiting factors. They will then use the objectives to identify monitoring needs on a project-by-project basis, (i.e. restoration and protection projects will require monitoring activities specific to the strategies employed). Research needs will be defined by gaps in knowledge identified through QHA, TBA, and other analyses.

Development of research and monitoring objectives

Defining research and monitoring objectives is the next logical step in the development of an RM&E Program. Managers in the subbasin will be developing a comprehensive RM&E program pending the completion of an ongoing Adaptive Environmental Assessment and Adaptive Management Workshop scheduled for Kootenai River Subbasin agencies during July 2004. Section 10.3.7 describes evaluation protocols that will be used in the development of the RM&E program.

Ongoing research and monitoring activities

The Management Plan presents an annotated list of ongoing RM&E activities in the Kootenai Subbasin and RM&E activities associated with specific BPA-funded projects.

Consistency with ESA and CWA requirements

Table 3 shows how the Subbasin habitat and biological objectives are reflective of and integrated with recovery goals of ESA recovery plans and where they are supportive of and consistent with the federal Clean Water Act (CWA). The majority of subbasin habitat and biological objectives directly support goals and objectives in relevant ESA recovery plans and involve activities that help satisfy CWA objectives in the Subbasin. Table 3 also shows the priority of each objective.

Prioritization of strategies (Measures/Projects) in the Kootenai Subbasin

As part of the subbasin planning process, planners present an approach for prioritizing management strategies to assist the Council in making recommendations for specific projects for BPA funding.

Table 3. Priority, code, and description of habitat and biological objectives, BPA funded projects that address these objectives, and whether they address ESA and CWA responsibilities. Objectives titles were shortened for inclusion in this table; objecitve codes, full objective titles and supporting strategies can be found in the objectives and strategies tables. Priority Scores: U = Urgent; H = Highly Recommended; R = Recommended Action.

Prioirty Score (U,H,R)	Objective Code	Prioritized Kootenai River Subbasin Objectives (Habitat and Biological)	199404900	199206100	199500400	199608702	198806400	198806500	200000400	200200200	200200800	200201100	Addresses ESA	Addresses CWA
U	M1, RP2, WB1 R3	Restore normative mainstem hydrograph	X		X			X		X		X	X	X
U	BT4 RBT3 WCT3 WB3 RP1 RP5 GS3 XF3 MF4	Suppress and remove non-native species	X	X	X							X	X	
U	BT4 RBT3 WCT3 WB3 RP1 RP5 GS3 XF3 MF4	Reduce and prevent non-native introductions	X	X	X							X	X	
U	T1	Protect Class 1 Habitat			X			X					X	X
U	BT5 KOK1 WST 1 BUR1 WB1 RP2	Restore productivity rates and nutrient concentrations to pre-dam levels	X					X			X	X	X	
U	BT5 RBT2 WCT2 KOK3 WST 3 BUR4	Restore/maintain population size required for populations to persist		X	X			X	X				X	
U	BT3	Restore/maintain population stability	X	X	X		X	X						
U	WST2 BUR3	Restore natural recruitment	X	X				X		X	X	X	X	X
U	M5 WB2 RP1 RP5 M1 M3 GS4 XF, XF2	Restore habitat conditions req d for recruitment	X	X	X			X		X	X	X	X	X
H	M1	Alter hydrograph to remove tributary deltas	X		X			X					X	
H	T7	Restore tributary hydrographs	X								X		X	
H	M2 T2 R2 RP1 RP4 RP5	Restore riparian habitat to reference condition	X	X	X						X		X	
H	M3 T3	Reduced fine sediment input	X	X	X								X	X
H	M3	Coordinate TMDL with req d boil. productivity		X				X					X	X
H	T5	Restore normative thermal regime in tributaries	X	X				X					X	
H	M5 T6 WB2 RP1 RP4 GS2 MF1 MF2 XF1 XF2	Increase habitat diversity to reference levels	X	X	X			X		X	X	X	X	

Table 3 (cont.). Priority, code, and description of habitat and biological objectives, BPA funded projects that address these objectives, and whether they address ESA and CWA responsibilities. Objectives titles were shortened for inclusion in this table; objective codes, full objective titles and supporting strategies can be found in the objectives and strategies tables. Priority Scores: U = Urgent; H = Highly Recommended; R = Recommended Action.

Prioirty Score (U,H,R)	Objective Code	Prioritized Kootenai River Subbasin Objectives (Habitat and Biological)	199404900	199206100	199500400	199608702	198806400	198806500	200000400	200200200	200200800	200201100	Addresses ESA	Addresses CWA
H	R2 RP1 RP4	Protect and revegetate riparian areas	X	X	X						X	X	X	X
H	M6 T4	Improve channel stability to reference levels	X	X	X			X					X	X
H	M3 T3 RP1 WB2	Restore appropriate turbidity levels	X					X		X			X	X
H	T8 WB2 RP1 RP3 GS1 XF2	Improve habitat connectivity		X	X						X	X	X	
H	R1 R3	Increase Libby Reservoir retention time			X									
H	R2	Revegetate top 10 feet of Libby Res. varial zone												
H	R1 R3	Reduce refill failure rate to top 5 of Libby Res.			X									
H	WST4 BUR5	Evaluate contaminant effects	X				X	X					X	X
R	WST4 BUR5	Seek remedies for contamination											X	X
R	M4 T5	Restore normative thermal regime in mainstem	X		X			X						
R	KOK2 BUR2 R2 R4	Rehabilitate native community composition	X	X			X	X			X	X	X	
H	BT 1 RBT1 WCT2	Number of local populations		X	X			X					X	