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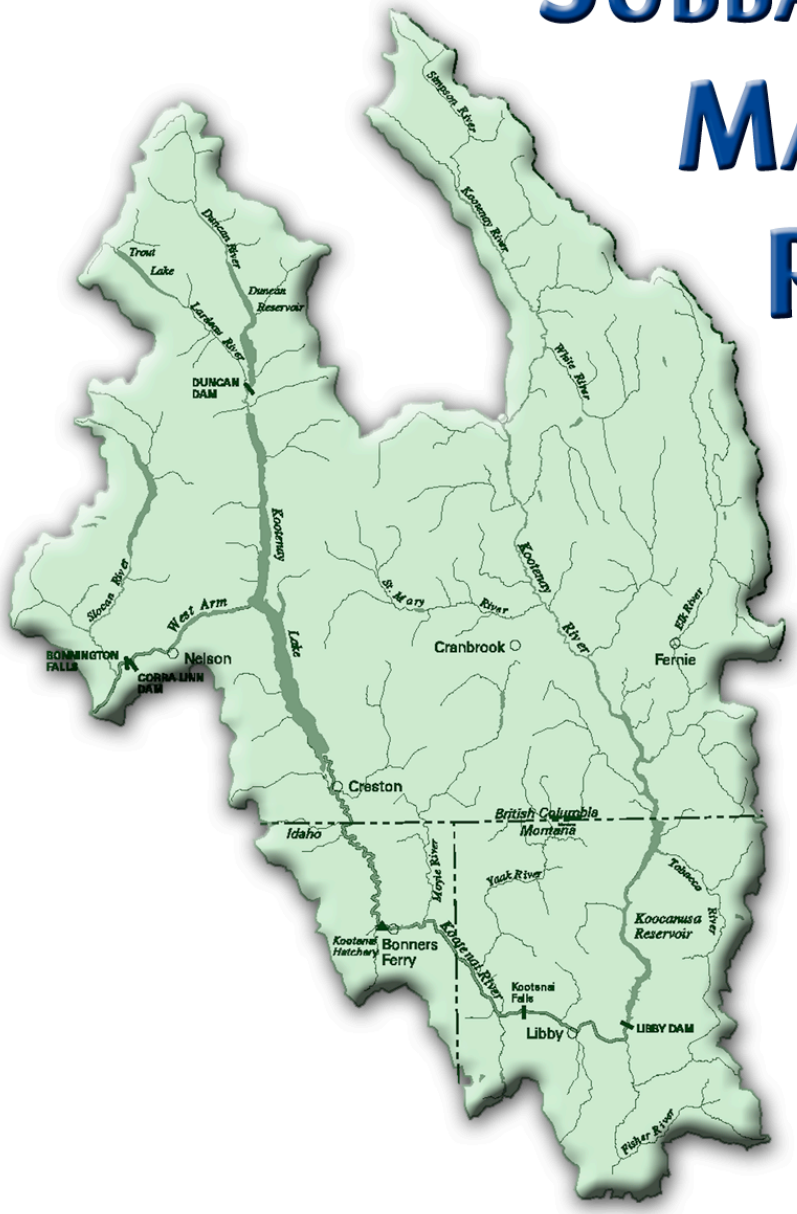
Kootenai River Subbasin Management Plan



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

A vision, guiding principles, management objectives and strategies, and a research, monitoring, and evaluation program to protect, mitigate, and enahnce fish and wildlife resources of the Flathead River Subbasin

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 and Conservation 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.

Nothing in this Plan or the participation in its development constitutes a waiver or release of any rights, including the right to election of other remedies, or is intended to compromise, influence, or preclude any government or agency from developing and prosecuting any damage claim for those natural resource impacts identified in the Plan which are not directly and exclusively resulting from, or related to, the development and operation of the Columbia River hydropower system.

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Introduction

This management plan is Part III of the Kootenai River Subbasin Plan. Part I, the Assessment, forms the scientific and technical foundation of the Subbasin Plan and identifies the limiting factors impeding the biological performance of fish and wildlife populations. Part II, the Inventory, summarizes fish and wildlife protection and restoration activities that have occurred within the subbasin over the last five years. The Inventory also evaluates how well past and current projects have addressed the limiting factors identified in the Assessment. This Management Plan, considered the heart of the Subbasin Plan, describes a vision for the subbasin and lists a series of objectives and strategies designed to address the limiting factors identified in the Assessment. It also includes a research, monitoring, and evaluation program. The overall goal of Management Plan is to protect, mitigate, and enhance aquatic and terrestrial habitats, species assemblages, and ecological functions in the Kootenai Subbasin over the next 10 to 15 years.

We have organized aquatic objectives and strategies by habitat type (mainstem, tributaries, and reservoirs) and by focal fish species (bull trout, westslope cutthroat trout, Columbia River redband trout, kokanee, white sturgeon and burbot). We have organized terrestrial objectives and strategies by biome (wetland, riparian, grassland, xeric forest, and mesic forest). The plan also includes administrative or programmatic objectives. A series of strategies follow each objective.

One of the underlying premises of the Subbasin Plan is that ecosystem components rarely function independently. Hence, most of the objectives and strategies that we have developed are interrelated, and the successful implementation of one will help to ensure the success of others, furthering our overall goal of protecting and enhancing species, populations, habitats, and ecological functions.

While the objectives and strategies have a biological focus, they also have important social, political, and economic implications. Indeed, those social factors are important determinants of future management plan success. For example, the accomplishment of some of the objectives and strategies will require the cooperation of private landowners and local communities. Years of professional and public stakeholder group communication in the Kootenai Subbasin have helped to shape this management plan, and our ongoing efforts in this area will continue to help resolve challenges that arise during the implementation phase of the plan.

An additional significant component of the management plan is the consideration of the cultural priorities of the Kootenai Tribe. Projects with objectives and strategies consistent with and supportive of tribal culture will be considered as an important overlay to the subbasin vision, and the biologically driven working hypotheses, objectives, and strategies.

Coordination with Canada

The B.C. Ministry of Water, Land, and Air Protection, as well as the B.C. Ministry of Sustainable Resource Management fully participated in and were committed to the development of the assessment for the Canadian portion of the Kootenai Subbasin. Because no policy-level process had been established to provide for transboundary management plan development prior to the initiation of subbasin planning, the Subbasin coordinators in Montana and Idaho felt it inappropriate for the U.S. planning process to encompass Canadian portions of the subbasin. Instead, members of the Planning Team from the U.S. developed the management plan for the U.S. portion of the subbasin. As the management agencies in Canada complete their planning processes (with appropriate Canadian First Nations and stakeholder input), Kootenai Subbasin planners and managers in the U.S. can coordinate and mesh the U.S. and Canadian plans. Until then, Canadian management agencies will have the assessment available to them for their planning processes. Fish and wildlife managers and planners in the U.S. and their counterparts in Canada believe it is critically important to work on transboundary issues in future planning processes.

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10.1 Vision and Scientific and Guiding Principles

The development of the Kootenai Subbasin vision, objectives, and strategies has been guided by the vision, scientific principles, and basin-level fish and wildlife objectives found in Northwest Power and Conservation Council 2000 Fish and Wildlife Program (Program). As such, they are consistent with the Program, key sections of which follow.

10.1.1 Overall Vision for the NWPCC Fish and Wildlife Program

LINKS

To access the full NWPCC Fish and Wildlife Program, go to: http://www.nwcouncil.org/library/2000/2000-19/Default.htm)

Click Here

The vision for the Northwest Power and Conservation Council's Fish and Wildlife Program is a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife, mitigating across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem and providing the benefits from fish and wildlife valued by the people of the region. This ecosystem provides abundant opportunities for tribal trust and treaty right harvest and for non-tribal harvest and the conditions that allow for the recovery of the fish and wildlife affected by the operation of the hydrosystem and listed under the Endangered Species Act.

Wherever feasible, this program will be accomplished by protecting and restoring the natural ecological functions, habitats, and biological diversity of the Columbia River Basin. In those places where this is not feasible, other methods that are compatible with naturally reproducing fish and wildlife populations will be used. Where impacts have irrevocably changed the ecosystem, the program will protect and enhance the habitat and species assemblages compatible with the altered ecosystem.

10.1.2 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 (which follow the Program's principles).

10.1.2. Scientific Principles of the NWPCC Fish and Wildlife Program

As part of its scientific foundation, the Program recognizes eight principles of general application. It is intended that all actions taken to implement this program be consistent with these principles.

Principle 1. The abundance, productivity and diversity of organisms are integrally linked to the characteristics of their ecosystems.
The physical and biological components of ecosystems together produce the diversity, abundance and productivity of plant and animal species, including humans. The combination of suitable habitats and necessary ecological functions forms the ecosystem structure and conditions needed to provide the desired abundance and productivity of specific species.

Principle 2. Ecosystems are dynamic, resilient and develop over time.
Although ecosystems have definable structures and characteristics, their behavior is highly dynamic, changing in response to internal and external factors. The system we see today is the product of its biological, human and geological legacy. Natural disturbance and change are normal ecological processes and are essential to the structure and maintenance of habitats.

Principle 3. Biological systems operate on various spatial and time scales that can be organized hierarchically.
Ecosystems, landscapes, communities and populations are usefully described as hierarchies of nested components distinguished by their appropriate spatial and time scales. Higher-level ecological patterns and processes constrain, and in turn reflect, localized patterns and processes. There is no single, intrinsically correct description of an ecosystem, only one that is useful to management or scientific research. The hierarchy should clarify the higher-level constraints as well as the localized mechanisms behind the problem.

Principle 4. Habitats develop, and are maintained, by physical and biological processes.
Habitats are created, altered and maintained by processes that operate over a range of scales. Locally observed conditions often reflect more expansive or non-local processes and influences, including human actions. The presence of essential habitat features created by these processes determines the abundance, productivity and diversity of species and communities. Habitat restoration actions are most effective when undertaken with an understanding and appreciation of the underlying habitat-forming processes.

Principle 5. Species play key roles in developing and maintaining ecological conditions.
Each species has one or more ecological functions that may be key to the development and maintenance of ecological conditions. Species, in effect, have a distinct job or occupation that is essential to the structure, sustainability and productivity of the ecosystem over time. The existence, productivity and abundance of specific species depend on these functions. In turn, loss of species and their functions lessens the ability of the ecosystem to withstand disturbance and change.

Principle 6. Biological diversity allows ecosystems to persist in the face of environmental variation.
The diversity of species, traits and life histories within biological communities contributes to ecological stability in the face of disturbance and environmental change. Loss of species and their ecological functions can decrease ecological stability and resilience. It is not simply that more diversity is always good; introduction of non-native species, for example, can increase diversity but disrupt ecological structure. Diversity within a species presents a greater range of possible solutions to environmental variation and change. Maintaining the ability of the ecosystem to express its own species composition and diversity allows the system to remain productive in the face of environmental variation.

Principle 7. Ecological management is adaptive and experimental.
The dynamic nature, diversity, and complexity of ecological systems routinely disable attempts to command and control the environment. Adaptive management — the use of management experiments to investigate biological problems and to test the efficacy of management programs — provides a model for experimental management of ecosystems. Experimental management does not mean passive "learning by doing," but rather a directed program aimed at understanding key ecosystem dynamics and the impacts of human actions using scientific experimentation and inquiry.

Principle 8. Ecosystem function, habitat structure and biological performance are affected by human actions.
As humans, we often view ourselves as separate and distinct from the natural world. However, we are integral parts of ecosystems. Our actions have a pervasive impact on the structure and function of ecosystems, while at the same time, our health and well being are tied to these conditions. These actions must be managed in ways that protect and restore ecosystem structures and conditions necessary for the survival and recovery of fish and wildlife in the basin. Success depends on the extent to which we choose to control our impacts so as to balance the various services potentially provided by the Columbia River Basin.

10.1.3. Guiding Principles for the Kootenai River Subbasin

The following principles will help guide implementation of all subbasin objectives, strategies and action:

- Recognize and support the basin-wide objectives for resident fish losses in the Northwest Power and Conservation Council's Fish and Wildlife Program (these are listed in section 10.2.1).
- Recognize and support the Basin-wide objectives for wildlife losses in the Northwest Power and Conservation Council's Fish and Wildlife Program (these are listed in section 10.2.1).
- Respect, recognize, and honor the legal authority, jurisdiction, tribal federally reserved rights, and all legal rights of all parties.
- Promote and enhance local participation in, and contribution to, natural resource problem solving and Subbasin-wide conservation efforts.
- Utilize a scientific foundation, for diagnosing biological problems, for designing and prioritizing projects, and for monitoring and evaluation to guide management to better achieve objectives.
- Provide information to residents of the Kootenai Subbasin to promote understanding and appreciation of the need to protect, enhance, and restore a healthy and properly functioning native ecosystem. Utilize incentive-based and educational approaches to promote ecologically sound use of natural resources.
- Protect, perpetuate, enhance, and restore habitats in a way that will sustain and recover native aquatic and terrestrial species with emphasis on the recovery of ESA-listed and native species. Provide adequate protections for unique habitats that may not be abundant but that play an important ecological role.
- Improve and maintain water quality throughout the Subbasin.
- Protect and enhance open space.

LINKS

For an example of the promotion and enhancement of local participation in, and contribution to, natural resource problem solving in the subbasin, go to Appendix 109, the Guiding Principles of the Wetland Conservation Plan.

Click Here

For an description of the promotion and enhancement of local participation in, and contribution to, subbasin planning via the Kootenai Valley Resource Initiative (KVRI), go to Appendix 110.

Click Here

- Foster ecosystem protection, enhancement, and restoration that result in the stewardship of natural resources while recognizing all components of the ecosystem, including the human component.

- Sustain natural resource-based economies in concert with native aquatic and terrestrial species, and encourage new industries and management programs that promote and contribute to healthy ecosystems.

- Coordinate efforts to implement the Pacific Northwest Electric Power Planning and Conservation Act, the Endangered Species Act, the Clean Water Act, the National Forest Management Act, tribal reserved rights, and other local, state, federal, and tribal programs, obligations, and authorities.

- Enhance native and desired non-native species populations to a level of healthy and, for those species for which it is appropriate, harvestable abundance to support exercise of tribal reserved rights and public harvest goals.

10.1.4. Scientific Framework for the Kootenai River Subbasin

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. Priority is assigned to the groups of activities identified in Figures 10.1 through 10.3. The Research, Monitoring, and Evaluation Program (Section 10.3) includes a more specific prioritization criteria that will operate at the project level.

Preventing the types of impacts that reduce the overall health of the Subbasin is a major priority (Figure 10.1). 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. Libby Dam, completed in 1972, impounded and fragmented the second largest tributary to the Columbia River (Kootenai River) by creating the 90-mile Koocanusa Reservoir. The reservoir inundated 109 miles of the mainstem Kootenai River and 40 miles of critical, low-gradient tributary habitat. The reservoir is also a nutrient sink, affecting physical and chemical conditions downstream. Annual operations cause fluctuations in the reservoir pool and the Kootenai River downstream, making fish and wildlife habitat in the zone of fluctuation (varial zone) biologically unproductive. In addition, Libby Dam acts as a barrier to fish and wildlife movements and fragments populations.

Preventing the introduction and spread of non-native species is another priority. Prevention and immediate detection of non-ntives (including non-native plants, invertebrates, fish and other animals) is critical if managers are to avoid major disruptions to the ecological community structure and balance. Surveys have already identified sources of genetic introgression between native westslope cutthroat and non-native rainbow trout. Bull trout hybridize with non-native brook trout where they coexist and the progeny are largely sterile. If no action is taken, genetic introgression will continue to erode the remaining stocks of native trout.

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 (figure 10.2). 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 (Figure 10.3). 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.

Planning and Technical Team members have developed objectives and identified near-term opportunities for watershed restoration and protection based on habitat quality (assessed using QHA for fish and TBA for wildlife), community composition, native species abundance, and Endangered Species Act requirements. Our near-term opportunities or highest priority watersheds for restoration are those that are (1) necessary for the recovery of listed species and (2) slightly to moderately degraded habitats important to focal and target species. More severely degraded watersheds with non-native species and limited or nonexistent native fish populations are lower priorities that will be addressed over a longer period of time. Our near-term opportunities for protection are those relatively undisturbed habitats that contain strong populations of native species. To support these objectives, this plan proposes a mix of strategies designed to cost effectively produce the greatest benefits to fish and wildlife. Monitoring will be necessary to assess the efficacy of objectives and strategies and improve the program over time.

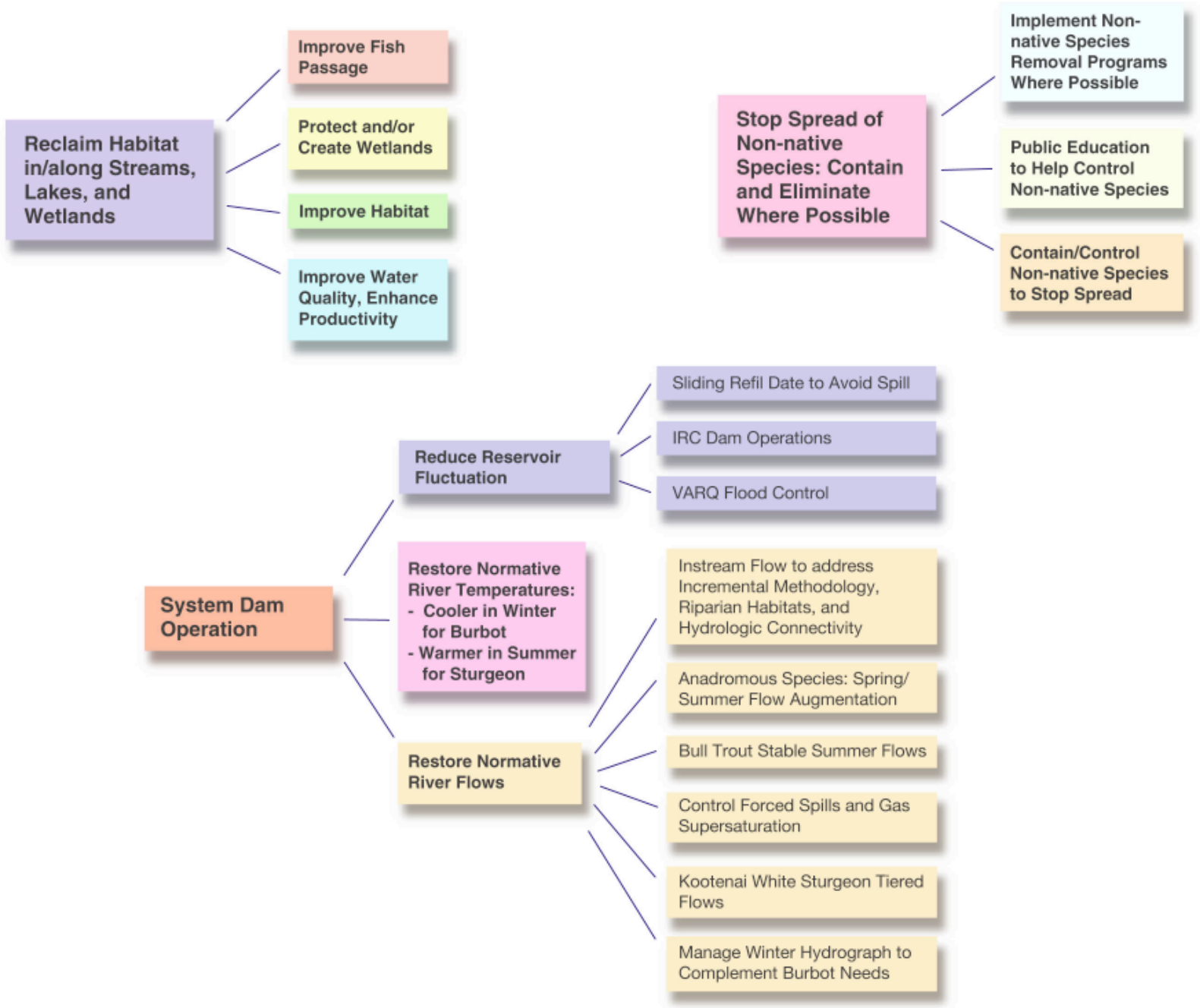

Figure 10.1. Basin-wide Mitigation Framework

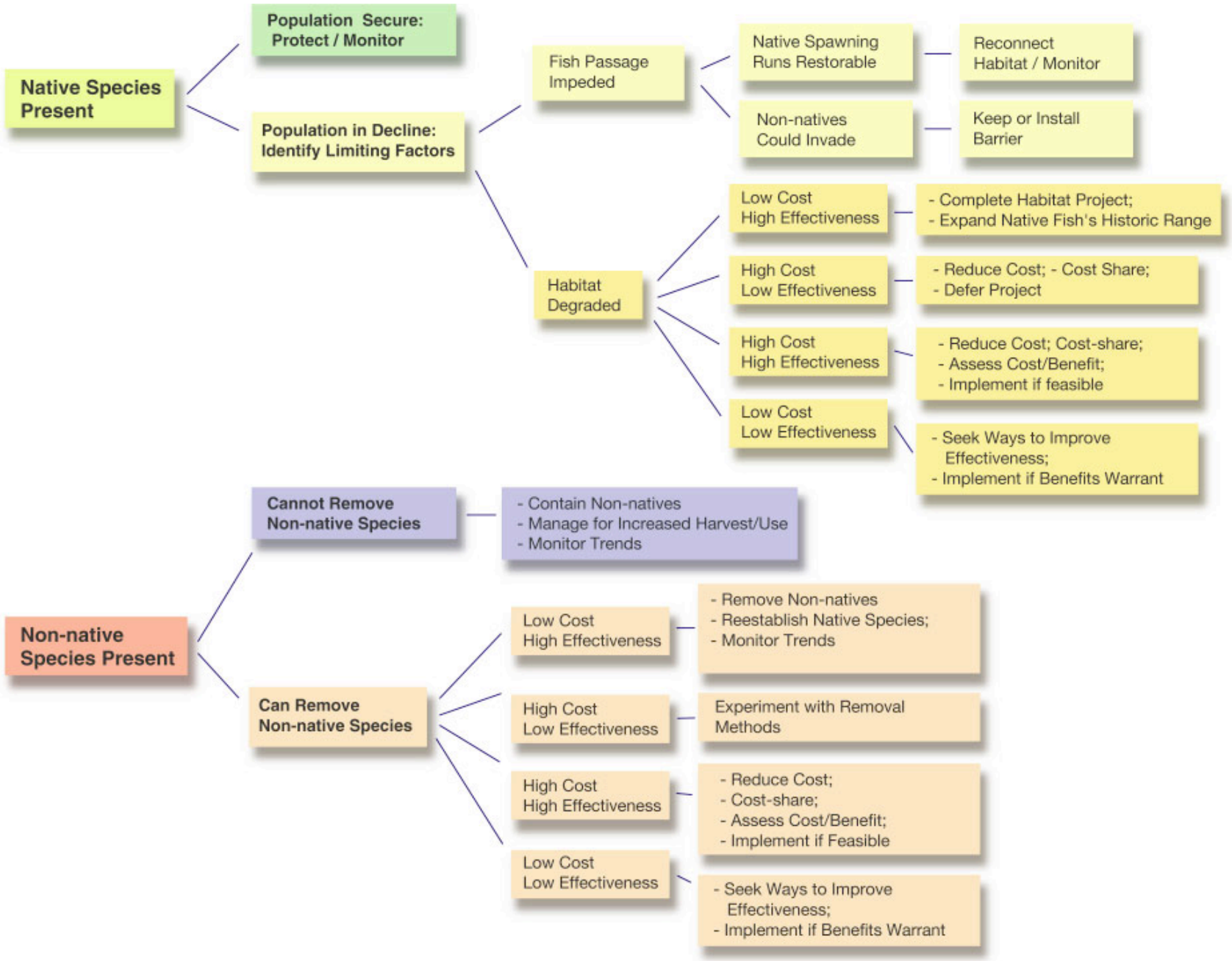

Figure 10.2. Decision pathways: Onsite Mitigation

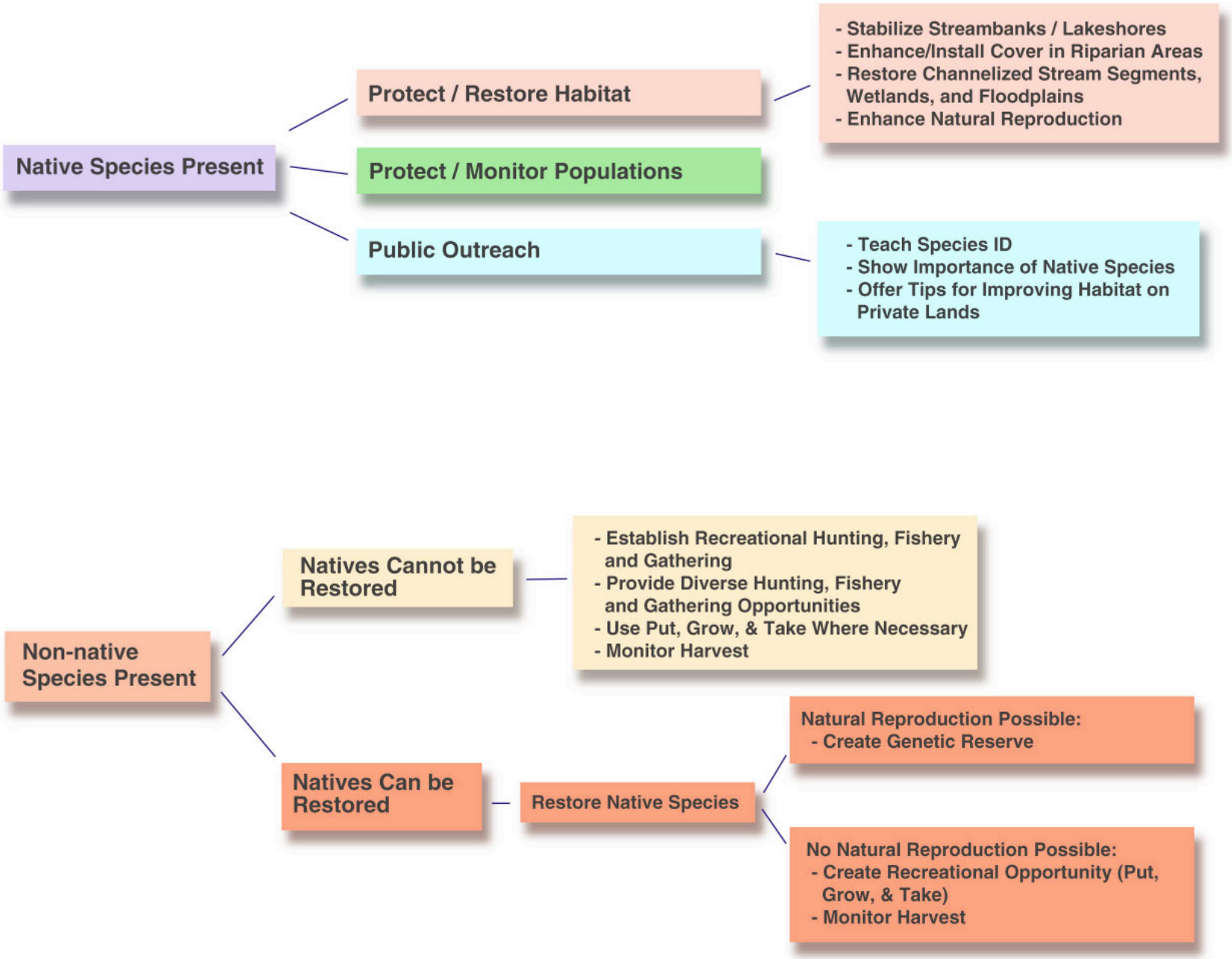

Figure 10.3. Decision Pathway: Offsite Mitigation.

10.2 Objectives and Strategies

10.2.1 Fish and Wildlife Program Basin-level Fish Objectives

The Council's basin-level objectives to mitigate for resident fish losses are based on the premise that the development and operation of the hydrosystem has resulted in losses of numbers and diversity of native resident fish, such as bull trout, cutthroat trout, kokanee, white sturgeon and other species. The following objectives address resident fish losses:

Basin-Level Resident Fish Objective 1

Complete assessments of resident fish losses throughout the basin resulting from the hydrosystem, expressed in terms of the various critical population characteristics of key resident fish species.

Basin-Level Resident Fish Objective 2

Maintain and restore healthy ecosystems and watersheds, which preserve functional links among ecosystem elements to ensure the continued persistence, health and diversity of all species including game fish species, nongame fish species, and other organisms.

Basin-Level Resident Fish Objective 3

Protect and expand habitat and ecosystem functions as the means to significantly increase the abundance, productivity, and life history diversity of resident fish at least to the extent that they have been affected by the development and operation of the hydrosystem.

Basin-Level Resident Fish Objective 4

Achieve population characteristics of these species (bull trout, westslope cutthroat trout, Columbia River redband trout, kokanee, white sturgeon, burbot, and other species) within 100 years that, while fluctuating due to natural variability, represent on average full mitigation for losses of resident fish.

10.2.2 Fish and Wildlife Program Basin-level WildlifeObjectives

The Council's basin-level objectives to mitigate wildlife losses are based on the premise that development and operation of the hydrosystem resulted in wildlife losses through construction and inundation losses, direct operational losses or through

secondary losses. The program has included measures and implemented projects to obtain and protect habitat units in mitigation for these calculated construction/ inundation losses. Operational and secondary losses have not been estimated or addressed. The program includes a commitment to mitigate for these losses. More specific wildlife objectives are:

Basin-Level Wildlife Objective 1

Quantify wildlife losses caused by the construction, inundation, and operation of the hydropower projects.

Basin-Level Wildlife Objective 2

Develop and implement habitat acquisition and enhancement projects to fully mitigate for identified losses.

Basin-Level Wildlife Objective 3

Coordinate mitigation activities throughout the basin and with fish mitigation and restoration efforts, specifically by coordinating habitat restoration and acquisition with aquatic habitats to promote connectivity of terrestrial and aquatic areas.

Basin-Level Wildlife Objective 4

Maintain existing and created habitat values.

Basin-Level Wildlife Objective 5

Monitor and evaluate habitat and species responses to mitigation actions.

10.2.3 Subbasin-level Objectives and Strategies

Background

In this document, we define primary limiting factors as the root causes of the problems in the subbasin, while secondary limiting factors are the specific issues caused by those over-arching problems (figure 10.4). Because it is difficult to develop a single objective for a primary limiting factor (for example, impoundment and hydro operations), our approach has been to develop a coordinated and integrated set of objectives for secondary limiting factors, thereby addressing more comprehensively the various facets of each of the primary limiting factors.

Ecological degradation has occurred in the Kootenai River Subbasin for over 100 years. Cascading trophic and biological effects resulting from these changes have occurred on the same time scale. It is therefore likely that successful restoration cannot be completed in a fraction of the time it took the system to be degraded. Time is also required to address, negotiate, and resolve societal issues associated with large-scale habitat and ecological change.

Linkage of Aquatic Objectives and Strategies with Limiting Factors

Primary limiting factors are severe, usually large-scale ecological alterations that result in multiple secondary ecological impacts. Primary and secondary limiting factors negatively affect ecological function and fish and wildlife populations in an additive fashion. Primary limiting factors are casual factors of ecological and demographic decay. Secondary limiting factors are the subset of problems resulting from the primary limiting factors. Because limiting factors are interrelated and often occur at several levels, attempting to mitigate a single cause of mortality for a single focal fish species or life stage cannot resolve the multivariate problem of ecological limitation. Therefore objectives and strategies must be developed and implemented in a coordinated fashion to address the primary limiting factors in a comprehensive way.

We identified three primary aquatic limiting factors in the Kootenai River Subbasin (figure 10.4): (1) impoundment and hydro operations, (2) physical habitat alteration (in addition to impoundments and hydro operations), and (3)

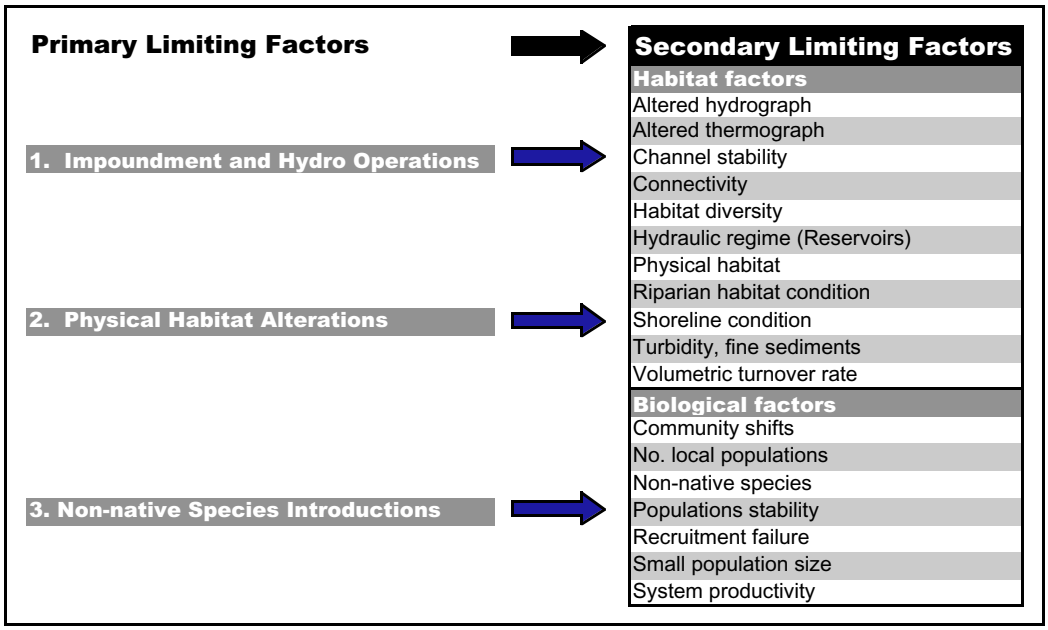

Figure 10.4. Primary and secondary aquatic limiting factor linkage in the Kootenai River Subbasin.

the introduction of non-native species. These three primary limiting factors resulted in at least 18 important secondary limiting factors that negatively affect habitat, fish, and wildlife. Our objectives and strategies address each of these limiting factors. Tables 10.1 and 10.2 show the linkage of secondary limiting factors to objectives.

Table 10.1. 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.

	Biome					
Limiting Factor	**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

Aquatic Objecitves

The tables that follow present Kootenai Subbasin aquatic management objectives and strategies designed to mitigate primary and secondary aquatic limiting factors in the Kootenai Subbasin. Objectives and strategies addressing the mainstem, tributaries, and reservoirs are followed by objectives and strategies for focal fish species (bull trout, Columbia River redband trout, westslope cutthroat trout, kokanee, sturgeon, and burbot).

Regulated Mainstem

Limiting factors:

Altered Hydrograph (M1)
Riparian Condition (M2)
Turbidity & Fine Sediment (M3)
Altered Thermograph (M4)
Habitat diversity (M5)
Channel Stability (M6)

Regulated Mainstem Objective M1	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) (Habitat)
Limiting Factor	Altered hydrograph
Timeframe	2005 to 2020+
Objective M1 (Measurable Actions)	M1a. Working with Action Agencies, bring Libby Dam operations 50% closer to normative conditions during summer and spring while providing flood control. M1b. Determine opportunities for hydro operations to remove delta blockages from tributary streams.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations
Additional Secondary Limiting Factor(s) Addressed	Altered thermograph, channel stability, habitat diversity, turbidity and fine sediments, community shifts, recruitment failure, and system productivity.
NWPCC Programmatic H's Addressed	Habitat, Hydro
Where	All reaches of the Kootenai River in the U.S. downstream from Libby Dam.
Other/Notes	Collaborate with Action agencies by preparing ecologically sound System Operation Requests (SORs) to benefit various life stages of white sturgeon, burbot, trout and other important fish species.
Strategies	- Restore hydraulic energy to create parafluvial and orthofluvial avulsions, tributary delta reductions, and channel bed material movement to increase habitat diversity required for increased biological diversity. - Develop and pursue opportunities to restore normative river functions in the lower Kootenai River, including hydrograph cycles, periodic channel maintenance flows, habitat diversity, and floodplain connectivity. - Develop multi-year experimental discharge agreements for Libby Dam operations to evaluate the effectiveness of restoring natural spawning, development, and recruitment for white sturgeon, burbot, bull trout and other important species and ecological functions. [The NWPCC Mainstem Amendment is the multi-year experiment we've been working toward] - Until a multi-year agreement is implemented, continue to negotiate and implement annual in-season flow measures to create more normative hydrographic conditions, and to provide supporting biological and ecological functions. - Define specific temperature and flow requirements that provide natural

Regulated Mainstem Objective M1	
	spawning, incubation, rearing, recruitment, and survival of Kootenai River white sturgeon, burbot, bull trout and other important species. - Update existing hydrological models based on historic temperature, flow, and velocity data, and include recent data to evaluate effects of operational alternatives on conditions required by white sturgeon, burbot, and bull trout and other important species. - Coordinate removal of cobble and gravel deltas with the U.S. Army Corps of Engineers and Burlington Northern and Santa Fe Railroad (for more details, see "Connectivity" section of objectives and strategy table for Tributaries). - Design, evaluate, and implement more normative seasonal flow windows and flow ramping rates.

Regulated Mainstem Objective M2	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) (Habitat)
Limiting Factor	Riparian Condition
Timeframe	By 2020
Objective M2 (Measurable Action)	Improve riparian function and complexity of mainstem riparian habitat to levels that support or contribute to sustainable population levels of focal species that function naturally and may be capable of supporting appropriate forms of human use.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Channel stability, habitat diversity, physical habitat, turbidity and fine sediments, community shifts, population stability, altered hydrograph and thermograph.
NWPCC Programmatic H's Addressed	Habitat
Where	All reaches of the Kootenai River in the U.S. downstream from Libby Dam.
Other/Notes	
Strategies	- Initiate and develop cooperative adaptive management strategies with local and regional agencies and entities in the U.S. and B.C. (State, federal, and provincial agencies, Native American Indian Tribes, local officials, stakeholders, environmental organizations, and industry). - Develop a consolidated riparian and wetland habitat map for the Kootenai River mainstem of the Kootenai Subbasin. - Investigate and analyze historic losses of riparian and wetland habitats in the Kootenai River mainstem of the Kootenai Subbasin. - Identify associated losses in biological functions and performance (e.g. riparian dependent fish, animals, birds). - Coordinate efforts with natural resource managers to develop comprehensive riparian and wetland habitat protection, rehabilitation, and enhancement plan for the Kootenai River mainstem.

Regulated Mainstem Objective M2	

	- Identify and address human impacts in the Kootenai River mainstem utilizing adaptive management techniques.
	  - Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions.
	  - Conduct watershed problem assessments. Identify site-specific threats (problem assessment) that may be limiting focal species.
	  - Revegetate denuded riparian areas. Revegetate to restore shade and canopy, riparian cover, and native vegetation in streams.
	  - Improve grazing practices. Reduce negative effects of grazing with improved grazing management or riparian fencing where investigation indicates such actions are likely to benefit native fish.
	  - Protect riparian habitats. When possible (i.e. with willing landowners) provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means.
	- Cooperate and coordinate efforts with stakeholders to protect, enhance and rehabilitate riparian and wetland habitats in the Kootenai River mainstem.
	- Initiate and develop noxious weed management strategies with local and regional agencies and entities in the U.S. and B.C.
	- Coordinate efforts with natural resource managers to develop comprehensive noxious weed management plan for the Kootenai River mainstem.

Regulated Mainstem Objective M3	
Species/Life stage	All Focal Species, All life stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) (Habitat)
Limiting Factor	Turbidity and Fine Sediment
Timeframe	2005 to 2020+
Objective M3 (Measurable Actions)	M3a. Achieve turbidity levels in the mainstem that support sustainable population levels of focal species that function naturally and may be capable of supporting appropriate forms of human use. M3b. Reduce the delivery of fine sediments in the mainstem to a level that supports sustainable population levels of focal species that function naturally and may be capable of supporting appropriate forms of human use.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Habitat diversity, physical habitat, community shifts, population stability, recruitment failure.
NWPCC Programmatic H's Addressed	Habitat
Where	All reaches of the Kootenai River in the U.S. downstream from Libby Dam.
Other/Notes	

Regulated Mainstem Objective M3	
Strategies	**Turbidity** - Monitor fish community dynamics annually at index sites on the mainstem Kootenai River. - Monitor macroinvertebrate community dynamics annually at index sites on the mainstem Kootenai River. - Monitor key water quality parameters annually within key reaches of the Kootenai River to assess primary productivity. - Assess pre and post dam trophic and water quality changes using fossil diatoms obtained from river coring done in 2000. - Collect algae and plankton monthly for ID and chlorophyll analysis and apply IBI to algae production to determine the available food base for larval fish. - Meet with relevant agencies to address and resolve resource policies regarding TMDLs and needed biological turbidity associated with restored biological productivity and ecological function. **Fine Sediment** - Monitor suspended sediment transport and bedload transport in white sturgeon habitat and develop conceptual and computer models of transport to aid in assessing the potential for substrate habitat creation or enhancement. - Monitor and evaluate the reuniting of adult white sturgeon spawners with suitable spawning substrate. - Monitor and evaluate the survival of artificially and directly fertilized white sturgeon eggs over suitable substrates. - Measure daily in-river sedimentation rates during incubation or under similar hydraulic conditions in various known white sturgeon and embryo incubation habitats; compare results to known mortality criteria associated with loss of gas exchange functions (suffocation). Evaluate current suitability of in-river incubation habitats for white sturgeon. - Design and implement research to further address biological and physiological mechanisms of mortality that contributes to failure of natural recruitment for Kootenai river white sturgeon. - Evaluate provision of suitable substrate and engineered habitat enhancing options to increase survival of white sturgeon eggs, embryos and early life stages. - Monitor river-bottom sand dunes and gravel substrate in white sturgeon spawning reaches using side-scan sonar and/or multi-beam acoustic survey to address bedload and substrate feature dynamics under a range of flow regimes. - Maintain and protect habitat by achieving compliance with existing habitat protection laws, policies, and guidelines. - Reduce sediment sources on tributaries by stabilizing roads, crossings, and other sources of sediment delivery. - Pave, upgrade, or relocate portions of major access roads to reduce impacts from sediment and remedy extensive floodplain encroachment and channel alterations. - Implement stream bank stabilization measures where necessary - Design and implement riparian revegetation/rehabilitation projects. - Agitate embedded gravels to remove silts and fine sands where appropriate.

Regulated Mainstem Objective M3	
	- Install artificial spawning structures where necessary. - Participate with the Idaho and Montana Department of Environmental Quality in the Total Maximum Daily Load planning, implementation, and monitoring process. Achieve compliance with appropriate multi-disciplinary water quality standards. - Support habitat protection and monitoring in British Columbia. Work collaboratively with British Columbia Ministry of Water, Land, and Air Protection and other Canadian governmental entities to ensure focal species habitat is protected and enhanced in the Kootenai River Subbasin upstream of Koocanusa Reservoir and in Kootenay Lake and its tributaries downstream of the United States. - Continue habitat and fishery monitoring efforts. - Sample fish populations at a minimum of four index sites and determine trophic structure, species composition, CPUE, and species biomass.

Regulated Mainstem Objective M4	
Species/Life stage	All Focal Species, All life stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) (Habitat)
Limiting Factor	Altered thermograph
Timeframe	2005 to 2020+
Objective M4 (Measurable Actions)	M4a. Modify the mainstem thermal regime to be more normative, within current thermal limitations imposed by Libby Dam and Koocanusa Reservoir, to be more within the tolerance range of all life stages of various aquatic and focal fish species. M4b. Research, develop, and test new operational strategies for Libby Dam that could expand its role in more effectively providing a more normative downstream thermograph.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations; Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Community shifts, non-native species, recruitment failure, system productivity.
NWPCC Programmatic H's Addressed	Habitat, Hydro
Where	All reaches of the Kootenai River in the U.S. downstream from Libby Dam.
Other/Notes	Tailwater optimum thermographs based on historic range of variability and biological focal species.
Strategies	- Use the reservoir model LMROD, thermal model, entrainment model and river IFIM model to evaluate the response of habitat and fish populations to alternative dam operating strategies. Recommend changes to dam operations when necessary based on output of these approaches. - Develop multi-year experimental discharge agreements for Libby Dam operations to evaluate the effectiveness of restoring natural spawning, development, and recruitment for white sturgeon, burbot, bull trout and other important species and ecological functions.

Regulated Mainstem Objective M4	
	- Until a multi-year agreement is implemented, continue to negotiate and implement annual measures to create more normative thermographic conditions, and to provide supporting biological and ecological functions. - Define specific temperature and flow requirements that provide natural spawning, incubation, rearing, recruitment, and survival of Kootenai River white sturgeon, burbot, bull trout and other focal species. - Develop a longitudinal thermal component to the existing thermal model based on historic temperature, flow, and velocity data, to evaluate effects of operational alternatives on conditions required by white sturgeon, burbot, and bull trout and other focal species. - Evaluate alternative Libby Dam operations to provide more appropriate water temperatures and increased flexibility in flow management, especially during winter and spring. - Evaluate alternatives for Libby Dam operations to provide more appropriate water temperatures and increased flexibility in flow management, especially during winter and spring. - Monitor temperatures within the reservoir and downstream sites during flow augmentation. - Deploy continuous-recording thermographs in various locations of the Kootenai River and tributaries to monitor water temperatures. - Under controlled laboratory conditions measure stress and reproductive fitness of burbot under varying temperature and velocity conditions and apply to water management and recovery needs for Kootenai River white sturgeon and burbot. - Evaluate reservoir discharges and spawning-zone stream water for selected microorganisms and water quality that may affect survival of white sturgeon eggs, embryos, larvae, and juvenile life stages. - Design and install a fixed telemetry receiver matrix on the Kootenai River for use with all fish species to provide adequate and cost-effective telemetry coverage of focal fish species movements and behaviors. - Monitor behavior and response of adult Kootenai River white sturgeon to experimental temperatures and flows during the spawning migration and spawning seasons, with sonic and radio telemetry. - Monitor and evaluate white sturgeon spawning, timing, and habitat with artificial substrate mats. - Design and implement ways to measure success of experimental temperatures and flows for white sturgeon spawning by sampling for larval and juvenile sturgeon with various net gears in the Kootenai River and Kootenay Lake. - Determine the affect of warmer water temperature of the Kootenai River and masking of cold-water tributaries by monitoring water temperatures of tributaries at their mouth and 100 m upstream.

Regulated Mainstem Objective M5	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) (Habitat)
Limiting Factor	Habitat Diversity
Timeframe	2005 to 2020+
Objective M5 (Measurable Action)	Improve habitat diversity to levels equivalent to the QHA-generated habitat diversity habitat restoration scores, and habitat diversity conditions based on ecological primary literature and possible references rivers.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Channel stability, physical habitat, turbidity and fine sediments, community shifts, recruitment failure, and population size.
NWPCC Programmatic H's Addressed	Habitat
Where	All reaches of the Kootenai River in the U.S. downstream from Libby Dam.
Other/Notes	
Strategies	- Periodically (consistent with water availability) alter Kootenai River hydrograph within limits to restore hydraulic energy needed to create parafluvial and orthofluvial avulsions, and channel bed material movement to increase habitat diversity required for increased biological diversity. - Design and implement creative solutions for increasing habitat diversity, including creation and re-connection of side channel, slough, backwater habitats, in-river habitat modification and creation, and seasonal and permanent wetlands in US waters. Support and coordinate with similar measures in British Columbia waters of the Kootenai Subbasin.

Regulated Mainstem Objective M6	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) (Habitat)
Limiting Factor	Channel Stability
Timeframe	2005-2020+
Objective M6 (Measurable Action)	Improve channel stability to a level equivalent to the QHA-generated, channel-stability habitat-restoration scores of reference streams, assuming that such levels will support sustainable population levels of focal species that function naturally and may be capable of supporting appropriate forms of human use.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Habitat diversity, physical habitat, riparian condition, turbidity and fine sediments.

Regulated Mainstem Objective M6	
NWPCC Programmatic H's Addressed	Habitat, Hydro
Where	All reaches of the Kootenai River in the U.S. downstream from Libby Dam.
Other/Notes	

Strategies	- Initiate and develop cooperative adaptive management strategies with local and regional agencies and entities in the U.S. and B.C.
	- Investigate and analyze historic losses of floodplain habitats in the Kootenai River mainstem of the Kootenai Subbasin.
	- Identify associated losses in biological functions and performance (i.e., riparian vegetation communities, etc.).
	- Coordinate efforts with natural resource managers and stakeholders to develop comprehensive floodplain habitat protection, rehabilitation and enhancement plan for the Kootenai River mainstem.
	- Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., natural vegetation, etc.) in the Kootenai River mainstem.
	- Identify and address human impacts in the Kootenai River mainstem.
	  - Upgrade problem roads. Pave, upgrade, or relocate portions of major access roads to reduce impacts from sediment and remedy extensive floodplain encroachment and channel alterations.
	  - Restore the stream channel. Conduct stream channel restoration activities where investigation indicates such actions are likely to benefit native fish. Restore proper pattern, profile, and form and incorporate Rosgen-based rehabilitation techniques into stream stabilization designs.
	  - Improve instream habitat. Increase or improve instream habitat by restoring recruitment of large woody debris, pool development, or other appropriate components in streams where investigation indicates such actions are likely to benefit native fish.
	  - Minimize potential stream channel degradation. Ensure that negative effects to native species of ongoing flood control activities are minimized or eliminated.
	- Cooperate and coordinate efforts to protect, enhance, and rehabilitate floodplain habitats in the Kootenai River mainstem.

Tributaries

Limiting factors:

Protection of Class 1 waters (T1)
Riparian Condition (T2)
Fine Sediment (T3)
Channel Stability (T4)
Altered Thermal Regime (T5)
Habitat Diversity (T6)
Altered Hydrograph (T7)
Connectivity (T8)

Tributary Objective T1	
Species/Life stage	All species, All life stages
4th-Code HUC	Tributaries (All 4th-Code HUCs) (Habitat)
Limiting Factor	Protection of Class 1 waters
Timeframe	2005 to 2020+
Objective T1 (Measurable Actions)	Protect and maintain prime, functioning tributary habitat (identified as Class 1 in QHA analysis)
Primary Limiting Factor(s) Addressed	Physical Habitat Degradation
Additional Secondary Limiting Factor(s) Addressed	Habitat diversity, connectivity, turbidity and fine sediments, physical habitat, population stability
NWPCC Programmatic H's Addressed	Habitat
Where	Class 1 streams in the US portion of the Kootenai Subbasin downstream from Libby Dam and in the US portion of the Koocanusa Reservoir watershed.
Other/Notes	
Strategies	- In conjunction with appropriate management and regulatory agencies, create new or use existing mechanisms to protect and maintain Class 1 streams or reaches (including but not limited to title acquisition, conservation easements, and long term leases). - Periodically evaluate and update habitat condition. Implement actions necessary to maintain Class 1 status.

Tributary Objective T2	
Species/Life stage	All resident stream and adfluvial fishes that use tributary habitat/All life stages for resident stream species; spawning, incubation, and rearing for adfluvial species.
4th-Code HUC	Tributaries (All 4th-Code HUCs) (Habitat)
Limiting Factor	Riparian Condition
Timeframe	2005 to 2020+
Objective T2 (Measurable Action)	Restore riparian habitats to levels equivalent to the QHA-generated riparian condition habitat restoration scores of reference streams.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Channel stability, connectivity, physical habitat, turbidity and fine sediments, altered hydrograph and thermograph.
NWPCC Programmatic H's Addressed	Habitat
Where	All tributary streams in the US portion of the Kootenai Subbasin downstream from Libby Dam and in the US portion of the Koocanusa Reservoir watershed.
Strategies	**General** - Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions. - Conduct watershed problem assessments. Identify site-specific threats (problem assessment) that may be limiting focal species in watersheds not already evaluated. - Revegetate denuded riparian areas. Revegetate to restore shade and canopy, riparian cover, and native plant communities. - Reconstruct stream banks in degraded riparian areas where needed to allow appropriate physical conditions for successful revegetation. **Valley Tributary Riparian Strategies** - Develop a consolidated riparian and wetland habitat map for the Kootenai River valley. - Develop working relationships with private landowners to improve or enhance nursery streams in riparian and stream-bank habitats. - Investigate and analyze historic losses of riparian and wetland habitats in Kootenai River valley tributaries. - Identify associated losses in biological functions and performance (e.g. riparian dependent fish, animals and birds). - Coordinate efforts with natural resource managers and stakeholders to develop comprehensive riparian and wetland habitat protection, rehabilitation, and enhancement plan for the Kootenai River Valley. - Cooperate and coordinate efforts to protect, enhance and rehabilitate riparian and wetland habitats in the Kootenai River valley. - Implement KTOI/BEF Model Watershed Objectives and strategies (Appendix 111)

Tributary Objective T3	
Species/Life stage	All resident stream and adfluvial fishes that use tributary habitat/All life stages for resident stream species; spawning, incubation, and rearing for adfluvial species.
4th-Code HUC	Tributaries (All 4th-Code HUCs) (Habitat)
Limiting Factor	Turbidity and Fine Sediment
Timeframe	2005 to 2020+
Objective T3 (Measurable Action)	Reduce the delivery of fine sediments to a level equivalent to the QHA-generated fine sediment habitat attribute scores of reference streams or reaches.
Primary Limiting Factor(s) Addressed	Physical Habitat Degradation
Additional Secondary Limiting Factor(s) Addressed	Habitat diversity, population stability, recruitment failure, small population size
NWPCC Programmatic H's Addressed	Habitat
Where	Tributary streams in the US portion of the Kootenai Subbasin downstream from Libby Dam and in the US portion of the Koocanusa Reservoir watershed.
Other/Notes	Reduction and control of problem (excessive anthropogenic) turbidity and fine sediments can reduce negative effects of siltation induced mortality in resident salmonid embryos in the redds, resulting in potentially increased recruitment magnitude and frequency, population size, and population stability.
Strategies	**Turbidity** - Monitor fish community dynamics annually at index sites on the mainstem Kootenai River. - Monitor macroinvertebrate community dynamics annually at index sites on the mainstem Kootenai River. - Monitor key water quality parameters annually within key reaches of the Kootenai River to assess primary productivity. - Assess pre and post dam trophic and water quality changes using fossil diatoms obtained from river coring done in 2000. - Collect algae and plankton monthly for ID and chlorophyll analysis and apply IBI to algae production to determine the available food base for larval fish. **Fine Sediment** - Design and implement empirical research to further address biological and physiological mechanisms of mortality that contribute to failure of natural recruitment for fish species. - Maintain and protect habitat by achieving compliance with existing habitat protection laws, policies, and guidelines. - Reduce sediment sources on tributaries by stabilizing roads, crossings, and other sources of sediment delivery. Work with the U.S. Forest Service to lower forest road densities. - Pave, upgrade, or relocate portions of major access roads to reduce impacts from sediment and remedy extensive floodplain encroachment and channel alterations. - Implement stream bank stabilization measures where necessary - Design and implement riparian revegetation/rehabilitation projects. - Agitate embedded gravels to remove silts and fine sands where appropriate.

Tributary Objective T3	
	- Install artificial spawning structures where necessary. - Participate with the Idaho and Montana Department of Environmental Quality in the Total Maximum Daily Load planning, implementation, and monitoring process. Achieve compliance with appropriate multi-disciplinary water quality standards. - Support habitat protection and monitoring in British Columbia. Work collaboratively with British Columbia Ministry of Water, Land, and Air Protection and other Canadian governmental entities to ensure focal species habitat is protected and enhanced in the Kootenai River Subbasin upstream of Koocanusa Reservoir and in Kootenay Lake and its tributaries downstream of the United States. - Monitor existing and future coal mine and coalbed methane development in the headwaters of the Wigwam drainage and other sites in British Columbia. Monitor and assess existing and potential sediment and acid mining runoff related to existing and proposed coal mining activities. Assess potential impacts on water quality and quantity, water temperature, and sediment input from coalbed methane development and associated road construction and other developments. - Continue habitat and fishery monitoring efforts. - Sample fish populations at a minimum of four index sites and determine trophic structure, species composition, CPUE, and species biomass. - Implement KTOI/BEF Model Watershed Objectives and strategies (Appendix 111)

Tributary Objective T4	
Species/Life stage	All resident stream and adfluvial fishes that use tributary habitat/All life stages for resident stream species; spawning, incubation, and rearing for adfluvial species.
4th-Code HUC	Tributaries (All 4th-Code HUCs) (Habitat)
Limiting Factor	Channel Stability
Timeframe	2005 to 2020+
Objective T4 (Measurable Action)	Improve channel stability to a level equivalent to the QHA-generated channel stability scores of reference and Class 1 streams.
Primary Limiting Factor(s) Addressed	Physical Habitat Degradation
Additional Secondary Limiting Factor(s) Addressed	Population stability, recruitment failure, small population size
NWPCC Programmatic H's Addressed	Habitat
Where	Tributary streams in the US portion of the Kootenai Subbasin downstream from Libby Dam and in the US portion of the Koocanusa Reservoir watershed.
Other/Notes	Initiate and develop cooperative adaptive management strategies with local and regional agencies and entities in the U.S. and B.C. (State, federal, and provincial agencies, Native American Indian Tribes, local elected officials, stakeholders, private landowners, environmental organizations).

Tributary Objective T4	
Strategies	- Initiate and develop cooperative adaptive management strategies with local and regional agencies and entities in the U.S. and B.C. (State, federal, and provincial agencies, Native American Indian Tribes, local elected officials, stakeholders, environmental organizations). - Develop a consolidated floodplain habitat map for the Kootenai River mainstem of the Kootenai Subbasin. - Investigate and analyze historic losses of floodplain habitats in the Kootenai River mainstem of the Kootenai Subbasin. - Identify associated losses in biological functions and performance (i.e., riparian vegetation communities, etc.). - Coordinate efforts with natural resource managers and stakeholders to develop comprehensive floodplain habitat protection, rehabilitation and enhancement plan for the Kootenai River mainstem. - Upgrade problem roads. Pave, upgrade, or relocate portions of major access roads to reduce impacts from sediment and remedy extensive floodplain encroachment and channel alterations. - Restore the stream channel. Conduct stream channel restoration activities where investigation indicates such actions are likely to benefit native fish. Restore proper pattern, profile, and form and incorporate Rosgen-based rehabilitation techniques into stream stabilization designs. - Improve instream habitat. Increase or improve instream habitat by restoring recruitment of large woody debris, pool development, or other appropriate components in streams where investigation indicates such actions are likely to benefit native fish. - Minimize potential stream channel degradation. Ensure that negative effects to native species of ongoing flood control activities are minimized or eliminated. - Cooperate and coordinate efforts to protect, enhance, and rehabilitate floodplain habitats in the Kootenai River tributaries. - Implement KTOI/BEF Model Watershed Objectives and strategies (Appendix 111)

Tributary Objective T5	
Species/Life stage	All resident stream and adfluvial fishes that use tributary habitat/All life stages for resident stream species; spawning, incubation, and rearing for adfluvial species.
4th-Code HUC	Tributaries (All 4th-Code HUCs) (Habitat)
Limiting Factor	Altered Thermograph
Timeframe	2005 to 2020+
Objective T5 (Measurable Actions)	5a. Protect and revegetate riparian areas to maintain shading and cool water temperatures. 5b.Improve the thermograph to a level equivalent to the QHA-generated thermograph scores of reference and Class 1 streams
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration

Tributary Objective T5	
Additional Secondary Limiting Factor(s) Addressed	Riparian habitat condition, ecological community shifts, non-native species, recruitment failure, system productivity.
NWPCC Programmatic H's Addressed	Habitat
Where	Class 2 and 2.5 tributary streams in the US portion of the Kootenai Subbasin downstream from Libby Dam and in the US portion of the Koocanusa Reservoir watershed.
Other/Notes	
Strategies	- Design and implement projects to protect and revegetate riparian areas to maintain shading and cool water temperatures. - Develop a working relationship with private landowners to improve or enhance nursery streams' riparian and stream-bank habitat - Deploy continuous recording thermographs in important tributaries to monitor water temperatures in relation to tolerance range of native fish species. - Evaluate temperature as a limiting factor. Evaluate the potential role of seasonally elevated water temperatures as a limiting factor to juvenile bull trout rearing and/or adult migration. - Monitor existing and future coal mine and coalbed methane development in the headwaters of the Wigwam drainage and other sites in British Columbia. Monitor and assess existing and potential impacts to riparian habitats and stream water temperatures from coalbed methane development and associated road construction and other activities. - Collect adequate data to ensure that significant water temperature issues can be addressed during the Total Maximum Daily Load planning, implementation, and monitoring process or through other legal mechanisms. - Participate with the Idaho and Montana Department of Environmental Quality in the Total Maximum Daily Load planning, implementation, and monitoring process. Achieve compliance with appropriate multi-disciplinary water quality standards. - Determine the effect of warmer water temperature of the Kootenai River and masking of cold-water tributaries by monitoring water temperatures of tributaries at their mouth and 100 m upstream. - Implement KTOI/BEF Model Watershed Objectives and strategies (Appendix 111)

Tributary Objective T6	
Species/Life stage	All resident stream and adfluvial fishes that use tributary habitat/All life stages for resident stream species; spawning, incubation, and rearing for adfluvial species.
4th-Code HUC	Tributaries (All 4th-Code HUCs) (Habitat)
Limiting Factor	Habitat Diversity
Timeframe	2005 to 2020+
Objective T6 (Measurable Actions)	T6a. Protect habitat diversity in Class 1 streams and reaches. T6b. Improve habitat diversity to a level equivalent to the QHA-generated habitat diversity scores of reference streams.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Altered hydrograph, channel stability, physical habitat, turbidity and fine sediments, community shifts, recruitment failure, and population size.
NWPCC Programmatic H's Addressed	Habitat
Where	Class 1, Class 2 and 2.5 streams in the US portion of the Kootenai Subbasin downstream from Libby Dam and in the US portion of the Koocanusa Reservoir watershed.
Other/Notes	
Strategies	- Increase or improve instream habitat by restoring recruitment of large woody debris, pool development, or other appropriate components in streams where investigation indicates such actions are likely to benefit native fish. - Place large rocks and woody debris in streams to restore the appropriate channel morphometry using Rosgen-type rehabilitation techniques. - Rehabilitate and maintain habitat conditions resulting in ecological and environmental selection pressures that favor native species assemblages. - Agitate embedded spawning gravels where spawning habitat is limiting. - Periodically alter Kootenai River hydrograph within limits to restore hydraulic energy needed to create parafluvial and orthofluvial avulsions, and channel bed material movement to increase habitat diversity required for increased biological diversity. - Design and implement creative solutions for increasing habitat diversity, including creation and re-connection of side channel, slough, backwater habitats, in-river habitat modification and creation, and seasonal and permanent wetlands in US waters. Support and coordinate with similar measures in British Columbia waters of the Kootenai Subbasin. - Implement KTOI/BEF Model Watershed Objectives and strategies (Appendix 111)

Tributary Objective T7	
Species/Life stage	All resident stream and adfluvial fishes that use tributary habitat/All life stages for resident stream species; spawning, incubation, and rearing for adfluvial species.
4th-Code HUC	Tributaries (All 4th-Code HUCs) (Habitat)
Limiting Factor	Altered Hydrograph
Timeframe	2005 to 2020+
Objective T7 (Measurable Actions)	T7a. Improve hydrographs so they are equivalent to the QHA-generated high/low flow habitat restoration scores of reference streams. T7b. Determine opportunities for altered hydro operations to remove delta blockages from tributary streams.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alterations
Additional Secondary Limiting Factor(s) Addressed	Altered thermograph, channel stability, habitat diversity, turbidity and fine sediments, community shifts, recruitment failure, system productivity
NWPCC Programmatic H's Addressed	Habitat, Hydro
Where	Class 1, Class 2 and 2.5 streams in the US portion of the Kootenai Subbasin downstream from Libby Dam and in the US portion of the Koocanusa Reservoir watershed.
Other/Notes	
Strategies	- Restore and maintain hydrologic conditions (flow, timing, duration) to mimic natural processes. - Improve instream flows. - Improve habitat and restore connectivity and opportunities for migration. - Develop a simple hydrological model based on historic tributary temperature, flow, and velocity data, and use to evaluate effects of conditions required by stream dwelling focal species. - Implement KTOI/BEF Model Watershed Objectives and strategies (Appendix 111)

Tributary Objective T8	
Species/Life stage	All resident stream and adfluvial fishes that use tributary habitat/All life stages for resident stream species; spawning, incubation, and rearing for adfluvial species.
4th-Code HUC	Tributaries (All 4th-Code HUCs) (Habitat)
Limiting Factor	Connectivity
Timeframe	2005 to 2020+
Objective T8 (Measurable Action)	Restore and provide passage to migratory fish by removing potential man-caused barriers, i.e. impassable culverts, hydraulic headcuts, water diversion blockages, landslides, and impassable deltas.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alterations
Additional Secondary Limiting Factor(s) Addressed	Altered thermograph, channel stability, habitat diversity, turbidity and fine sediments, community shifts, recruitment failure, system productivity
NWPCC Programmatic H's Addressed	Habitat
Where	Tributary streams in the US portion of the Kootenai Subbasin downstream from Libby Dam and in the US portion of the Koocanusa Reservoir watershed.
Other/Notes	
Strategies	- Improve instream flows. Restore connectivity and opportunities for migration by securing or improving instream flows and acquiring water rights from willing sellers. - Identify, monitor, and maintain existing barriers necessary to keep introduced species at bay; install new barriers where necessary to prevent invasion of introduced species. - Identify barriers or sites of entrainment for focal species, and implement tasks to provide passage and eliminate entrainment. - Eliminate entrainment in diversions. Identify potential loss of fish in diversions and screen water diversions and irrigation ditches identified as high priority. - Provide fish passage around diversions. Install appropriate fish passage structures around diversions and/or remove related migration barriers. - Eliminate culvert barriers. Monitor road crossings for blockages to upstream passage and replace existing culverts that impede passage.

Reservoirs

Limiting factors:

Volumetric Turnover Rates (R1)
Shoreline Condition (R2)
Hydraulic Regime (R3)

Reservoir Objective R1	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Reservoirs (Habitat)
Limiting Factor	Volumetric turnover rates
Timeframe	2005 to 2020+
Objective R1 (Measurable Action)	Improve reservoir refill probability and reduce maximum drawdown to increase reservoir retention time by at least five days relative to past operations during similar water years.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Altered hydrograph, altered thermograph, habitat diversity, physical habitat, population stability, recruitment failure, and population size.
NWPCC Programmatic H's Addressed	Habitat, Hydro
Where	Koocanusa Reservoir
Other/Notes	Lower volumetric turnover rates retain in-reservoir productivity in pelagic and littoral zones. Alternatively, higher volumetric turnover rates flush in-reservoir productivity downstream.
Strategies	- Work with action agencies to improve reservoir refill probability and reduce maximum drawdown and increase seasonal and in-seasonal reservoir retention time by at least five days relative to past operations during similar water years.

Reservoir Objective R2	
Species/Life stage	All Focal species, All Life Stages
4th-Code HUC	Reservoirs (Habitat)
Limiting Factor	Shoreline condition
Timeframe	By 2020
Objective R2 (Measurable Action)	Revegetate the top ten feet (as measured from full pool) of varial zone substrate using techniques developed by BOR for Hungry Horse Reservoir
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations
Additional Secondary Limiting Factor(s) Addressed	Altered hydraulic regime, connectivity, volumetric turnover rates.
NWPCC Programmatic H's Addressed	Habitat, Hydro
Where	Koocanusa Reservoir varial zone
Other/Notes	Initial conclusive results expected from Hungry Horse reservoir by 2008.
Strategies	- Review results from BOR techniques developed and tested for Hungry Horse reservoir after their expected release in 2008. - Plan and coordinate cost-effective means of revegetating the reservoir varial zone with appropriate agencies and organizations. - Initiate and develop noxious weed management strategies with local and regional agencies and entities in the U.S. and B.C. (State, federal, and provincial agencies, Native American Indian Tribes, environmental organizations).

Reservoir Objective R3	
Species/Life stage	All Focal species, All life stages
4th-Code HUC	Reservoirs (Habitat)
Limiting Factor	Hydraulic regime
Timeframe	2005-2020+
Objective R3 (Measurable Action)	Reduce reservoir drawdown and reduce the frequency of Koocanusa Reservoir refill failure to within five feet of full pool as compared to previous post-dam operation.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations,
Additional Secondary Limiting Factor(s) Addressed	Altered hydrograph, connectivity, volumetric turnover rate, system productivity
NWPCC Programmatic H's Addressed	Habitat, Hydro
Where	Koocanusa Reservoir

Reservoir Objective R3	
Other/Notes	Future water regulatory rulings will be incorporated into these operations
Strategies	- Operate Libby Dam and the downstream hydropower system in ways that restore normative river functions in the lower Kootenai River, including hydrograph cycles that promote and maintain habitat diversity, and floodplain connectivity. - Reduce runoff-forecasting error by increasing the number of monitoring sites and incorporating improved remote sensing technology. - Balance the releases of stored water for flow augmentation with reservoir refill. Specifically, calculate tiered flows for sturgeon using a conservative inflow forecast, assuming the lowest 25th percentile precipitation (rather than average). - Modify the mandatory draft of 2 MAF by January 1 to maintain higher reservoir elevations during the annual drawdown period to improve reservoir refill probability. - Implement a sliding refill date to refill earlier in low water years and later in high water years to avoid uncontrolled spill events. - Gradually draft the reservoir after refill to provide a stable or gradually decreasing discharge in the Kootenai River through September 30. Maintain the reservoir at or above ten feet from full pool during all years except during the lowest 20th percentile water years when the elevation may be drafted to 20 feet from full pool by the end of September. - Plan, coordinate, and implement cost-effective means of revegetating the Koocanusa Reservoir varial zone with appropriate local and regional agencies and entities.

Bull Trout

Limiting factors:

Number of local populations (BT1)
Population size (BT2)
Population stability (BT3)
Non-native species (BT4)
System productivity (BT5)

Bull Trout Objective BT1	
Species/Life stage	Bull Trout, All Life Stages
4th-Code HUC	All 4th-Code HUCs (Biological)
Limiting Factor	Number of Local Populations
Timeframe	2005 to 2020+
Objective BT1 (Measurable Action)	Maintain or increase the total number of identified local populations (currently numbering 10 in United States waters), and maintain the broad distribution of local populations across all four existing core areas.
Additional Secondary Limiting Factor(s) Addressed	Population stability, connectivity
NWPCC Programmatic H's Addressed	Habitat, Harvest
Where	Bull Trout Core Areas: Lake Koocanusa, Sophie Lake, Kootenai River (MT/ID/BC) and Kootenay Lake (BC), and Bull Lake.
Other/Notes	This objective is from the Bull Trout Recovery Plan.
Strategies	- Populations in Bull Lake and Sophie Lake. Evaluate the isolated adfluvial bull trout populations in Sophie and Bull lakes to determine core area status and critical limiting factors, to provide recovery actions, and to establish genetic background - Monitor kokanee entrainment through Libby Dam. Continue monitoring kokanee entrainment through Libby Dam and assess the potential importance of this supplemental food source for downstream bull trout. - Minimize unintentional bull trout mortality. Evaluate and prevent over-harvest and incidental angling mortality of bull trout. Ensure that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of bull trout in Koocanusa Reservoir, the Kootenai River, and tributaries. - Evaluate potential effects of introduced fishes on bull trout recovery, westslope cutthroat trout, redband trout, and kokanee conservation and implement tasks to minimize negative effects. - Evaluate effects of existing and proposed sport fishing regulations on bull trout. - Evaluate opportunities for regulated bull trout fisheries. Evaluate carefully regulated harvest of bull trout (in Koocanusa Reservoir or other waters) where monitoring of the population status provides a clear record that a harvestable surplus can be maintained and that such harvest will benefit, or at least not be detrimental to, recovery goals. Limited harvest regulations may increase public

Bull Trout Objective BT1	
	support for recovery goals, as well as aid for implementing other recovery tasks. - Characterize, conserve, and monitor genetic diversity and gene flow among local populations. - Incorporate conservation of genetic and behavioral attributes of bull trout into recovery and management plans. - Conduct genetic inventory to understand the genetic baseline and to monitor genetic changes throughout the range of bull trout. Continue coordinated genetic inventory throughout recovery unit, emphasizing origin of bull trout captured from the mainstem Kootenai River between Libby Dam and Kootenay Lake. - Experiment with micro-elemental signatures in fish scales and otoliths to determine the natal stream of origin. - Maintain long-term viability. Manage local populations (numbers and life forms) to maintain long-term viability. - Maintain or increase opportunities for gene flow among bull trout populations. Restore fish passage on a case-by-case basis where connectivity has been artificially severed. - Maintain connectivity with British Columbia. Emphasize the importance of connectivity of the British Columbia populations (spawning in British Columbia supports Koocanusa Reservoir, and Kootenay Lake is essential to the Kootenai River stocks) and the important factors related to maintaining that connectivity across the international border. - Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation. [The bull trout Scientific Group developed a protocol entitled “The Role of Stocking in Bull Trout Recovery”.

Bull Trout Objective BT2	
Species/Life stage	Bull Trout, All Life Stages
4th-Code HUC	All 4th-Code HUCs (Biological)
Limiting Factor	Population Size
Timeframe	2005 to 2020+
Objective BT2 (Measurable Actions)	BT2a. Achieve at least 5 local populations (including British Columbia tributaries) with 100 adults in each of the primary Lake Koocanusa and Kootenai River/Kootenay Lake core areas, with each of these primary core areas containing at least 1,000 adult bull trout. BT2b. Achieve at least 1 local population of bull trout containing 100 or more adult fish in each of the Bull Lake and Sophie Lake secondary core areas.
Additional Secondary Limiting Factor(s) Addressed	Number of local populations, population stability, recruitment failure
NWPCC Programmatic H's Addressed	Habitat, Harvest
Where	Objective BT2a: Bull Trout Primary Core Areas Objective BT2b: Bull Trout Secondary Core Areas
Other/Notes	This objective originated from the Bull Trout Recovery Plan.
Strategies	- Research populations in Bull Lake and Sophie Lake. Evaluate the isolated adfluvial bull trout populations in Sophie and Bull lakes to determine core area status and critical limiting factors, to provide recovery actions, and to establish genetic background - Monitor fish entrainment through Libby Dam. Continue monitoring kokanee entrainment through Libby Dam and assess the potential importance of this supplemental food source for downstream bull trout. - Minimize unintentional bull trout mortality. Evaluate and prevent over-harvest and incidental angling mortality of bull trout. Ensure that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of bull trout in Koocanusa Reservoir, the Kootenai River, and tributaries. - Evaluate potential effects of introduced fish species on bull trout recovery, westslope cutthroat trout, redband trout, and kokanee conservation and implement tasks to minimize negative effects. - Evaluate regulated harvest of bull trout (in Koocanusa Reservoir or other waters) where monitoring of the population status provides a clear record that a harvestable surplus can be maintained and that such harvest will benefit, or at least not be detrimental to, recovery goals. Where limited harvest regulations can be implemented, additional sport-fishing support can be solicited for recovery goals, as well as aid for implementing other recovery tasks. - Characterize, conserve, and monitor genetic diversity and gene flow among local populations. - Incorporate conservation of genetic and behavioral attributes of bull trout into recovery and management plans. - Conduct genetic inventory to understand the genetic baseline and to monitor genetic changes throughout the range of bull trout, continue coordinated genetic inventory throughout recovery unit, emphasizing origin of bull trout captured

Bull Trout Objective BT2	
	from the mainstem Kootenai River between Libby Dam and Kootenay Lake. - Experiment with micro-elemental signatures in fish scales and otoliths to determine the natal stream of origin - Manage local populations (numbers and life forms) to maintain long-term viability. - Maintain or increase opportunities for gene flow among bull trout populations. Restore fish passage on a case-by-case basis where connectivity has been artificially severed. - Maintain connectivity with British Columbia. Emphasize the importance of connectivity of the British Columbia populations (spawning in British Columbia supports Koocanusa Reservoir, and Kootenay Lake is essential to the Kootenai River stocks) and the important factors related to maintaining that connectivity across the international border. - Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation. [[The bull trout Scientific Group developed a protocol entitled "The Role of Stocking in Bull Trout Recovery".

Bull Trout Objective BT3	
Species/Life stage	Bull Trout, All Life Stages
4th-Code HUC	All 4th-Code HUCs (Biological)
Limiting Factor	Population stability
Timeframe	2005 to 2020+
Objective BT3 (Measurable Action)	Achieve an overall bull trout population trend in the Kootenai River Recovery Unit that is accepted, under contemporary standards of the time, to be stable or increasing, based on at least 10 years of monitoring data.
Additional Secondary Limiting Factor(s) Addressed	Number of local populations, recruitment failure, population size
NWPCC Programmatic H's Addressed	Harvest
Where	Bull Trout Primary and Secondary Core Areas
Other/Notes	This objective originated from the Bull Trout Recovery Plan
Strategies	- Research populations in Bull Lake and Sophie Lake. Evaluate the isolated adfluvial bull trout populations in Sophie and Bull lakes to determine core area status and critical limiting factors, to provide recovery actions, and to establish genetic background - Monitor kokanee entrainment through Libby Dam. Continue monitoring kokanee entrainment through Libby Dam and assess the potential importance of this supplemental food source for downstream bull trout. - Minimize unintentional bull trout mortality. Evaluate and prevent over-harvest and incidental angling mortality of bull trout. Ensure that sport angling

Bull Trout Objective BT3	
	regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of bull trout in Koocanusa Reservoir, the Kootenai River, and tributaries. - Evaluate potential effects of introduced fishes on bull trout recovery, westslope cutthroat trout, redband trout, and kokanee conservation and implement tasks to minimize negative effects. - Evaluate effects of existing and proposed sport fishing regulations on bull trout. - Evaluate opportunities for regulated bull trout fisheries. Evaluate management proposals to allow carefully regulated harvest of bull trout (in Koocanusa Reservoir or other waters) where monitoring of the population status provides a clear record that a harvestable surplus can be maintained and that such harvest will benefit, or at least not be detrimental to, recovery goals. If allowable harvest levels can be implemented, additional sport-fishing support can be solicited for recovery goals, as well as aid for implementing other recovery tasks. - Characterize, conserve, and monitor genetic diversity and gene flow among local populations. - Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans. - Conduct genetic inventory. To contribute to establishing a program to understand the genetic baseline and to monitor genetic changes throughout the range of bull trout, continue coordinated genetic inventory throughout recovery unit, emphasizing origin of bull trout captured from the mainstem Kootenai River between Libby Dam and Kootenay Lake. - Maintain long-term viability. Manage local populations (numbers and life forms) to maintain long-term viability. - Maintain or increase opportunities for gene flow among bull trout populations. Restore fish passage on a case-by-case basis where connectivity has been artificially severed. - Maintain connectivity with British Columbia. Emphasize the importance of connectivity of the British Columbia populations (spawning in British Columbia supports Koocanusa Reservoir, and Kootenay Lake is essential to the Kootenai River stocks) and the important factors related to maintaining that connectivity across the international border. - Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.

Bull Trout Objective BT4	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) (Biological)
Limiting Factor	Non-native Species
Timeframe	2020
Objective BT4 (Measurable Actions)	BT4a. Suppress and prevent expansion of populations of non-native fish species beyond current levels in Koocanusa Reservoir. BT4b. Support and coordinate with suppression and removal activities for non-native fish species in British Columbia waters of the Kootenai Subbasin to reduce relative and total abundance of non-native fishes in the Subbasin.

Bull Trout Objective BT4	
Primary Limiting Factor(s) Addressed	Non-native Species Introduction
Additional Secondary Limiting Factor(s) Addressed	Community shifts
NWPCC Programmatic H's Addressed	Hatchery, Habitat
Where	All regulated mainstem and tributary reaches of the Kootenai River containing bull trout.
Other/Notes	
Strategies	- Evaluate opportunities for experimentally removing brook trout from selected streams and lakes. - Where logistically and technically feasible and socially acceptable, suppress or eradicate introduced species that compete with, hybridize with, or prey on genetically pure westslope cutthroat trout. - Rehabilitate habitat to favor native species assemblages. - Use RSI's to increase native species densities in areas where natural colonization is not possible. - Prevent introductions of non-native fishes from private fish ponds. Reduce threat of inadvertent introduction from private fish ponds by closely regulating existing permits and by screening future applications. - Evaluate and upgrade all fish stocking programs and private and public hatchery practices to minimize inadvertent introduction of non-native species to the Subbasin. - Provide information to the public about ecosystem concerns of illegal introductions of non-native fishes and discourage unauthorized fish introductions. Implement an educational effort about the problems and consequences of unauthorized fish introductions. - Continue assessment of predator and prey interactions with emphasis on preventing illegal introductions non-native fishes. - Develop tasks to reduce negative effects of non-native taxa on focal species, and implement control of non-native fishes where found to be feasible and appropriate. - Rehabilitate habitat conditions resulting in ecological and environmental selection pressures that favor native species assemblages.

Bull Trout Objective BT 5	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) and Kootenay Lake (Biological)
Limiting Factor	System Productivity (Nutrients)
Timeframe	2005 to 2020+
Objective BT5 (Measurable Action)	Restore primary, secondary, and tertiary productivity rates and nutrient values downstream from Libby Dam to pre-dam condition (equal to those of inflows into Koocanusa Reservoir, corrected for downstream lateral input).
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations
Additional Secondary Limiting Factor(s) Addressed	Turbidity, community shifts, population stability, recruitment failure, population size.
NWPCC Programmatic H's Addressed	Habitat
Where	All reaches of the Kootenai River in the U.S. downstream from Libby Dam.
Other/Notes	Current depressed system productivity (ultraoligotrophy) is a major underlying factor negatively affecting all biological aspects of species, population, and habitat restoration and recovery in the Kootenai River (and Kootenay Lake) downstream from Libby Dam. System productivity must be improved within the mainstem to expect positive changes in fish populations to result from simultaneous physical habitat improvements when trophic status (reduced productivity) are co-limiting.
Strategies	- Research the link between system productivity and bull trout abundance. Evaluate the effects of the nutrient sink caused by Koocanusa Reservoir on the downstream system. Monitor BC efforts to restore productivity to Kootenay Lake via artificial fertilization. Emphasis should be placed on continuing to track bull trout population trends through surveys of catch and harvest in Kootenay Lake as well as other monitoring indices (*e.g.*, redd counts) of migratory fish in the upstream waters.

Redband Trout

Limiting factors:

Number of local populations (RBT1)
Population size (RBT2)
Non-native species (RBT3)

Redband Trout Objective RBT 1	
Species/Life stage	Redband Trout, All Life Stages
4th-Code HUC	All 4th-Code HUCs (Biological)
Limiting Factor	Number of Local Populations
Timeframe	2005 to 2020+
Objective RBT1 (Measurable Actions)	RBT1a. Maintain or increase the total number of genetically pure local populations. RBT1b. Replicate genetically pure redband stocks for use in restoration actions throughout their historic range.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Number of conservation populations and population stability
NWPCC Programmatic H's Addressed	Harvest, Hatchery
Where	Kootenai River and tributaries (MT/ID/BC) and Kootenay Lake (BC).
Other/Notes	The current distribution in Montana includes isolated, genetically pure populations in Basin Creek, a tributary to the East Fork Yaak River, and Callahan Creek, a tributary to the Kootenai River. Genetically altered remnant populations exist in Wolf Creek, a tributary to the Fisher River, and Libby Creek, a tributary to the Kootenai River, indicating that redband may have been native upstream of Kootenai Falls. A genetically distinct redband stock exists in Kootenay Lake B.C.
Strategies	- Protect remaining redband populations by enacting conservation measures in sport angling regulations and fisheries management plans, guidelines, and policies to minimize unintentional mortality of redband trout in Kootenai River tributaries. - Evaluate potential effects of introduced fishes on bull trout recovery, westslope cutthroat trout, redband trout, and kokanee conservation and implement tasks to minimize negative effects. - Evaluate effects of existing and proposed sport harvest regulations on redband trout. - Characterize, conserve, and monitor genetic diversity in isolate populations. - Incorporate conservation of genetic and behavioral attributes of redband trout into recovery and management plans. - Maintain long-term viability of conservation populations (numbers and lifecycle strategies) and establish wild populations where native stocks have been extirpated.

Redband Trout Objective RBT 1	
	- Cooperate with fisheries personnel in British Columbia to conserve genetically pure stocks of redband trout and monitor genetic changes throughout Kootenai Subbasin. - Utilize the Natural Rearing Facility at the Libby Area Office to replicate genetically pure redband trout for use in restoration efforts. - Develop genetic management plans and update guidelines for appropriate use of transplantation and artificial propagation. All donor populations will be 100% genetically pure and free of all reportable fish pathogens. The degree of relatedness among populations, expressed in genetic dendrograms, will form the basis for selecting nearest neighbor stocks where evidence exists for the population targeted for restoration. Donor fish will be collected over several years to maximize heterogeneity and held in isolation until their health and genetic status can be determined.

Redband Trout Objective RBT2	
Species/Life stage	Redband Trout, All Life Stages
4th-Code HUC	All 4th-Code HUCs (Biological)
Limiting Factor	Population Size
Timeframe	2005 to 2020+
Objective RBT2 (Measurable Action)	Achieve a minimum of 2 genetically pure conservation populations, each containing at least 250 adult redband trout (including British Columbia tributaries). In Kootenai Subbasin redband trout populations that have subpopulations, subpopulations should contain at least 50 adult individuals to improve the probability of subpopulation persistence.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Number of conservation populations, population size and stability.
NWPCC Programmatic H's Addressed	Harvest, Hatchery
Where	Redband Trout conservation populations
Other/Notes	
Strategies	- Minimize unintentional redband trout mortality by ensuring that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of redband trout in Kootenai River tributaries and small Subbasin lakes. - Evaluate potential effects of introduced fish species on redband trout restoration, bull trout recovery, westslope cutthroat trout, and kokanee conservation and implement tasks to minimize negative effects. - Evaluate effects of existing and proposed sport harvest regulations on redband trout populations. - Maintain long-term viability of conservation populations (numbers and life cycle strategies). Where necessary, isolate pure populations to prevent invasion of nonnative species or genetically introgressed populations

Redband Trout Objective RBT2	
	- Rear genetically pure redband trout in restored natural rearing habitat at the Libby Area Office. Use F1 progeny for restoration projects within their historic range. - Restore river productivity for food production to improve redband trout survival and growth. - Evaluate available over-winter rearing habitat for young redband trout and determine means of improving or optimizing available over winter rearing habitat.

Redband Trout Objective RBT3	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) (Biological)
Limiting Factor	Non-native Species
Timeframe	2020
Objective RBT3 (Measurable Actions)	RBT3a. Suppress and prevent expansion of populations of non-native fish species. RBT3b. Support and coordinate with suppression and removal activities for non-native fish species in British Columbia waters of the Kootenai Subbasin to reduce relative and total abundance of non-native fishes in the Subbasin.
Primary Limiting Factor(s) Addressed	Non-native Species Introduction
Additional Secondary Limiting Factor(s) Addressed	Community shifts
NWPCC Programmatic H's Addressed	Hatchery, Habitat
Where	All regulated mainstem and tributary reaches of the Kootenai River containing bull trout.
Other/Notes	
Strategies	- Evaluate opportunities for experimentally removing brook trout from selected streams and lakes. - Where logistically and technically feasible and socially acceptable, suppress or eradicate introduced species that compete with, hybridize with, or prey on genetically pure redband trout. - Rehabilitate habitat to favor native species assemblages. - Use RSI's to increase native species densities in areas where natural colonization is not possible. - Prevent introductions of non-native fishes from private fish ponds. Reduce threat of inadvertent introduction from private fish ponds by closely regulating existing permits and by screening future applications. - Evaluate and upgrade all fish stocking programs and private and public hatchery practices to minimize inadvertent introduction of non-native species

Redband Trout Objective RBT3	
	to the Subbasin. - Provide information to the public about ecosystem concerns of illegal introductions of non-native fishes and discourage unauthorized fish introductions. Implement an educational effort about the problems and consequences of unauthorized fish introductions. - Continue assessment of predator and prey interactions with emphasis on preventing illegal introductions non-native fishes. - Develop tasks to reduce negative effects of non-native taxa on focal species, and implement control of non-native fishes where found to be feasible and appropriate. - Rehabilitate habitat conditions resulting in ecological and environmental selection pressures that favor native species assemblages.

Westslope Cutthroat Trout

Limiting factors:

Number of local populations (WCT1)
Small population size (WCT2)
Non-native species (WCT3)

Westslope Cutthroat Trout Objective WCT1	
Species/Life stage	Westslope cutthroat trout, All Life Stages
4th-Code HUC	All 4th-Code HUCs (Biological)
Limiting Factor	Number of Local Populations
Timeframe	2005 to 2020+
Objective WCT1 (Measurable Action)	Maintain or increase the total number of genetically pure local populations, and maintain the broad distribution of local populations in existing metapopulations.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration and Non-native species
Additional Secondary Limiting Factor(s) Addressed	Population stability, connectivity
NWPCC Programmatic H's Addressed	Harvest, Hatchery
Where	Lake Koocanusa (MT/BC), Kootenai River (MT/ID/BC) and Kootenay Lake (BC), and Bull Lake.
Other/Notes	This objective originated from the Memorandum of Understanding and Conservation Agreement for westslope cutthroat trout (*Oncorhynchus clarki lewisi*) and status of westslope cutthroat trout in the United States. The current distribution in the upper Kootenai includes 1212.7 miles of habitat (1.9 miles remain genetically unaltered); lower Kootenai includes 525.5 miles (53.9 miles unaltered plus 16.3 suspected unaltered); Yaak has 355.7 miles (20.2 unaltered, 6 suspected unaltered); Fisher has 416.4 miles (67.9 unaltered, 65.5 suspected) and Moyie includes 129.6 miles of occupied habitat (91.1 miles are suspected unaltered).
Strategies	- Minimize unintentional westslope cutthroat trout mortality. Evaluate and prevent over-harvest and incidental angling mortality of westslope cutthroat trout. Ensure that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of westslope cutthroat trout in Koocanusa Reservoir, the Kootenai River, and tributaries. - Evaluate potential effects of introduced fishes on westslope cutthroat trout conservation and implement tasks to minimize negative effects. - Evaluate effects of existing and proposed sport harvest regulations on westslope cutthroat trout. - Characterize, conserve, and monitor genetic diversity and gene flow among local populations. - Incorporate conservation of genetic and behavioral attributes of westslope cutthroat trout into recovery and management plans. - Conduct genetic inventory to complete the genetic baseline (untested areas) and to monitor genetic changes throughout the range of westslope cutthroat trout.

Westslope Cutthroat Trout Objective WCT1	
	Continue coordinated genetic inventory. - Experiment with micro-elemental signatures in fish scales and otoliths to determine the natal stream of origin. - Maintain long-term viability of conservation populations (numbers and lifecycle strategies) and establish wild populations where native stocks have been extirpated. - Maintain existing opportunities for gene flow among westslope cutthroat trout populations. - Maintain connectivity with British Columbia. Emphasize the importance of connectivity of the British Columbia populations (spawning in British Columbia supports Koocanusa Reservoir stocks) and the important factors related to maintaining that connectivity across the international border. - Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation. All donor populations will be 100% genetically pure and free of all reportable fish pathogens. The degree of relatedness among populations, expressed in genetic dendrograms, will form the basis for selecting nearest neighbor stocks where evidence exists for the population targeted for restoration. Donor fish will be collected over several years to maximize heterogeneity and held in isolation until their status can be determined. - Complete renovation of the Sekokini Springs Natural Rearing Facility to facilitate experimental culture of up to four genetic strains of westslope cutthroat. Rear juveniles to maturity under nearly natural conditions to conserve wild behavioral traits and produce F1 progeny to restore wild spawning runs in restored or reconnected habitat.

Westslope Cutthroat Trout Objective WCT2	
Species/Life stage	Westslope cutthroat trout, All Life Stages
4th-Code HUC	All 4th-Code HUCs (Biological)
Limiting Factor	Small Population Size
Timeframe	2005 to 2020+
ObjectiveWCT2 (Measurable Action)	Achieve at least 5 genetically pure conservation populations (including British Columbia tributaries) with 50 adults in each of the subpopulations in Lake Koocanusa, Kootenai River and Kootenay Lake, with each of these conservation populations containing at least 500 adult westslope cutthroat trout.
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration, Non-native Species Introductions
Additional Secondary Limiting Factor(s) Addressed	Number of local populations, population stability, recruitment failure
NWPCC Programmatic H's Addressed	Harvest, Habitat
Where	Westslope Cutthroat Trout conservation waters
Other/Notes	Strategies under this objective were adapted from the WCT MOU and status report.

Westslope Cutthroat Trout Objective WCT2	
Strategies	- Minimize unintentional westslope cutthroat trout mortality. Evaluate and prevent over-harvest and incidental angling mortality of westslope cutthroat trout. Ensure that sport angling regulations and fisheries management plans, guidelines, and policies minimize unintentional mortality of westslope cutthroat trout in Koocanusa Reservoir, the Kootenai River, and tributaries. - Evaluate potential effects of introduced fish species on westslope cutthroat trout restoration, bull trout recovery, redband trout, and kokanee conservation and implement tasks to minimize negative effects. - Evaluate effects of existing and proposed sport harvest regulations on westslope cutthroat trout populations. - Maintain long-term viability of conservation populations (numbers and life cycle strategies). Where necessary, isolate pure populations to prevent invasion of nonnative species or genetically introgressed populations. - Complete renovation of the Sekokini Springs Natural Rearing Facility to facilitate experimental culture of up to four genetic strains of westslope cutthroat. Rear juveniles to maturity under nearly natural conditions to conserve wild behavioral traits and produce F1 progeny to restore wild spawning runs in restored or reconnected habitat.

Westslope Cutthroat Trout Objective WCT3	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) (Biological)
Limiting Factor	Non-native Species
Timeframe	2020
Objective WCT3 (Measurable Actions)	WCT3a. Suppress and prevent expansion of populations of non-native fish species. WCT3b. Support and coordinate with suppression and removal activities for non-native fish species in British Columbia waters of the Kootenai Subbasin to reduce relative and total abundance of non-native fishes in the Subbasin.
Primary Limiting Factor(s) Addressed	Non-native Species Introduction
Additional Secondary Limiting Factor(s) Addressed	Community shifts
NWPCC Programmatic H's Addressed	Hatchery, Habitat
Where	All regulated mainstem and tributary reaches of the Kootenai River containing bull trout.
Other/Notes	
Strategies	- Evaluate opportunities for experimentally removing brook trout from selected streams and lakes. - Where logistically and technically feasible and socially acceptable, suppress or eradicate introduced species that compete with, hybridize with, or prey on

Westslope Cutthroat Trout Objective WCT3	
	genetically pure westslope cutthroat trout. - Rehabilitate habitat to favor native species assemblages. - Use RSI's to increase native species densities in areas where natural colonization is not possible. - Prevent introductions of non-native fishes from private fish ponds. Reduce threat of inadvertent introduction from private fish ponds by closely regulating existing permits and by screening future applications. - Evaluate and upgrade all fish stocking programs and private and public hatchery practices to minimize inadvertent introduction of non-native species to the Subbasin. - Provide information to the public about ecosystem concerns of illegal introductions of non-native fishes and discourage unauthorized fish introductions. Implement an educational effort about the problems and consequences of unauthorized fish introductions. - Continue assessment of predator and prey interactions with emphasis on preventing illegal introductions non-native fishes. - Develop tasks to reduce negative effects of non-native taxa on focal species, and implement control of non-native fishes where found to be feasible and appropriate. - Rehabilitate habitat conditions resulting in ecological and environmental selection pressures that favor native species assemblages.

Kokanee

Limiting factors:

System Productivity (KOK1)
Ecological Community Shifts (KOK2)
Population size (KOK3)

Kokanee Objective KOK1	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River, Reservoirs, and Tributaries (Habitat)
Limiting Factor	System productivity (Nutrients)
Timeframe	2005 to 2020+
Objective KOK1 (Measurable Action)	Restore primary, secondary, and tertiary productivity rates and values downstream from Libby Dam to pre-dam condition (equal to those of inflows into Koocanusa Reservoir).
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations
Additional Secondary Limiting Factor(s) Addressed	Turbidity, community shifts, population stability, recruitment failure, population size.
NWPCC Programmatic H's Addressed	Habitat
Where	All reaches of the Kootenai River in the U.S. downstream from Libby Dam.
Other/Notes	Current depressed system productivity (ultraoligotrophy) is a major underlying factor negatively affecting all biological aspects of species, population, and habitat restoration and recovery in the Kootenai River (and Kootenay Lake) downstream from Libby Dam. System productivity must be improved (ideally to pre-dam levels) within the mainstem to expect positive changes in fish populations to result from simultaneous physical habitat improvements.
Strategies	- Continue monitoring and evaluation programs among all trophic levels in US portions of the Kootenai River Subbasin that help evaluate and track responses of Kootenay Lake fertilization. - Conduct further research to understand the "nutrient pump" affect that was historically provided by kokanee in the lower Kootenai. - Provide data from US RM&E programs to Canadian agency personnel in the best interest of viability and persistence of trans-boundary fish and wildlife populations. - Model and evaluate experimental river-scale fertilization in the Kootenai River. - Assess primary productivity and algal community composition and simulate nutrient addition effects using mesocosm analysis within key reaches of the Kootenai River in Montana and Idaho. - Analyze assessment program and mesocosm results and use analytical results to evaluate the appropriateness of experimental river-scale fertilization. - Annually reconvene the International Kootenai River Ecosystem Restoration

Kokanee Objective KOK1	
	Team (IKERT) to develop recommendations for possible implementation of nutrient-addition experiments. - If supported by IKERT recommendation and supporting scientific analysis, implement, monitor, and evaluate large-scale, controlled, nutrient addition experiment downstream from the Idaho-Montana border. - Determine the effect of nutrient additions on sport fish populations in Kootenai River downstream of Montana. - Conduct a creel survey on the Kootenai River after three years of nutrient additions and compare harvest and catch rates to pre-treatment creel. - Estimate population changes, size, condition and age structure changes in burbot, white sturgeon, redband and bull trout, and mountain whitefish post nutrient treatment. - Sample fish populations at minimum of four index sites and determine trophic structure, species composition, CPUE, and species biomass and compare to pre nutrient treatment data. - Investigate historic and current potential of floodplain/river nutrient exchange. - Continue to monitor, evaluate and refine large-scale monitoring of primary, secondary, and tertiary trophic levels. Continue to: - Monitor fish community dynamics annually at index sites on the mainstem Kootenai River. - Monitor macroinvertebrate community dynamics annually at index sites on the mainstem Kootenai River. - Monitor key water quality parameters annually within key reaches of the Kootenai River to assess primary productivity. - Evaluate aquatic biota community dynamics and productivity of backwater slough habitats adjacent to the lower Kootenai River. - Evaluate terrestrial biota community dynamics and productivity of wetland and riparian habitats adjacent to the lower Kootenai River. - Collect algae and plankton monthly for ID and chlorophyll analysis and apply IBI to algae production to determine the available food base for larval fish. - Assess pre and post dam trophic and water quality changes using fossil diatoms obtained from river coring done in 2000. - Continue to sample fish populations at a minimum of five standardized index sites and determine trophic structure, species composition, CPUE, and species biomass. - Periodically re-calculate statistical power of multi-trophic level biomonitoring program. - *Conduct a creel survey on the Kootenai River one year prior to nutrient ad*ditions and compare harvest and catch rates to post treatment creel. - Continue efforts to restore other components of the native fish community. - Continue to support implementation of South Arm Kootenay Lake fertilization. - Continue to support implementation of Arrow Lake fertilization due impacts of the Libby/Arrow water swap. - Conduct controlled and in-situ laboratory bioassays to determine the physiological effects of temperature, contaminants, predation, nutrients, and other potential environmental stressors on various critically impaired life stages of focal fish species.

Kokanee Objective KOK2	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River, Reservoirs, and Tributaries (Habitat)
Limiting Factor	Ecological community shifts
Timeframe	2005 to 2020+
Objective KOK2 (Measurable Action)	Rehabilitate tributary fish community structure and density to better approximate pre-Libby Dam ecological community characteristics.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alteration, Non-native Species Introduction
Additional Secondary Limiting Factor(s) Addressed	Altered hydrograph, altered thermograph, habitat diversity, physical habitat, population stability, recruitment failure, population size.
NWPCC Programmatic H's Addressed	Habitat, Hydro
Where	Tributary streams in the US portion of the Kootenai Subbasin downstream from Libby Dam and in the US portion of the Koocanusa Reservoir watershed.
Other/Notes	Restoration of normative ecological community structure is a multidisciplinary endeavor, including improvements to hydro operations, physical habitat and ecological community components to restore ecological and environmental selection pressures to favor native taxa assemblages.
Strategies	- Develop, evaluate, implement, and monitor improvements to hydro operations, physical habitats, and ecological community components to restore ecological and environmental selection pressures to favor native assemblages of fish & wildlife in the mainstem Kootenai R. and associated historical floodplain areas.

Kokanee Objective KOK3	
Species/Life stage	Kokanee, All life stages
4th-Code HUC	Mainstem Kootenai River, Kootenay Lake, Tribs (Biological)
Limiting Factor	Small Population Size
Timeframe	By 2020
Objective KOK3 (Measurable Action)	Document greater than 50 adult spawning kokanee in each tributary by 2007. Document greater than 100 adult spawning kokanee in each tributary by 2020. Develop a multi-year average of 250 adult spawning kokanee in each tributary by 2030.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Community shifts, population stability.

Kokanee Objective KOK3	
NWPCC Programmatic H's Addressed	Habitat, Hatchery
Where	Lower Kootenai River, ID.
Other/Notes	
Strategies	- Implement KTOI/BEF Model Watershed Objectives and strategies (Appendix 111) - Reintroduce kokanee into tributaries to the Kootenai River - Restore natural recruitment in Westside Kootenai River tributaries in Idaho.

White Sturgeon

Limiting factors:

System Productivity (WST1)
Recruitment Failure (WST2)
Small Population Size (WST3)
Contaminants (WST4)

White Sturgeon Objective WST1	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) and Kootenay Lake (Biological)
Limiting Factor	System Productivity (Nutrients)
Timeframe	2005 to 2020+
Objective WST1 (Measurable Action)	Restore primary, secondary, and tertiary productivity rates and nutrient values downstream from Libby Dam to pre-dam condition (equal to those of inflows into Koocanusa Reservoir, corrected for downstream lateral input).
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Turbidity, community shifts, population stability, recruitment failure, population size.
NWPCC Programmatic H's Addressed	Habitat
Where	All reaches of the Kootenai River in the U.S. downstream from Kootenai Falls, including Kootenay Lake British Columbia.
Other/Notes	Current depressed system productivity (ultraoligotrophy) is a major underlying factor negatively affecting all biological aspects of species, population, and habitat restoration and recovery in the Kootenai River (and Kootenay Lake) downstream from Libby Dam. System productivity must be improved within the mainstem to expect positive changes in fish populations to result from simultaneous physical habitat improvements when trophic status (reduced productivity) are co-limiting.

Strategies	- Model and evaluate experimental river-scale fertilization in the Kootenai River.
	  - Assess primary productivity and algal community composition, and simulate nutrient addition effects using mesocosm analysis within key reaches of the Kootenai River in Montana and Idaho.
	  - Use mesocosm techniques to address additional critical uncertainties regarding system productivity, function, and small-scale ecological responses to nutrient addition.
	  - Analyze assessment program and mesocosm results; use analytical results to evaluate the appropriateness of experimental river-scale fertilization.
	  - Annually reconvene the International Kootenai River Ecosystem Restoration Team (IKERT) to develop recommendations regarding nutrient enhancement management options.
	  - If supported by IKERT recommendation and supporting scientific analysis, design, implement, monitor, and evaluate annually replicated large-scale, controlled, nutrient addition experiments.

White Sturgeon Objective WST1	

	- Document effects of nutrient addition on sport fish and focal species populations in the mainstem Kootenai River, and in its tributaries for adfluvial fish species.
	  - Conduct a creel survey on the Kootenai River before, during and after three years of nutrient additions, should they occur, and compare harvest and catch rates to pre-treatment values.
	  - Estimate population parameter value changes, size, condition and age structure changes in burbot, white sturgeon, redband and bull trout, and mountain whitefish before, during, and after experimental nutrient addition, should it occur.
	  - Sample fish populations at minimum of four index sites and determine trophic structure, species composition, CPUE, and species biomass and compare to pre nutrient treatment data.
	- Investigate historic and current potential of floodplain/river nutrient exchange.
	- Design and implement creative solutions for increasing habitat diversity, including creation and re-connection of side channels (evaluate and pursue natural and engineered habitat options), slough, backwater habitats, in-river habitat modification and creation, and seasonal and permanent wetlands in US waters. Support and coordinate with similar measures in British Columbia waters of the Kootenai Subbasin.
	- Continue to monitor, evaluate and refine large-scale monitoring of primary, secondary, and tertiary trophic levels. Continue to:
	  - Monitor fish community dynamics annually at mainstem Kootenai River index sites.
	  - Monitor macroinvertebrate community dynamics annually at mainstem Kootenai River index sites.
	  - Monitor key water quality parameters annually within key reaches of the Kootenai River to assess primary productivity.
	  - Evaluate aquatic biota community dynamics and productivity of backwater slough habitats within the historic Kootenai River floodplain.
	  - Evaluate terrestrial biota community dynamics and productivity of wetland and riparian habitats within the historic Kootenai River floodplain.
	  - Collect algae and plankton monthly for identification and chlorophyll analysis, and apply IBI to algae production to determine the available food base for larval fish.
	  - Assess pre and post dam trophic and water quality changes using accepted paleocoring methods of Kootenai River sediment strata.
	  - Continue to sample fish populations at a minimum of four standardized index sites and determine trophic structure, species composition, CPUE, species biomass, and condition factor.
	  - Periodically re-calculate and maintain adequate statistical power of multi-trophic level biomonitoring program.
	- Continue efforts to restore stream habitats and other components of the native fish community, including kokanee (See kokanee objectives and strategies tables for more details).
	- Continue to support implementation of South Arm Kootenay Lake fertilization.
	- Continue to support implementation of Arrow Lake fertilization due impacts of the Libby/Arrow water swap.
	- Endorse potential benefits to white sturgeon and burbot populations and to the food base from ongoing efforts in other forums to assess and remedy sources of environmental contaminants.

White Sturgeon Objective WST1	
	- Conduct controlled and in-situ laboratory bioassays to determine the physiological effects of temperature, contaminants, predation, nutrients, and other potential environmental stressors on various critically impaired life stages of focal fish species.

White Sturgeon Objective WST2	
Species/Life stage	White Sturgeon, All life stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower)
Limiting Factor	Recruitment Failure
Timeframe	By 2020
Objective WST2 (Measurable Action)	Achieve natural production of white sturgeon in at least 3 different years of a 10-year period. A naturally produced year class is demonstrated through detection by standard recapture methods of at least 20 juveniles from that class reaching more than 1 year of age (as defined in the 1999 USFWS Recovery Plan for white sturgeon in the Kootenai River)
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Population stability, recruitment failure, population size.
NWPCC Programmatic H's Addressed	Hydro, Hatchery
Where	All regulated mainstem reaches of the Kootenai River in the U.S. downstream from Kootenai Falls, MT.
Other/Notes	
Strategies	- Restore natural recruitment - Develop and implement conservation aquaculture using adaptive breeding plan as a guide.

White Sturgeon Objective WST3	
Species/Life stage	White Sturgeon, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower)
Limiting Factor	Small Population Size
Timeframe	By 2020
Objective WST3 (Measurable Actions)	WST3a. Achieve an estimated white sturgeon population that is stable or increasing with juveniles reared through a conservation aquaculture program available to be added to the wild population each year for a 10-year period. For this purpose, a year class will be represented by the equivalent of 1,000 one-year-old fish from each of 6 to 12 families, i.e. 3 to 6 female parents. Each of these

White Sturgeon Objective WST3	
	year classes must be large enough to produce 24 to 120 white sturgeon surviving to sexual maturity. WST3b. Evaluate establishment of experimental non-essential white sturgeon population.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Population stability, recruitment failure, population size
NWPCC Programmatic H's Addressed	Hydro, Habitat, Hatchery
Where	Kootenai River mainstem and Kootenay Lake.
Other/Notes	A breeding plan has been updated and recovery plan will be revised soon – targets will change (Currently under discussion within Recovery Team (4/18/04)

Strategies	- Restore natural recruitment
	- Develop and implement conservation aquaculture using adaptive breeding plan as a guide.
	  - Implement annual multi-year breeding protocols to: a) maximize annual effective population numbers; b) re-establish age-class structure and population abundance; c) avoid further demographic and genetic bottlenecking; and d) contribute to long-term population viability and persistence.
	  - Implement "demographic restoration" and "early life history research" stocking methods to maximize demographic and genetic vigor, and to address critical uncertainties overshadowing natural recruitment and population recovery.
	  - Preserve and monitor genetic variability and diversity in the wild population and in the subset hatchery brood stock and progeny groups. (Variability refers to the relative composition of all genetic types within a sample, whereas diversity reflects the total number of different types). Use genetic analysis to avoid inbreeding in the hatchery whenever possible.
	  - Implement and maintain a long-term database that incorporates all life stages, and is sensitive to individual- and family-level identity.
	  - Evaluate program success and appropriateness of goals and objectives with an individual-based demographic and population genetic model.
	  - Evaluate and test feasibility of alternative site(s) to develop and maintain an experimental, non-essential population of Kootenai River white sturgeon.
	  - Evaluate development of genetically diverse captive brood stock population to serve as back-up to current wild population for acquisition of genetically diverse brood stock for contribution to the next generation.
	- Monitor and evaluate the reuniting of adult white sturgeon spawners with suitable spawning substrate.
	- Monitor and evaluate the survival of artificially and directly fertilized white sturgeon eggs over suitable substrates.

White Sturgeon Objective WST4	
Species/Life stage	White Sturgeon, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower)
Limiting Factor	Contaminants
Timeframe	By 2020
Objective WST4 (Measurable Actions)	WST4a. Evaluate lethal and sub-lethal effects of environmental contaminants, including reproductive and behavioral effects on Kootenai River white sturgeon and burbot. WST4b. Seek remedies for contaminant problems if warranted
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Population stability, recruitment failure, small population size
NWPCC Programmatic H's Addressed	Habitat
Where	Kootenai River mainstem and Kootenay Lake.
Other/Notes	
Strategies	- Summarize available historic information about contaminant effects on sturgeon and burbot - Implement non-lethal monitoring techniques to determine potential effects of environmental contaminants on Kootenai River white sturgeon and burbot. - Assess bioaccumulation and potential chronic effects of existing Environmental contaminants on Kootenai River white sturgeon and burbot through laboratory bioassays and in-situ studies - Develop a program to monitor contaminant levels and effects on white sturgeon and burbot - Provide management recommendations (pertaining to environmental contaminants) to remediate for contaminant effects and assist with recovery of the Kootenai River white sturgeon and burbot.

Burbot

Limiting factors:

System Productivity (BUR1)
Ecological Community Shift (BUR2)
Recruitment Failure (BUR3)
Small Population Size (BUR 4)
Contaminants (BUR5)

Burbot Objective BUR1	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) and Kootenay Lake (Biological)
Limiting Factor	System Productivity (Nutrients)
Timeframe	2005 to 2020+
Objective BUR1 (Measurable Action)	Restore primary, secondary, and tertiary productivity rates and nutrient values downstream from Libby Dam to pre-dam condition (equal to those of inflows into Koocanusa Reservoir, corrected for downstream lateral input).
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations
Additional Secondary Limiting Factor(s) Addressed	Turbidity, community shifts, population stability, recruitment failure, population size.
NWPCC Programmatic H's Addressed	Habitat
Where	All reaches of the Kootenai River in the U.S. downstream from Libby Dam.
Other/Notes	Current depressed system productivity (ultraoligotrophy) is a major underlying factor negatively affecting all biological aspects of species, population, and habitat restoration and recovery in the Kootenai River (and Kootenay Lake) downstream from Libby Dam. System productivity must be improved within the mainstem to expect positive changes in fish populations to result from simultaneous physical habitat improvements when trophic status (reduced productivity) are co-limiting.

Strategies	- Model and evaluate experimental river-scale fertilization in the Kootenai River.
	  - Assess primary productivity and algal community composition, and simulate nutrient addition effects using mesocosm analysis within key reaches of the Kootenai River in Montana and Idaho.
	  - Use mesocosm techniques to address additional critical uncertainties regarding system productivity, function, and small-scale ecological responses to nutrient addition.
	  - Analyze assessment program and mesocosm results; use analytical results to evaluate the appropriateness of experimental river-scale fertilization.
	  - Annually reconvene the International Kootenai River Ecosystem Restoration Team (IKERT) to develop recommendations regarding nutrient enhancement management options.
	  - If supported by IKERT recommendation and supporting scientific analysis, design, implement, monitor, and evaluate annually replicated large-scale, controlled, nutrient addition experiments downstream from the Idaho-Montana border.

Burbot Objective BUR1	

	- Document effects of nutrient addition on sport fish and focal species populations in the mainstem Kootenai River, and in its tributaries for adfluvial fish species.
	  - Conduct a creel survey on the Kootenai River before, during and after three years of nutrient additions, should they occur, and compare harvest and catch rates to pre-treatment values.
	  - Estimate population parameter value changes, size, condition and age structure changes in burbot, white sturgeon, redband and bull trout, and mountain whitefish before, during, and after experimental nutrient addition, should it occur.
	  - Sample fish populations at minimum of four index sites and determine trophic structure, species composition, CPUE, and species biomass and compare to pre nutrient treatment data.
	- Investigate historic and current potential of floodplain/river nutrient exchange.
	- Continue to monitor, evaluate and refine large-scale monitoring of primary, secondary, and tertiary trophic levels. Continue to:
	  - Monitor fish community dynamics annually at mainstem Kootenai River index sites.
	  - Monitor macroinvertebrate community dynamics annually at mainstem Kootenai River index sites.
	  - Monitor key water quality parameters annually within key reaches of the Kootenai River to assess primary productivity.
	  - Evaluate aquatic biota community dynamics and productivity of backwater slough habitats within the historic Kootenai River floodplain.
	  - Evaluate terrestrial biota community dynamics and productivity of wetland and riparian habitats within the historic Kootenai River floodplain.
	  - Collect algae and plankton monthly for identification and chlorophyll analysis, and apply IBI to algae production to determine the available food base for larval fish.
	  - Assess pre and post dam trophic and water quality changes using accepted paleocoring methods of Kootenai River sediment strata.
	  - Continue to sample fish populations at a minimum of four standardized index sites and determine trophic structure, species composition, CPUE, species biomass, and condition factor.
	  - Periodically re-calculate and maintain adequate statistical power of multi-trophic level biomonitoring program.
	- Continue efforts to restore other components of the native fish community, including kokanee (See kokanee objectives and strategies tables for more details).
	- Endorse potential benefits to white sturgeon and burbot populations and to the food base from ongoing efforts in other forums to assess and remedy sources of environmental contaminants.
	- Conduct controlled and in-situ laboratory bioassays to determine the physiological effects of temperature, contaminants, predation, nutrients, velocities, and other potential environmental stressors on various critically impaired life stages of focal fish species.

Burbot Objective BUR2	
Species/Life stage	All Focal Species, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower Kootenai) (Biological)
Limiting Factor	Ecological Community Shifts
Timeframe	2005 to 2020+
Objective BUR2 (Measurable Action)	Rehabilitate mainstem Kootenai River fish community structure and density to better approximate pre-Libby Dam ecological community characteristics.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alteration, Non-native Species Introduction
Additional Secondary Limiting Factor(s) Addressed	Altered hydrograph, altered thermograph, habitat diversity, physical habitat, population stability, recruitment failure, and population size.
NWPCC Programmatic H's Addressed	Habitat, Hydro
Where	All reaches of the Kootenai River in the U.S. downstream from Libby Dam.
Other/Notes	Restoration of normative ecological community structure is a multidisciplinary endeavor, including improvements to hydro operations, physical habitat and ecological community components to restore ecological and environmental selection pressures to favor native taxa assemblages.
Strategies	- Develop, evaluate, implement, and monitor improvements to hydro operations, physical habitats, and ecological community components to restore ecological and environmental selection pressures to favor native assemblages of fish and wildlife taxa in the mainstem Kootenai River and associated and historical floodplain areas. - Restore lower winter temperatures.

Burbot Objective BUR3	
Species/Life stage	Burbot, Spawning/Incubation and Juvenile Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower) and Tributaries (Biological)
Limiting Factor	Recruitment Failure
Timeframe	By 2020
Objective BUR3 (Measurable Actions)	BUR3a. Achieve consistent natural recruitment in at least three different spawning areas with net recruitment and juvenile population size sufficient to support desired adult population size. BUR3b. Achieve stable size and age distributions as determined by an upward trend in a 6-year moving average of population abundance.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Community shifts, population stability, population size
NWPCC Programmatic H's Addressed	Hydro, Habitat, Hatchery
Where	For burbot, multiple spawning areas might include the Kootenai River mainstem and at least two tributaries.
Other/Notes	In some parts of the Kootenai River Subbasin burbot recruitment failure may be due to stock limitation, habitat limitation or both. Strategies should be designed to address both potential sources of limitation

Strategies	- Restore natural recruitment
	- Restore normative or near normal winter discharge and temperatures that will provide a migration corridor for adult burbot spawners and temperatures suitable for burbot maturing and spawning.
	- Design and implement a monitoring and evaluation scheme for burbot population status (based on CPUE of adults, sampling of eggs or larva, age structure of catch, and PSD) encompassing index sites at two tributary streams and three mainstem reaches.
	- Develop and implement conservation aquaculture
	  - Develop effective methods and facilities for holding, spawning, fertilizing, and rearing burbot in a hatchery.
	  - Develop hatchery methods using burbot from other regional similar burbot - populations where abundant (e.g. Arrow, Upper Columbia, Upper Kootenai, MT) to avoid impacts to depleted or limited Kootenai River, Kootenay Lake, and Duncan populations.
	  - Design and complete genetic analyses to help identify the most appropriate source for supplementation and/or reintroduction into the Kootenai River.
	  - When effective burbot culture techniques have been identified, and if natural recruitment sufficient to meet recovery goals has not been restored, implement an experimental burbot stocking program to identify life cycle bottlenecks in burbot survival and to determine whether hatchery-produced burbot can effectively survive in the wild.
	  - Design, evaluate, and implement a fish culture strategy with strict genetic guidelines, fish health protocols, and rigorous M&E components to assess

Burbot Objective BUR3	
	and balance risks to natural production, while recognizing the need for significant recovery measures. - Identify subsequent hatchery roles in recovery, based on monitoring and evaluation of post-release and those responses of natural recruitment to other recovery measures, and to the performance of experimental releases of hatchery fish. - Design, develop, and implement as necessary, hatchery facilities as appropriate to implement this plan. - Use hatchery-reared offspring to assist in other research on limiting factors (for example, the potential effects of contaminants on burbot, pathology research).

Burbot Objective BUR4	
Species/Life stage	Burbot, All life stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower) and Kootenay Lake (Biological)
Limiting Factor	Small Population Size
Timeframe	By 2020
Objective BUR4 (Measurable Action)	Achieve a minimum number of 2,500 adults in the burbot population.
Primary Limiting Factor(s) Addressed	Impoundment and Hydro Operations, Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Community shifts, population stability, population size
NPCC Programmatic H's Addressed	Hydro, Habitat, Hatchery
Where	Kootenai River in the US downstream from Libby Dam.
Other/Notes	

Strategies	- Restore natural recruitment
	- Develop and implement conservation aquaculture
	  - Develop effective methods and facilities for holding, spawning, fertilizing, and rearing burbot in a hatchery.
	  - Develop hatchery methods using burbot from other regional similar burbot - populations where abundant (e.g. Arrow, Upper Columbia, Upper Kootenai, MT) to avoid impacts to depleted or limited Kootenai River, Kootenay Lake, and Duncan populations.
	  - Design and complete genetic analyses to help identify the most appropriate source for supplementation and/or reintroduction into the Kootenai River.
	  - When effective burbot culture techniques have been identified, and if natural recruitment sufficient to meet recovery goals has not been restored, implement an experimental burbot stocking program to identify life cycle bottlenecks in burbot survival and to determine whether hatchery-produced burbot can effectively survive in the wild.
	  - Design, evaluate, and implement a fish culture strategy with strict genetic guidelines, fish health protocols, and rigorous M&E components to assess and balance risks to natural production, while recognizing the need for significant recovery measures.
	  - Identify subsequent hatchery roles in recovery, based on monitoring and evaluation of post-release and those responses of natural recruitment to other recovery measures, and to the performance of experimental releases of hatchery fish.
	- Design, develop, and implement as necessary, hatchery facilities as appropriate to implement this plan.
	  - Use hatchery-reared offspring to assist in other research on limiting factors (i.e., potential effects of contaminants on burbot pathology research).

Burbot Objective BUR5	
Species/Life stage	Burbot, All Life Stages
4th-Code HUC	Mainstem Kootenai River (Upper and Lower) and tributaries
Limiting Factor	Contaminants
Timeframe	By 2020
Objective BUR5 (Measurable Actions)	BUR5a. Evaluate lethal and sub-lethal effects of environmental contaminants, including reproductive and behavioral effects on Kootenai River white sturgeon and burbot. BUR5b. Seek remedies for contaminant problems if warranted
Primary Limiting Factor(s) Addressed	Physical Habitat Alteration
Additional Secondary Limiting Factor(s) Addressed	Population stability, recruitment failure, small population size
NWPCC Programmatic H's Addressed	Habitat
Where	Kootenai River mainstem and Kootenay Lake.
Other/Notes	
Strategies	- Summarize available historic information about contaminant effects on sturgeon and burbot - Implement non-lethal monitoring techniques to determine potential effects of environmental contaminants on Kootenai River white sturgeon and burbot. - Assess bioaccumulation and potential chronic effects of existing Environmental contaminants on Kootenai River white sturgeon and burbot through laboratory bioassays and in-situ studies - Develop a program to monitor contaminant levels and effects on white sturgeon and burbot - Provide management recommendations (pertaining to environmental contaminants) to remediate for contaminant effects and assist with recovery of the Kootenai River white sturgeon and burbot.

Harvest

Tribal Subsistence and Angler Harvest Objective

Tribal Subsistence and Angler Harvest (HAR1)

Tribal Subsistence and Angler Harvest Objective HAR1	
Species/Life stage	Juvenile and Adult Sportfish
4th-Code HUC	All 4th-Code HUCs
Limiting Factor	Population Size
Timeframe	2005 to 2020+
Objective (Measurable Action)	Maintain or increase harvestable sportfish while protecting the long-term persistence of native species populations.
Primary Limiting Factor(s) Addressed	None
Additional Secondary Limiting Factor(s) Addressed	Number of local populations, population stability
NPCC Programmatic H's Addressed	None
Where	Lake Koocanusa (MT/BC), Kootenai River (MT/ID/BC), Kootenay Lake (BC), and lakes within the Kootenai Subbasin.
Other/Notes	
Strategies	- Maintain long-term viability of conservation populations (numbers and lifecycle strategies) and establish wild populations where native stocks have been extirpated. - Minimize unintentional mortality of native species through restrictive harvest regulations, fisheries management plans, guidelines, and policies. - Promote angler compliance to fishing regulations through law enforcement and education. - Initiate natural reproduction of fish species where suitable habitat can be restored or reconnected to reduce reliance on artificial propagation. - Create alternative harvest opportunities in offsite lakes through hatchery production of native fish to maintain angler interest in species conservation. Where native species cannot be restored, maximize harvest by introducing fish species that will not threaten the recovery of bull trout, westslope cutthroat trout, redband trout, burbot and native kokanee populations. - Evaluate potential effects of introduced fish species on westslope cutthroat trout restoration, bull trout recovery, redband trout, and kokanee conservation and implement tasks to minimize negative effects. - Evaluate effectiveness of stocking size and season on survival, growth and angler harvest using periodic population estimation and angler creel census. - Cooperatively regulate fish harvests with British Columbia. Emphasize the importance of cooperative management transboundary fish populations. - Develop fisheries management plans and guidelines for appropriate use of transplantation and artificial propagation.

Terrestrial Objectives

The tables that follow present Kootenai Subbasin terrestrial management objectives and strategies designed to mitigate terrestrial limiting factors in the Kootenai Subbasin. Objectives and strategies are grouped by biome.

Wetland Biome

Regulated Mainstem Wetland Limiting Factors:

Altered Hydrograph (WB1 and WB2)
Diking (WB1 and WB2)

Other Wetland Limiting Factors:

Roads (WB3)
Land Conversion (WB3)
Forest Management (WB3)
Overgrazing (WB3)

Wetland Objective WB1	
Species	All Wetland Target Species
Units	Regulated Mainstem – Kootenai River (Habitat)
Limiting Factor	Altered Hydrograph and Diking
Timeframe	2005 to 2020+
Objective (Measurable Action)	Working with Action Agencies, bring Libby Dam operations 50% closer to normative conditions during summer and spring while providing flood control.[1]
Strategies	- Secure management rights and implement management agreements to conserve, maintain and restore wetland and floodplain areas. - Continue to vigorously seek opportunities to restore normative river functions in the lower Kootenai River, including hydrograph cycles, periodic flood flows, habitat diversity, and floodplain connectivity. - Develop an experimental Kootenai River flow/water temperature agreement to evaluate the effectiveness of restoring native aquatic and terrestrial species. A multi-year agreement can help maximize opportunities for experimental operations to evaluate biological requirements while preserving flexibility in needed hydropower production and flood control operations. - Research, design and implement floodplain/river reconnectivity experiments and

[1] *"Normative " is defined as the condition where natural flood plain functions and channel maintenance can occur. This includes a reduction in the width of the varial zone (that becomes biologically unproductive), removing unseasonable flow fluctuations (natural day to day fluctuations vary by 5% during basal conditions and 10% during spring runoff), restoring a natural spring freshet (runoff occurs in late May or early June, followed by a stable, low basal flow period), periodic channel maintenance flows (a bankfull flow for at least 48 hours on a periodicity of 2.5 years, or every second or third year, or 3 out of 10), stable summertime flows that are constant or gradually reducing after spring runoff (this can include a sliding scale to respond to varying water availability). The condition allows the river to flush fine sediments into the channel margins during runoff (cleaning fines from interstitial spaces in river cobbles creating insect habitat). As flows decline from the spring peak, terrestrial vegetation can invade the margins and as flows stabilize (riparian can establish including willows, cottonwood, grasses and sedges), roots prevent fines from being swept back into the channel (preventing embeddedness and siltation). Rivers that maintain normative functions have stabile banks, slow channel migrations, maintain low width/depth ratios, and high pool/length ratios.*

Wetland Objective WB1	
	environmental engineering techniques (i.e., re-engineered two way fish ladders, etc.). - Investigate historic and current potential of floodplain/river nutrient exchange. - Cooperate and coordinate efforts to restore natural stream flows and associated river connections (i.e., channelized tributaries, etc.) in the Kootenai River mainstem. - Research, design and implement tributary reconnectivity and restoration. - Identify and address human impacts in the Kootenai River mainstem utilizing adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance, and rehabilitate floodplain habitats in the Kootenai River mainstem. - Develop a hydrological model based on historic flow, hydrologic connectivity, and velocity data, and use to evaluate effects of operational alternatives on conditions required by aquatic and terrestrial plant communities and fish and wildlife species. - Evaluate alternatives for Libby Dam operations to provide increased flexibility in flow management, especially during winter and spring. - Coordinate evaluation of depositional areas, cobble and gravel bars with the U.S. Army Corps of Engineers and Burlington Northern and Santa Fe Railroad. - Develop a consolidated riparian and wetland habitat map for the regulated mainstem of the Kootenai River. - Investigate and analyze historic losses of riparian and wetland habitats in the regulated mainstem of the Kootenai River. - Identify associated losses in biological functions and performance (i.e., riparian dependent birds, etc.). - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., floods) in riparian habitats. - Identify and address human impacts in wetland areas with adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance and rehabilitate riparian habitats with an emphasis in low elevation and intact riparian habitats. - Protect, enhance and maintain riparian habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones. - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plan for the Kootenai River mainstem. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., natural vegetation, etc.) in the Kootenai River mainstem. - Identify and address direct and indirect human introduction and spread of noxious weeds in the Kootenai River mainstem utilizing adaptive management techniques. - Cooperate and coordinate with weed spraying, biological control, and other management technique in an efforts to reduce noxious weeds in the Kootenai River mainstem.

Wetland Objective WB2	
Species	All Wetland Target Species
Units	Regulated Mainstem – Kootenai River (Biological)
Limiting Factor	Altered Hydrograph and Diking
Timeframe	2005 to 2020+
Objective (Measurable Action)	Protect, maintain or enhance terrestrial species associated with wetlands, where 10% of those subunits for which the Vegetation Distribution Intensity Index in the TBA spreadsheet tool is ≤ a value of 6, consistent with current or future management and mitigation plans.
	- Survey priority zones and species for neo-tropical migrant birds, native birds, and amphibian and reptile habitat protection, rehabilitation and enhancement activities. - Identify, protect, enhance and maintain neo-tropical migrant birds, native birds, and amphibian and reptile critical habitats. - Enhance each specific zone for identified priority neo-tropical migrant birds, native birds, and amphibian and reptile species annually through habitat manipulation, adaptive management techniques and forest management practices. - Protect, enhance and maintain neo-tropical migrant birds, native birds, and amphibian and reptile habitat with an emphasis on critical, riparian, wetland and low elevation habitats in specific zones. - Protect, enhance and maintain neo-tropical migrant birds, native birds, and amphibian and reptile habitat with an emphasis on livestock management techniques in specific zones. - Identify priority zones for big game, upland birds and waterfowl habitat protection, and rehabilitation and enhancement activities. - Protect, enhance and maintain big game, upland birds and waterfowl critical habitats. - Expand efforts to monitor and assess population trends, productivity, distribution and movement of grizzly bears. - Investigate and analyze grizzly spring range habitat availability, capability and suitability. - Investigate and analyze grizzly bear low elevation habitat availability, capability and suitability. - Cooperate and coordinate efforts to protect, rehabilitate, enhance and maintain grizzly spring range and low elevation habitats. - Cooperate and coordinate efforts to investigate, protect, enhance and rehabilitate low elevation habitats (i.e., early winter) for woodland caribou.

Wetland Objective WB3	
Species	All Wetland Target Species
Units	All Units (Habitat)
Limiting Factor	Roads, Land Conversion, Forest Management and Overgrazing
Timeframe	2005 to 2020+
Objective (Measurable Action)	Secure management rights and implement management agreements to conserve, maintain and restore 10% of those subunits for which the Vegetation Distribution Intensity Index in the TBA spreadsheet tool is > a value of 6, consistent with current or future management and mitigation plans.
Strategies	- Coordinate subbasin activities with appropriate agencies and organizations such as adjacent subbasins (i.e., Priest River, Pend Oreille, Flathead), soil and water conservation districts, United States Department of Agriculture, and Canadian agencies. - Initiate and develop cooperative adaptive management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Identify associated losses in biological functions and performance (i.e., riparian dependent birds, etc.). - Coordinate efforts with all natural resource managers to develop comprehensive riparian and wetland habitat protection, rehabilitation, and enhancement plan for the Kootenai River mainstem. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., natural vegetation, etc.) in the Kootenai River mainstem. - Identify and address human impacts in Kootenai River mainstem wetland and riparian areas utilizing adaptive management techniques. - Conduct watershed problem assessments. Identify site-specific threats (problem assessment) that may be limiting target and focal species. - Improve grazing practices. Reduce negative effects of grazing with improved grazing management or fencing where investigation indicates such actions are likely to benefit native wetland species. - Protect wetland habitats. When possible (i.e. with willing landowners) provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means. - Cooperate and coordinate efforts with all stakeholders to protect, enhance and rehabilitate riparian and wetland habitats in the Kootenai River mainstem. - Initiate and develop noxious weed management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plan for the Kootenai River mainstem wetland and riparian areas.

Riparian Biome

Regulated Mainstem Wetland Limiting Factors:

Altered Hydrograph (RP1 and RP2)
Diking (RP1 and RP2)

Other Wetland Limiting Factors:

Land Conversion (RP3)
Human/Wildlife Conflicts (RP3)
Forest Management (RP4)
Exotics (RP5)

Riparian Objective RP1	
Species	All Riparian Target Species
Units	Regulated Mainstem – Kootenai River (Habitat)
Limiting Factor	Altered Hydrograph and Diking
Timeframe	2005 to 2020+
Objective (Measurable Action)	Restore riparian vegetation communities on 10% of the riparian acres in those subunits for which the Floodplain Vegetation Index/Vegetation Distribution Intensity Index in the TBA spreadsheet tool is ≤ a value of 8, consistent with current or future management and mitigation plans.
Strategies	- Secure management rights and implement management agreements to conserve, maintain and restore riparian and floodplain areas. - Continue to vigorously seek opportunities to restore normative river functions in the lower Kootenai River, including hydrograph cycles, periodic flood flows, habitat diversity, and floodplain connectivity. - Develop an experimental Kootenai River flow/water temperature agreement to evaluate the effectiveness of restoring native aquatic and terrestrial species. A multi-year agreement can help maximize opportunities for experimental operations to evaluate biological requirements while preserving flexibility in needed hydropower production and flood control operations. - Define specific flow requirements that provide natural pioneering species recruitment and survival. - Research, design and implement floodplain/river reconnectivity experiments and environmental engineering techniques (i.e., re-engineered two way fish ladders, etc.). - Investigate historic and current potential of floodplain/river nutrient exchange. - Cooperate and coordinate efforts to restore natural stream flows and associated river connections (i.e., channelized tributaries, etc.) in the Kootenai River mainstem. - Research, design and implement tributary reconnectivity and restoration. - Identify and address human impacts in the Kootenai River mainstem utilizing adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance, and rehabilitate floodplain habitats in the Kootenai River mainstem. - Develop a hydrological model based on historic flow, hydrologic connectivity, and velocity data, and use to evaluate effects of operational alternatives on conditions required by aquatic and terrestrial plant communities and fish and wildlife species. - Evaluate alternatives for Libby Dam operations to provide increased flexibility in flow management, especially during winter and spring. - Coordinate evaluation of depositional areas, cobble and gravel bars with the U.S. Army

Riparian Objective RP1	
	Corps of Engineers and Burlington Northern and Santa Fe Railroad. - Implement seasonal flow windows and flow ramping rates. - Develop a consolidated riparian and wetland habitat map for the regulated mainstem of the Kootenai River. - Investigate and analyze historic losses of riparian and wetland habitats in the regulated mainstem of the Kootenai River. - Identify associated losses in biological functions and performance (i.e., riparian dependent birds, etc.). - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., floods) in riparian habitats. - Identify and address human impacts in riparian areas with adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance and rehabilitate riparian habitats with an emphasis in low elevation and intact wetland habitats. - Protect, enhance and maintain riparian habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones. - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plan for the Kootenai River mainstem. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., natural vegetation, etc.) in the Kootenai River mainstem. - Identify and address direct and indirect human introduction and spread of noxious weeds in the Kootenai River mainstem utilizing adaptive management techniques. - Cooperate and coordinate with weed spraying, biological control, and other management technique in an efforts to reduce noxious weeds in the Kootenai River mainstem.

Riparian Objective RP2	
Species	All Riparian Target Species
Units	Regulated Mainstem – Kootenai River (Biological)
Limiting Factor	Altered Hydrograph and Diking
Timeframe	2005 to 2020+
Objective (Measurable Action)	Protect, maintain or enhance terrestrial species associated with riparian areas where 10% in those subunits for which the Floodplain Vegetation Index in the TBA spreadsheet tool is ≤ a value of 7, consistent with current or future management and mitigation plans.
	- Survey priority zones and species for neo-tropical migrant birds, native birds, and amphibian and reptile habitat protection, rehabilitation and enhancement activities. - Identify, protect, enhance and maintain neo-tropical migrant birds, native birds, and amphibian and reptile critical habitats. - Enhance each specific zone for identified priority neo-tropical migrant birds, native birds, and amphibian and reptile species annually through habitat manipulation,

Riparian Objective RP2	
	adaptive management techniques and forest management practices. - Protect, enhance and maintain neo-tropical migrant birds, native birds, and amphibian and reptile habitat with an emphasis on critical, riparian, and low elevation habitats in specific zones. - Protect, enhance and maintain neo-tropical migrant birds, native birds, and amphibian and reptile habitat with an emphasis on livestock management techniques in specific zones. - Investigate and analyze grizzly bear low elevation habitat availability, capability and suitability. - Cooperate and coordinate efforts to protect, rehabilitate, enhance and maintain grizzly spring range and low elevation habitats. - Cooperate and coordinate efforts to investigate, protect, enhance and rehabilitate low elevation habitats (i.e., early winter) for woodland caribou. - Identify priority zones for big game, upland birds and waterfowl habitat protection, and rehabilitation and enhancement activities. - Protect, enhance and maintain big game, upland birds and waterfowl critical habitats.

Riparian Objective RP3	
Species	All Riparian Target Species
Units	All Units (Habitat)
Limiting Factor	Land Conversion and Human/Wildlife Conflicts
Timeframe	2005 to 2020+
Objective (Measurable Action)	Secure management rights and implement management agreements to conserve, maintain and restore 10% in those subunits for which the Floodplain Vegetation Index in the TBA spreadsheet tool is > a value of 7, consistent with current or future management and mitigation plans.
Strategies	- Coordinate subbasin activities with appropriate agencies and organizations such as adjacent subbasins (i.e., Priest River, Pend Oreille, Flathead), soil and water conservation districts, United States Department of Agriculture, and Canadian agencies. - Initiate and develop cooperative adaptive management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Identify associated losses in biological functions and performance (i.e., riparian vegetation communities, etc.). - Coordinate efforts with all natural resource managers to develop a comprehensive floodplain habitat protection, rehabilitation and enhancement plan for the Kootenai River mainstem. - Identify and address human impacts in the Kootenai River mainstem utilizing adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance, and rehabilitate floodplain habitats in the Kootenai River mainstem. - Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means.

Riparian Objective RP4	
Species	All Riparian Target Species
Units	All Units (Habitat)
Limiting Factor	Forest Management
Timeframe	2005 to 2020+
Objective (Measurable Action)	Restore riparian vegetation communities on 10% of the riparian acres in those subunits for which the Floodplain Vegetation Index/Vegetation Distribution Intensity Index in the TBA spreadsheet tool is > a value of 8, consistent with current or future management and mitigation plans.

Strategies	- Coordinate subbasin activities with appropriate agencies and organizations such as adjacent subbasins (i.e., Priest River, Pend Oreille, Flathead), soil and water conservation districts, United States Department of Agriculture, and Canadian agencies.
	- Initiate and develop cooperative adaptive management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.).
	- Develop a consolidated riparian and wetland habitat map for the Kootenai River mainstem of the Kootenai subbasin.
	- Investigate and analyze historic losses of riparian and wetland habitats in the Kootenai River mainstem of the Kootenai subbasin.
	- Identify associated losses in biological functions and performance (i.e., riparian dependent birds, etc.).
	- Coordinate efforts with all natural resource managers to develop comprehensive riparian and wetland habitat protection, rehabilitation, and enhancement plan for the Kootenai River mainstem.
	- Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., natural vegetation, etc.) in the Kootenai River mainstem.
	- Identify and address human impacts in the Kootenai River mainstem utilizing adaptive management techniques.
	  - Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions.
	  - Conduct watershed problem assessments. Identify site-specific threats (problem assessment) that may be limiting focal and target species.
	  - Revegetate denuded riparian areas. Revegetate to restore shade and canopy, riparian cover, and native vegetation in streams where investigation indicates such actions are likely to benefit native wildlife.
	  - Improve grazing practices. Reduce negative effects of grazing with improved grazing management or riparian fencing where investigation indicates such actions are likely to benefit native wildlife.
	  - Protect riparian habitats. When possible (i.e. with willing landowners) provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, and other means.
	- Cooperate and coordinate efforts with all stakeholders to protect, enhance and rehabilitate riparian and wetland habitats in the Kootenai River mainstem.

Riparian Objective RP4	
	- Initiate and develop noxious weed management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plan for the Kootenai River mainste**m.**

Riparian Objective RP5	
Species	All Riparian Target Species
Units	All Units (Habitat)
Limiting Factor	Exotics
Timeframe	2005 to 2020+
Objective (Measurable Action)	Monitor and treat an average of 10% of acres in those subunits for which the Exotic Vegetation Index in the TBA spreadsheet tool is > a value of 6, consistent with current and future management and mitigation plans.

Strategies	- Coordinate subbasin noxious weed activities with appropriate agencies and organizations.
	- Initiate and develop noxious weed management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.).
	- Coordinate efforts to develop comprehensive riparian/wetland protection, restoration and enhancement plan for the Kootenai subbasin ecosystem.
	- Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., fires) in riparian habitats.
	- Identify and address human impacts in riparian habitats with adaptive management techniques.
	- Protect, enhance and maintain riparian habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones.
	  - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plan for the Kootenai River mainstem.
	  - Identify and address direct and indirect human introduction and spread of noxious weeds utilizing adaptive management techniques.
	- Cooperate and coordinate with weed spraying, biological control, and other management technique in an efforts to reduce noxious weeds in the Kootenai River mainstem.

Grassland/Shrub Biome

Grassland/Shrub Limiting Factors:

Land Conversion (GS1)
Human Developments (GS1)
Forest Encroachment (GS2)
Exotics (GS3)
Overgrazing (GS4)

Grassland/Shrub Objective GS1	
Species	All Grassland/Shrub Target Species
Units	All Units (Habitat)
Limiting Factor	Land Conversion and Human Development
Timeframe	2005 to 2020+
Objective (Measurable Action)	Secure management rights and implement management agreements to conserve, maintain, and restore 10% of those subunits for which the Area Change Index in the TBA spreadsheet tool > a value of 5, consistent with current or future management and mitigation plans.
Strategies	- Coordinate subbasin activities with appropriate agencies and organizations. - Initiate and develop cooperative adaptive management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Develop a consolidated grassland habitat map for the Kootenai subbasin. - Investigate and analyze historic losses of grassland habitats in the Kootenai subbasin. - Identify grassland habitat losses and associated losses in biological functions and performance. - Coordinate efforts to develop comprehensive grassland protection, restoration and enhancement plan for the Kootenai subbasin ecosystem. - Identify and address human impacts in grassland habitats with adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance and rehabilitate grassland habitats with an emphasis in intermountain areas and intact grassland habitats. - Protect, enhance and maintain grassland habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones.

Grassland/Shrub Objective GS2	
Species	All Grassland/Shrub Target Species
Units	All Units (Habitat)
Limiting Factor	Forest Encroachment
Timeframe	2005 to 2020+

Grassland/Shrub Objective GS2	
Objective (Measurable Action)	Restore grassland/shrubland communities on 10% of grassland acres in those subunits for which the Area Change Index in the TBA spreadsheet tool > a value of 9, consistent with current or future management and mitigation plans.
Strategies	- Coordinate subbasin activities with appropriate agencies and organizations. - Initiate and develop cooperative adaptive management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Develop a consolidated grassland habitat map for the Kootenai subbasin. - Investigate and analyze encroached areas of grassland habitats in the Kootenai subbasin. - Identify grassland habitat losses and associated losses in biological functions and performance. - Coordinate efforts to develop comprehensive grassland protection, restoration and enhancement plan for the Kootenai subbasin ecosystem that may include prescribed fire and other management strategies. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., fires) in grassland habitats.

Grassland/Shrub Objective GS3	
Species	All Grassland/Shrub Target Species
Units	All Units (Habitat)
Limiting Factor	Exotic Species
Timeframe	2005 to 2020+
Objective (Measurable Action)	Monitor and treat an average of 10% of the acres in those subunits for which the Exotic Vegetation Index in the TBA spreadsheet tool is > a value of 6, consistent with current and future management and mitigation plans.
Strategies	- Coordinate subbasin noxious weed activities with appropriate agencies and organizations. - Initiate and develop noxious weed management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Coordinate efforts to develop comprehensive grassland protection, restoration and enhancement plan for the Kootenai subbasin ecosystem. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., fires) in grassland habitats. - Identify and address human impacts in grassland habitats with adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance and rehabilitate grassland habitats with an emphasis in intermountain areas and intact grassland habitats. - Protect, enhance and maintain grassland habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones. - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plan for the Kootenai River mainstem. - Identify and address direct and indirect human introduction and spread of noxious

Grassland/Shrub Objective GS3	
	weeds utilizing adaptive management techniques. - Cooperate and coordinate with weed spraying, biological control, and other management technique in an efforts to reduce noxious weeds in the Kootenai River mainstem.

Grassland/Shrub Objective GS4	
Species	All Grassland/Shrub Target Species
Units	All Units (Habitat)
Limiting Factor	Overgrazing
Timeframe	2005 to 2020+
Objective (Measurable Action)	Over the next 10-15 years, restore grassland or shrubland communities on 10% of grassland/shrubland acres in those subunits for which the grazing intensity Index in the TBA spreadsheet tool is > a value of 5, consistent with current and future management and mitigation plans.

Strategies	- Coordinate subbasin grassland activities with appropriate agencies and organizations.
	- Initiate and develop cooperative adaptive management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.).
	- Coordinate efforts to develop comprehensive grassland protection, restoration and enhancement plan for the Kootenai subbasin ecosystem.
	- Identify and address human impacts in grassland habitats with adaptive management techniques.
	  - Protect, enhance and maintain grassland habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones.
	  - Protect, enhance and maintain grassland habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones.
	- Cooperate and coordinate efforts to protect, enhance and rehabilitate grassland habitats with an emphasis in intermountain areas and intact grassland habitats.

Xeric Forest Biome

Xeric Forest Limiting Factors:

Fire Exclusion (XF1)
Forest Management (XF2)
Exotics (XF3)

Xeric Forest Objective XF1	
Species	All Xeric Forest Target Species
Units	All Units (Habitat)
Limiting Factor	Fire Exclusion
Timeframe	2005 to 2020+
Objective (Measurable Action)	Restore fire-resistant xeric forest communities on 10% of acres in those subunits for which the Forest Structure Departure Index in the TBA spreadsheet tool is > a value of 5, consistent with current or future management and mitigation plans.
Strategies	- Coordinate efforts to develop comprehensive fire regime maps for the Subbasin. - Implement wildlife enhancement and protection projects in cooperation with all interested parties in the subbasin as opportunities arise. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., fires) and/or to use a combination of prescribed fire and mechanical treatments to mimic natural disturbances.

Xeric Forest Objective XF2	
Species	All Xeric Forest Target Species
Units	All Units (Habitat)
Limiting Factor	Forest Management
Timeframe	2005 to 2020+
Measurable Action	Utilize appropriate silvicultural methods to treat an average of 10% of the acreage in those subunits for which the Forest Structure Disruption Index in the TBA spreadsheet tool is > a value of 5, consistent with current and future management and mitigation plans
Strategies	- Coordinate subbasin activities with appropriate agencies and organizations such as adjacent subbasins (i.e., Priest River, Pend Oreille, Flathead), soil and water conservation districts, United States Department of Agriculture, and Canadian agencies. - Initiate and develop cooperative adaptive management strategies with International entities (i.e., BC Ministry of the Environment, environmental organizations, etc.). - Work with the US Forest Service to ensure there is a comprehensive xeric forest protection, rehabilitation, and enhancement plan for the Kootenai subbasin ecosystem. - Cooperate to restore natural disturbance regimes (i.e., fires) to xeric forest habitats. - Identify and address human impacts in xeric forest habitats utilizing adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance, and rehab xeric forest habitats.

Xeric Forest Objective XF3	
Species	All Xeric Forest Target Species
Units	All Units (Habitat)
Limiting Factor	Exotics
Timeframe	2005 to 2020+
Objective (Measurable Action)	Monitor and treat an average of 10% of acres in those subunits for which the Exotic Vegetation Index in the TBA spreadsheet tool is > a value of 6, consistent with current and future management and mitigation plans.
Strategies	- Coordinate subbasin noxious weed activities with appropriate agencies and organizations. - Initiate and develop noxious weed management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Coordinate efforts to develop comprehensive xeric forest protection, restoration and enhancement plan for the Kootenai subbasin ecosystem. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., fires) in xeric habitats. - Identify and address human impacts in xeric forest habitats with adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance and rehabilitate xeric forest habitats with an emphasis in intermountain areas and intact xeric forest habitats. - Protect, enhance and maintain xeric forest habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones. - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plan for the Kootenai River mainstem. - Identify and address direct and indirect human introduction and spread of noxious weeds utilizing adaptive management techniques. - Cooperate and coordinate with weed spraying, biological control, and other management technique in an efforts to reduce noxious weeds in the Kootenai River mainstem.

Mesic Forest Biome

Mesic Forest Limiting Factors:

Fire Exclusion (MF1)
Forest Management (MF2)
Roads (MF3)
Exotics (MF4)
Insects and Disease (MF5)

Mesic Forest Objective MF1	
Species	All Mesic Forest Target Species
Units	All Units (Habitat)
Limiting Factor	Fire Exclusion
Timeframe	2005 to 2020+
Objective (Measurable Action)	Utilize appropriate prescribed fire and mechanical measures to treat an average of 10% of the acreage in those subunits for which the Fire Interval Disruption Index in the TBA spreadsheet tool > a value of 8.5, consistent with current or future management and mitigation plans.
Strategies	- Coordinate efforts to develop comprehensive fire regime maps for the biome. - Implement wildlife enhancement and protection projects in cooperation with all interested parties in the subbasin as opportunities arise. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., fires) and/or to use a combination of prescribed fire and mechanical treatments to mimic natural disturbances.

Mesic Forest Objective MF2	
Species	All Mesic Forest Target Species
Units	All Units (Habitat)
Limiting Factor	Forest Management
Timeframe	2005 to 2020+
Objective (Measurable Action)	Over the next 10-15 years, utilize appropriate silvicultural methods to treat an average of 10% of the acreage in those subunits for which the Forest Structure Disruption Index in the TBA spreadsheet tool is > a value of 7, consistent with current and future management and mitigation plans
Strategies	- Coordinate subbasin activities with appropriate agencies and organizations such as adjacent subbasins (i.e., Priest River, Pend Oreille, Flathead), soil and water conservation districts, United States Department of Agriculture, and Canadian agencies. - Initiate and develop cooperative adaptive management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Work with the US Forest Service to ensure there is a comprehensive mesic forest protection, rehabilitation, and enhancement plan for the Kootenai subbasin ecosystem.

Mesic Forest Objective MF2	
	- Cooperate to restore natural disturbance regimes (i.e., fires) are returned to mesic forest habitats. - Identify and address human impacts in mesic forest habitats utilizing adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance, and rehabilitate mesic forest habitats.

Mesic Forest Objective MF3	
Species	All Mesic Forest Target Species
Units	All Units (Habitat)
Limiting Factor	Roads
Timeframe	2005 to 2020+
Objective (Measurable Action)	Manage motorized vehicle access in those subunits for which the Road Density Index in the TBA spreadsheet tool exceeds 4 miles of road/square mile (or lower in critical habitat areas), consistent with current and future management and mitigation plans.
Strategies	- Work with the U.S. Forest Service to lower forest road densities. - Investigate and analyze road densities and associated impacts to sensitive and ESA-listed wildlife species. - Decommission unnecessary roads to reduce harassment of wildlife and encourage more uniform use of available wildlife habitat.

Mesic Forest Objective MF4	
Species	All Mesic Forest Target Species
Units	All Units (Habitat)
Limiting Factor	Exotics
Timeframe	2005 to 2020+
Objective (Measurable Action)	Monitor and treat an average of 10% of acres in those subunits for which the exotic vegetation index in the TBA spreadsheet tool is > a value of 7, consistent with current and future management and mitigation plans.
Strategies	- Coordinate subbasin noxious weed activities with appropriate agencies and organizations. - Initiate and develop noxious weed management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Protect, enhance and maintain sensitive forest habitats with an emphasis on livestock watering facilities, fencing, and livestock management techniques in specific zones. - Coordinate efforts with all natural resource managers to develop comprehensive noxious weed management plan for the Kootenai River mainstem and other

Mesic Forest Objective MF4	
	sensitive areas. - Identify and address direct and indirect human introduction and spread of noxious weeds utilizing adaptive management techniques. - Cooperate and coordinate with weed spraying, biological control, and other management technique in an efforts to reduce noxious weeds in the Kootenai River mainstem.

Mesic Forest Objective MF5	
Species	All Mesic Forest Target Species
Units	All Units (Habitat)
Limiting Factor	Forest Insect and Disease
Timeframe	2005 to 2020+
Objective (Measurable Action)	Over the next 10-15 years, reduce the impact of native and non-native insects and diseases to an average of 5% per year, consistent with current and future management and mitigation plans.
Strategies	- Coordinate subbasin mesic forest activities with appropriate agencies and organizations such as adjacent subbasins (i.e., Priest River, Pend Oreille, Flathead), soil and water conservation districts, United States Department of Agriculture, and Canadian agencies. - Initiate and develop cooperative adaptive management strategies with International entities (i.e., British Columbia Ministry of the Environment, environmental organizations, etc.). - Work with the Kootenai and Idaho Panhandle National Forests to develop strategies to address forest insect and disease issues in the Kootenai Subbasin. - Develop a consolidated whitebark pine and subalpine larch forest habitats map for the Kootenai subbasin. - Investigate and analyze historic losses of whitebark pine and subalpine larch forest habitats in the Kootenai subbasin. - Identify whitebark pine forest habitat losses and associated losses in biological functions and performance (i.e., grizzly bears, subalpine larch etc.). - Coordinate efforts to develop comprehensive whitebark pine forest protection, rehabilitation, and enhancement plan for the Kootenai subbasin ecosystem. - Cooperate and coordinate efforts to restore natural disturbance regimes (i.e., fires) in whitebark pine forest habitats. - Identify and address human impacts in whitebark pine forest habitats utilizing adaptive management techniques. - Cooperate and coordinate efforts to protect, enhance, and rehabilitate whitebark pine forest habitats.

Administrative/Programmatic Objectives

The tables that follow present Kootenai Subbasin administrative/programmatic objectives and strategies designed to facilitate appropriate funding, implementation, evaluation, and management activities.

Administrative/Programmatic Objectives:

Adequate resources (AP1)
Adequate regional and international coordination (AP2)
Independent peer-review and qualified scientific counsel (AP3)
Locally recognized stakeholder groups (AP4)
Distribution of information (AP5)

Administrative/Programmatic Objective AP1	
Objective (Measurable Action)	Provide adequate resources for program implementation and evaluation.
Where	All portions of the Kootenai River Subbasin
Other/Notes	
Strategies	- Complete MOA II to ensure BPA funding commitment through the next rate case. - Design and implement 5 and 10-year funding blocks to address appropriate temporal scales of successful habitat, ecosystem, and population restoration in the Kootenai Subbasin. (Note: Use KTOI/BEF Model Watershed Program as template to rationally organize sequencing and implementation of objectives/strategies/measures and allow for a reasonable pace of implementation. Include scientifically 2based monitoring and evaluation, and an adaptive management feedback loop). Go to: KTOI/BEF Model Watershed Objectives and strategies (Appendix 111) - Pursue and acquire additional funding sources to fully implement the Subbasin Plan.

Administrative/Programmatic Objective AP2	
Objective (Measurable Action)	Develop and maintain adequate regional and international coordination to efficiently and successfully implement the Kootenai Subbasin Plan.
Where	All portions of the Kootenai River Subbasin.
Other/Notes	
Strategies	- Support and enhance existing coordination forums and other forms of communication to meet regional and international coordination needs to efficiently and successfully implement the Kootenai Subbasin Plan (e.g., IKERT, RDRT, Recovery teams). - Provide for adequate regional participation and feedback in decision making processes that will impact fish and wildlife resources in the Kootenai Subbasin that are affected by the Columbia River FCRPS - Reduce number of meetings (and associated costs) by reducing unnecessary process. - Optimize communication efficiency by using e-mail, conference calls, and video conferencing.

Administrative/Programmatic Objective AP3	
Objective (Measurable Action)	Continue to pursue and support independent peer-review and qualified scientific counsel to improve and maintain rigor of Subbasin Plan components.
Where	All portions of the Kootenai River Subbasin
Other/Notes	
Strategies	- Request and facilitate scientific review during all critical implementation and evaluation phases of the Subbasin Plan.

Administrative/Programmatic AP4	
Objective (Measurable Action)	Support locally recognized stakeholder groups that improve coordination and implementation of existing local, state, and federal programs in the Kootenai Subbasin.
Where	All portions of the Kootenai River Subbasin
Other/Notes	- Integration addressed by this objective will provide needed stakeholder involvement to successfully implement the Subbasin Plan. - Different needs exist at various geographic scales and political levels across the Subbasin. Therefore, an array of stakeholder groups is needed to effectively meet this range of needs at appropriate geographic scales and political levels. For example, in the Lower Kootenai Subbasin, the KVRI is empowered/recognized through a Joint Powers Agreement with the Kootenai Tribe of Idaho, City of Bonners Ferry, and Boundary County (June 2001). The parties continue to work together to develop and enhance community-based approaches for addressing resource issues. Membership is composed of private citizens/landowners, local governments, federal and state agencies, an environmental advocacy group, an Indian Nation, and representatives of business and industry (including timber & agriculture) within the area.
Strategies	- Develop partnerships and collaborative approaches to raise awareness, share information, and provide recommendations to address and resolve important resource issues in the Subbasin. - Build and maintain connectivity between local communities, Tribal, state & federal agencies, and transboundary partners. - Bring key players to the table to provide an ongoing proactive forum for the community and agencies to work together in natural resource planning. - Provide an ongoing, accessible conduit/forum for information sharing & exchange. - Serve as a sounding board for community involvement in natural resource issues. - Develop work groups & subcommittees to accommodate active & substantive community participation & stakeholder involvement in planning, implementation and coordination of the Subbasin Plan.

Administrative/Programmatic Objective AP5	
Objective (Measurable Action)	Improve distribution of information required to successfully implement the Subbasin Plan.
Where	All portions of the Kootenai River Subbasin
Other/Notes	
Strategies	- Involve community stakeholder and public groups to provide valuable local historical and biological information to help successfully implement Subbasin Plan activities (See Objective A/P 4 for more details). - Provide and support education and outreach opportunities. - Maintain and support data storage and exchange.

10.3. Research, Monitoring and Evaluation (RM&E) Program

This 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.

LINKS

For more information on the Pacific Northwest Aquatic Monitoring Partnership, go to: http://www.nwcouncil.org/fw/subbasinplanning/admin/guides/pnamp.pdf

Click Here

10.3.1. Adoption of Ecological and Scientific Management Framework Elements

Kootenai River Subbasin Planners adopted a hierarchical, multi-scale scientific framework (Section 10.1.4.) to address primary and secondary limiting factors. This framework is composed of three step-down processes: one at the subbasin level and two different multi-scale decision pathways, one for on-site mitigation and the other for off-site mitigation (Figures 10.1 – 10.3).

10.3.2. 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 (figure 10.5). 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, IBIS, and other analyses.

10.3.3 Development of research and monitoring objectives

Defining research and monitoring objectives is the next logical step in the development of an RM&E Program (figure 10.4). Managers in the subbasin will

Figure 10.5. General logic path used to develop research and monitoring needs in the Kootenai River Subbasin.

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 10.3.8 describes evaluation protocols that will be used in the development of the RM&E program.

10.3.4. Kootenai River Adaptive Management Program Framework

Background

This section provides the supporting ecological background for a Kootenai River adaptive management program. Subsequent sections provide additional detail on proposed program components

A Proposed Experimental Design for Long-term Adaptive Management Of The Kootenai River Ecosystem

Carl Walters and Josh Korman
Fisheries Centre, University of British Columbia
and Ecometric Research Inc., Vancouver, B.C.
July 24, 2004

In ecosystem management situations where there is high uncertainty about efficacy of some policy options and where multiple options may be implemented at the same time, adaptive management cannot safely proceed as a simple process of trying options and monitoring whether or not they succeed. Instead, we generally recommend developing a long term plan for implementing options over time in some experimental sequence that will provide deliberate experimental contrast in management "treatments", along with replication, where possible, of treatment versus control or reference policy comparisons. Such designs might involve factorial arrangement of policy treatments (classic experimental design), but it is typically

simpler and more effective to use a "titration" approach where treatments are added successively (or are started all at once as a "kitchen sink" approach then deleted successively) until a desired system response is assessed.

At a recent multi-agency adaptive management workshop (July 22-23, 2004), we had an opportunity for multiple scientific and management stakeholders involved with ecosystem management for the Kootenai River to develop such a long term plan. The workshop discussions leading to the plan involved three steps: (1) identification of particular management options that have potential for restoring key functions in the Kootenai River ecosystem, and important attributes of these options (cost, possible negative side effects, monitoring time required for detection of response, etc.); (2) evaluation of alternative plans for applying combinations of these options over the next few decades, so as to identify plans that offer opportunities for contrasting effects of each option along with prudent economic cost trajectories over time; and (3) review of key needs for improvement of monitoring programs so as to insure timely detection of intended immediate effects of each option as well as possible longer-term side effects.

Tables 10.4 and 10.5 describe the basic plan that emerged from the discussions as a clear consensus favorite among the participants. This plan aims to restore a range of critical ecosystem functions in the Kootenai River, through manipulation of productivity, habitat features, and seasonal flow regimes, while utilizing hatchery production systems as a backup to guard against extinction of species that are still declining. The critical components of this plan are (a) a fertilization program to restore basic productivity and carrying capacity for fish of the River, to near historical levels from the Montana border through the South Arm of Kootenay Lake; (b) experimental restoration of hard-bottom features in the river reach where sturgeon now spawn unsuccessfully; (c) experimental manipulation of sturgeon hatchery operations so as to test for possible competitive effects of hatchery releases on wild sturgeon survival and to determine optimum size and location of release for hatchery sturgeon juveniles; (d) development and testing of a plan "aquatic ecosystem management" hydrograph for Libby Dam releases, where this plan hydrograph involves both lower winter flows to provide a more natural ecosystem low-flow""reset" feature (and more natural conditions for burbot spawning and migration) and also spring-summer peak flows to improve conditions for sturgeon spawning and also restore some sediment transport functions; and (e) opportunistic, small-scale experimentation with localized restoration of connections between the channelized river and its flood plain, in areas where such connections can be restored without serious impact to flood plain land users.

The experimental treatment sequence shown in Table 2 is not ideal from a scientific viewpoint, i.e., effects of fertilization/hydrograph modification options will be partly confounded in the first few years of application. Most options will

Table 10.3. Characteristics of proposed adaptive management plan activities and potential outcomes.

	River Fertilization	South Arm Fert. & Kokanee Introductions Tributary Enhancement	Hatchery Sturgeon / Burbot	Substrate Modification (Gravel/cobble additions over sand substrate, hydraulics)	Ecosystem Restoration Flows Winter Low, Spring Runoff Peaking, Sediment Augmentation	Flood Plain Reconnection
Target Benefit	Community, increased growth, survival, and biol. condition	Kokanee, burbot, sturgeon,	Addresses potential sturgeon reproductive stock limitation	Increase survival of eggs, larvae	Sturgeon recruitment, cottonwood recruitment, natural processes	Increased surv/growth of larvae, juv for sturgeon, increase productivity for comm.
Potential Negative Effects	Stimulation of non-target species.		Overstocking sturgeon could limiting wild production	Unintended hydraulic consequences	Seepage at higher flows, cooler water temperatures inhibit sturgeon spawning, reduced productivity in reservoir (not refilled)	
Required Time to See Effect	Periphyton =wks, invert=months, fish = 1-5 yrs,	Kokanee =1-3 yrs	Variable dep. on life stage and objective (e.g. 30 to det. spawn)	In-season detection of larvae, 2+ yrs to fully recruit to gill nets	Same as above	
Monitoring Requirements	All taxa responses in Kootenay Lake and lower Kootenai River	All taxa responses in Kootenay Lake	Ongoing	Better definition of spawning and egg deposition areas. Start at small-scale to work-out mechanics, spawning pref. studies	Same as above	Assess nutrient and habitat heterogeneity contribution
Small Scale	No	No	Yes for reduced sturgeon growth due to pot l overstocking	Yes	No	Yes
Pre-Implementation Steps	Mesocosm studies (completed)		Completed population modeling	Small-scale evaluation of predators	Evaluation of flow alteration results	Feasibility Assessments

Table 10.4. Draft 20-Year Multi-agency Adaptive Management Program Framework

	Aquatic							Riparian		Terrestrial		
Year	Kootenai River fertilization	South Arm Fert. and Kok. Introductions / Tributary Enhancement	Sturgeon Conservation Aquaculture	Burbot Conservation Aquaculture	Aquatic system Biomonitoring	Habitat creation , modification, or restoration	Ecosystem function restoration flows (winter low, spring runoff peaking, sediment augmentation)	Flood plain reconnection, wetlands restoration	Terracosm studies	Terrestrial Invert. surveys	Vegetation surveys	Small mammal surveys
2004	Design	1	1	Evaluate	1	Assess	Hydrograph design	Local, small scale tests	Assess	Assess	1	Assess
2005	1	1	Evaluate	Evaluate	1	Evaluate	1+fry bioassay	as opportunities	Design	Contingent	1	Contingent
2006	1	1	1	Evaluate	1	1	1	arise	1	Contingent	1	Contingent
2007	1	1	Evaluate	Contingent	1	1	1	Including:	1	Contingent	c	Contingent
2008	Review	Review	1	Contingent	1	1	1	restoration,	1	Contingent	c	Contingent
2009	0	Contingent	Evaluate	Contingent	1	Review	1	side channel	Review	Contingent	c	Contingent
2010	0	Contingent	1	Contingent	1	Contingent	1	artificial spawning	Contingent	Contingent	c	Contingent
2011	0	Contingent	Evaluate	Contingent	1	Contingent	Review	channel construction	Contingent	Contingent	c	Contingent
2012	1	Contingent	1	Contingent	1	Contingent	Contingent	Contingent	Contingent	Contingent	c	Contingent
2013	1	Contingent	Evaluate	Contingent	1	Contingent	Contingent	Contingent	Contingent	Contingent	c	Contingent
2014	1	Contingent	Review	Contingent	1	Contingent	Contingent	Contingent	Contingent	Contingent	c	Contingent
.	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	c	Contingent
.	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	c	Contingent
2024	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	Contingent	c	Contingent

1=Annual implementation and evaluation, 0=No annual implementation but evaluation, "c"=contingent

be implemented as quickly as possible, so the experimental design is a reverse-titration or "kitchen sink" structure. Considering response lags in key ecological variables (e.g. sturgeon recruitment), it should be possible to begin reviews of monitoring results after about five years, and these will likely lead to changes in the treatment sequence so as to more clearly separate effects that are confounded in the initial treatment results.

Aquatic Program Components

1. *Kootenai River experimental fertilization* – The controlled addition of limiting nutrients to artificially de-nutrified aquatic systems is a well established, rigorous, yet rapidly emerging scientific discipline, with nearly 30 years of empirical history (Stockner 2003). Beginning with North Arm Kootenay Lake fertilization in 1992, the Kootenay Lake system provides a good example of the successes of fertilizing artificially denitrified waters. For example, downstream from Libby and Duncan Dams, Kootenay Lake was experiencing declines in productivity (nutrient levels) and fish populations during the 1980s. In response to these declines, the BC Ministry of Environment and BC Hydro initiated an experimental program to fertilize the North Arm of Kootenay Lake in 1992. By 1998, kokanee numbers in Kootenay Lake had jumped over 800% to 25-30 million. Combined kokanee spawning runs to Meadow Creek Spawning Channel and the Lardeau River increased from 270,000 in 1991 to 2.2 million in 1998. There are currently 30 to 35 million kokanee in Kootenay Lake, due largely to the fertilization program and the presence of suitable kokanee spawning habitat, in the form of engineered habitat channels. The same ecological approach was applied to the South Arm of Kootenay Lake in 2004, and will be applied to the Kootenai River in Idaho, beginning in 2005. (Lead agencies: KTOI, IDFG).

2. *South Arm experimental fertilization* – Following up on the success of the North Arm Kootenay Lake fertilization program, a fertilization program began in the lake's South Arm to compensate for lost productivity and current ultraoligotrophy imposed by Libby Dam and the loss of the river's historical floodplain (Figures 1 and 2). (Lead agency: BC WLAP).

3. *Tributary stream enhancements* – High quality tributary stream habitat within the Kootenai River Subbasin are paramount for survival of native resident and adfluvial fishes, riparian biological communities, and their supporting taxa. Consistent with this understanding, several tributary

habitat improvement projects supported by BPA and the Bonneville Environmental Foundation funding are ongoing. Project proponents recognize the need to assess and pursue the benefits of expanding the scopes and scales of these and related tributary habitat enhancement projects. (Cooperating agencies: KTOI, IDFG, MFWP, BCWLAP).

4. *Conservation aquaculture, white sturgeon* – Started in 1989, the white sturgeon conservation aquaculture program is providing reliable annual recruitment, representation of current wild fish genetic diversity for the next generations, and the demographic base to maximize benefits of future mainstem habitat improvements designed to benefit natural spawning and recruitment. Currently, the conservation aquaculture program is the only program successfully contributing to demographic and genetic preservation of this endangered population (Lead agency: KTOI).

5. *Conservation aquaculture, burbot* – Initial success of experimental burbot conservation aquaculture occurred during the first year (2004) of research to develop techniques and facilities capable of reliably rearing burbot in captivity. (Lead agency: KTOI). (See Section 4.5.1 of the Kootenai Subbasin Assessment for an update on this program.)

6. *Aquatic biomonitoring* – Agency, tribal, and academic scientists have produced an ongoing biomonitoring program that evaluates water quality, and algal, aquatic insect and fish productivity in the Kootenai River from Kootenay Lake upstream to Wardner, BC. This program has annually documented baseline ecological conditions in the Kootenai River since the mid-1990s, more rigorously during the past four years, and will be used to evaluate experimental river fertilization treatments, relative to pre-fertilization (baseline) conditions (Lead Agencies: KTOI, IDFG).

7. *Habitat creation, modification, or restoration* – In response to extensive artificial alteration of the Kootenai ecosystem, innovative sturgeon projects including gravel/cobble additions over sand substrate, hydraulic manipulation structures, and spawning habitat, spawning and early life rearing channels, and natural-engineered hatchery systems are being considered for reestablishment of vital ecosystem functions. An array of additional projects are being currently being assessed to provide benefit for other fish and wildlife communities and the river's required supporting ecological functions (Tables 1 and 2) (Lead Agencies: USACOE, USFWS; cooperating agencies: KTOI, IDFG, MFWP, BCWLAP).

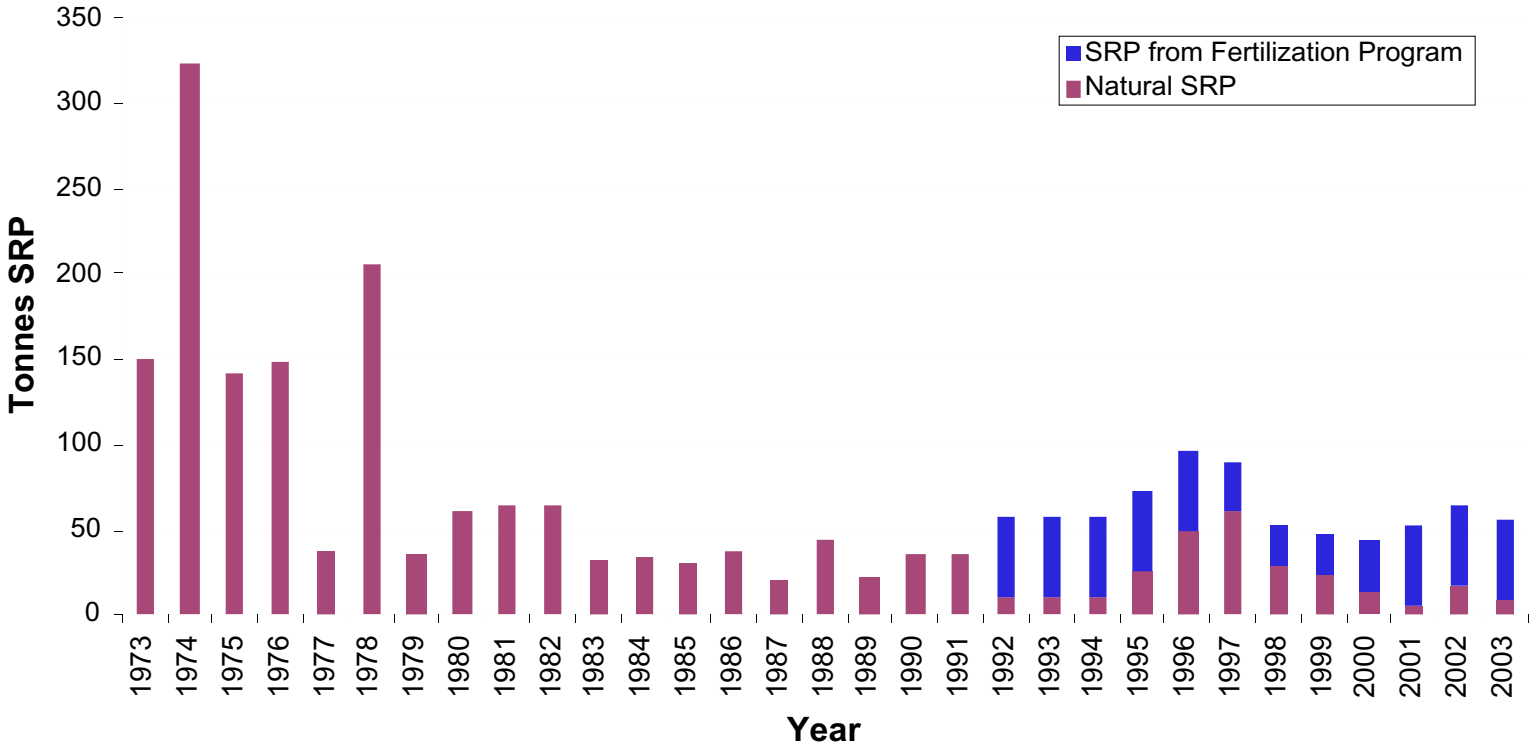

Figure 10.6. Nutrient (soluble reactive phosphorous) loading to Kootenay Lake from the Kootenai River, 1973-2003. Libby Dam was completed in 1974.

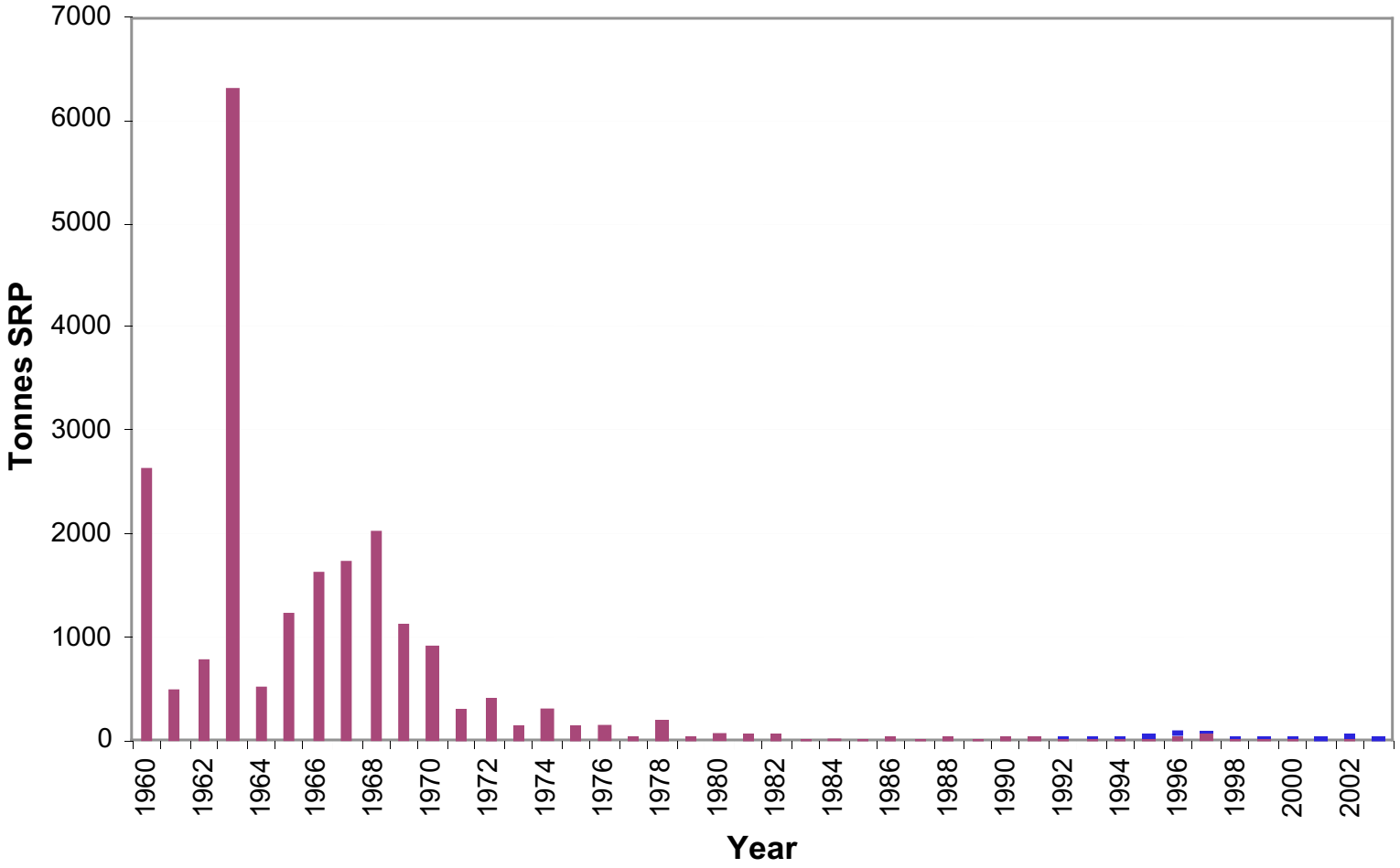

Figure 10.7. Nutrient (soluble reactive phosphorous) loading to Kootenay Lake from the Kootenai River, 1960-2003. Libby Dam was completed in 1974. Elevated levels of phosphorous loading from the Kootenai River prior to the 1970s resulted in cultural eutrophication. Kootenay Lake fertilization is indicated by the blue bars after 1991.

8. *Ecosystem restoration (normative) mainstem flows* – (All agencies) Libby Dam operation for flood control and power production has reversed the natural (pre-dam) Kootenai River hydrograph and has significantly altered downstream thermographs and water quality parameter values. All collaborators in the lower Kootenai River Subbasin have a vested interest in providing a more natural or normative river downstream from Libby Dam for a variety of ecological, social, cultural, recreational, and economic reasons, while sharing a vested interest in avoiding negative affects on flood control and power production.

Riparian Program Components

1. *Floodplain reconnections, wetlands creation, riparian habitat function restoration* —(Lead agencies: KTOI, IDFG) Investigations and monitoring studies are currently underway in the Lower Kootenai River floodplain to determine the feasibility of reconnecting historical floodplain habitat with the main Kootenai River channel.

2. *"Terracosm" studies* – (Lead agency: KTOI)–"Terracosms" are a land-based analogue for mesocosms that are medium-scale experimentally controlled systems used to quantify primary and secondary production and other ecological changes associated with experimental nutrient addition in aquatic systems. Unlike mesocosms, which simulate biological conditions in the water column of a river, terracosms are designed to measure the effects of water-borne nutrient levels on biological productivity over submerged floodplain habitat. The purpose of the terracosm experiments is to obtain valuable empirical data to more accurately quantify and understand the ecological changes that have occurred in Kootenai River following diking, channelization and impoundment. An associated digital elevation modeling exercise essentially represents a large book keeping procedure to determine the magnitude of the floodplain losses. This, in turn is used to determine location, depth, and duration of floodplain inundation under pre- and post-development floodplain landscapes. An additional key step is to collect empirical data to determine the various productivity estimates from the vegetation groups that exist within the mosaic of riparian ecosystems along the Kootenai River. Some of the data (e.g. carbon leaf-fall per unit area, insect emergence) can be obtained from the literature, but requires validation to ensure the numbers accurately reflect the various measurable ecosystem flux rates that exist within the lower Kootenai River Subbasin. Terracosms and additional empirical

measurements (i.e. leaf litter fall, leaf decomposition rates) are proposed to obtain these data (Table 2).

Terrestrial Program Components — To be developed

1. *Terrestrial invertebrate surveys*
2. *Vegetation surveys*
3. *Small mammal surveys Bird surveys*

10.3.5. Ongoing Research, Monitoring, and Evaluation Activities

The following RM&E activities are ongoing in the Kootenai Subbasin. Additional information for BPA projects is listed at the end of each subsection.

LINKS

For a Protocol for Monitoring Trajectories of Bull Trout Populations Using Demographic Parameters in a Probabilistic Framework, go to Appendix 115.

Click Here

Fisheries and Aquatic Science

All on-the-ground BPA-funded projects described in the inventory include a number of monitoring, evaluation, and research activities. Specific monitoring strategies, including pre- and post-treatment sampling, have been designed for each completed and ongoing project. Monitoring includes parameters from the watershed scale to project-specific activities. These activities are combined with watershed-level, long-term, time-series data from habitat and population indices that evaluate direct and indirect effects of projects.

Specific ongoing monitoring activities led by Montana Fish, Wildlife & Parks include:

- Monitor permanent stream form and maintain sediment monitoring stations in the Wigwam River (B.C.) and in Grave Creek (MT).

- Evaluate the effectiveness of remote site incubators (RSI) and artificial redd construction as a means of increasing recruitment of age-2 or greater Westslope cutthroat trout into tributary populations. The agency monitors the spawning population and strength of emigration through the operation of the permanent weir on Young Creek to capture upstream migrant adult trout and downstream migrant juvenile trout. It monitors the effects of RSI's and artificial redds by conducting electrofishing population estimates in historically sampled reaches, and it monitors the effectiveness of Westslope cutthroat trout at displacing non-native eastern brook trout by deploying RSI's in Barron Creek in conjunction with physical habitat inventory, beginning in 2001.

- Monitor and assess trout populations pre- and post-project implementation in stream reaches where enhancement activities will/have been implemented. Either population estimates (for purely habitat-based projects) or CPUE (for primarily hydrologically-based projects) are monitored. Aquatic insect response, temperature response, and in some cases, vegetative response, are also monitored. The biological and hydrological effects of lake rehabilitation is evaluated by monitoring zooplankton recolonization and fisheries growth in chemically treated lakes.

- Monitor spawning and rearing of fluvial burbot and cutthroat and bull trout in the mainstem Kootenai River and principal tributaries. The agency monitors burbot spawning activity in the stilling basin below Libby Dam by continuing hoop netting operations during December and February. It monitors tributary use of fluvial bull trout in the Montana portion of the Kootenai River and conducts bull trout redd counts in core-area tributaries in the U.S. and Canada. Redd counts have been the principal bull trout monitoring tool since 1983.

- The agency counts rainbow trout redds below Libby Dam between Alexander Creek and the Fisher River.

- Monitor bull trout movement and habitat use of main stem Kootenai River and tributaries. The agency collects adult bull trout in the Kootenai River via electrofishing and from Bear Creek via migrant trapping and surgically implant radio tags. It tracks fish from boats and planes on a bi-weekly basis annually, and weekly during spawning season.

- Document entrainment of fish through Libby Dam during flow events greater than 20,000 cfs. The agency monitors entrainment of fish through Libby Dam; measures draft tube velocities and determine relationships to discharge and reservoir elevation; incorporates >20 kcfs entrainment data into the existing entrainment model (Skaar et al. 1996). It estimates forebay kokanee densities using hydroacoustic technology and equipment.

- Monitor zooplankton and gamefish populations in Koocanusa Reservoir and monitor zooplankton and gamefish populations in Libby Reservoir. MFWP monitors seasonal and annual changes in fish abundance in near-shore zones with seasonal gillnetting, conducts annual estimates of population numbers of each age class of kokanee (hydroacoustics) with

MFWP Regional Fisheries Program, and monitors zooplankton populations in the reservoir.

- Assess bull trout food habits in Koocanusa Reservoir and the Kootenai River.

Specific ongoing BPA funded research, monitoring, and evaluation activities led by the KTOI include:

- Monitor fish community dynamics at index sites on the mainstem Kootenai River. In cooperation with IDFG, the Tribe conducts late summer, nighttime electrofishing of near-shore feeding-zone habitats, gillnetting of deep-water habitats, and beach seining of shallow water habitats.

- Monitor fish community dynamics at index sites on selected tributaries of the Kootenai River. The tribe will derive fish community composition and relative abundance by snorkeling techniques and backpack electrofishing techniques.

- Monitor macroinvertebrate community dynamics within the mainstem Kootenai River as part of a pre-nutrient enhancement decision. The Tribe deploys macroinvertebrate samplers during the biologically productive months at sites within representative reaches of the Kootenai River from Libby Dam to Porthill, Idaho, conducts monthly field collections of macroinvertebrate samplers, cleans and sorts macroinvertebrate samples in the laboratory and prepares for identification, and conducts a macroinvertebrate taxonomy and community dynamics analysis.

- Monitor primary productivity, algal community composition, and test nutrient addition effects on these parameters. The Tribe performs mesocosm analysis within key reaches of the Kootenai River in Montana and Idaho.

- Monitor key water-quality parameters at mainstem Kootenai River sites as part of pre-nutrient enhancement decision. The Tribe takes monthly water quality samples during the biologically productive months within key reaches of the Kootenai River in Montana and Idaho, and British Columbia, and ships water-quality samples to certified lab for nutrient and chemical analysis

- Monitor and evaluate genetic variability and diversity of hatchery white sturgeon juveniles produced and wild brood stock spawned in the Kootenai Hatchery. In cooperation with the University of Idaho, the Tribe optimizes and use nuclear and mitochondrial DNA marker analyses (sequencing, RFLP's, and microsatellites) to document existing variability and diversity of wild brood stock and hatchery progeny. It compares genetic variability and diversity of hatchery progeny and wild brood stock with that of the wild population to assess genetic representation in hatchery progeny and refine breeding matrix if necessary.

- Monitor and evaluate survival, condition, growth, movement, and habitat use of hatchery-reared juvenile white sturgeon released into the Kootenai River. In cooperation with IDFG and B.C. Ministry of Fisheries, the Tribe samples juvenile white sturgeon to collect information pertaining to life history characteristics using gillnets, hoop nets, and angling. It conducts sonic tracking studies to determine movement and habitat use of juvenile white sturgeon. It evaluates habitat characteristics in areas used by white sturgeon and identify habitat improvements opportunities and monitors and evaluates juvenile and adult sturgeon and burbot in Kootenay Lake, B.C.

- Monitor and evaluate biological condition and related population dynamics of white sturgeon in the Kootenai River. The Tribe and IDFG determine existing empirical range and variation of growth and condition values of white sturgeon in the Columbia and Kootenai Basin; identify, develop, and rank techniques to determine biological condition as it relates to carrying capacity and associated population dynamics; and evaluate cumulative effects of incremental annual stocking of white sturgeon on growth, condition, and behavioral responses of the hatchery origin and wild population components in the Kootenai River.

- Monitor and evaluate flora and fauna biological condition on habitat mitigation projects. The Tribe will determine baseline Habitat Evaluation Procedures (HEP), using Habitat Suitability Indices (HIS's), to measure enhancements, variation of flora growth and condition values on habitat mitigation projects in the Columbia and Kootenai Basin; identify and develop appropriate HSI models to determine changing biological conditions as they relate to management activities, carrying capacity and associated ecological functions; and evaluate cumulative effects of management activities on vegetative growth, condition, and wildlife responses in the Kootenai River.

- Research, monitor and evaluate the integration of hydraulic-topographic, riparian floodplain and riverine-floodplain food web models via RDRT/AEA process and associated adaptive management strategies and trial restoration experiments. These efforts are to compliment other existing Subbasin project and RM&E work.

- Research, monitor and evaluate riparian and floodplain primary and secondary productivity (e.g., algal, nutrients, birds, etc.), in conjunction with other ongoing project work, to assess ecosystem functions and reconnection opportunities in Kootenai River watershed.

LINKS

For information on the Council's Review of Strategies for Tributary Restoration, go to: http://www.nwcouncil.org/library/isab/isab2003-2.pdf

Click Here

Regarding tributary restoration, all RM&E in the Kootenai Subbasin will benefit from guidance of the Council's Review of Strategies for Tributary Restoration.

In addition to the above KTOI monitoring activities, the Kootenai Tribe performs the following activities for tributary RM&E:

Research: KTOI Tributary Data Analysis Methodology

1. Historic data
    a. Macroinvertebrate tolerance data
    b. Macroinvertebrate densities
    c. Fish densities
    d. Fish population estimates
2. Fish
    a. Community composition (bar graph).
    b. Relative abundance (pie charts).
    c. Population estimates (table).
    d. Densities (table).
    e. Fulton-type condition factors
    f. Age distribution (bar graph).
    g. Species lists with length, weight and age data
3. Macroinvertebrates
    a. Community composition (bar graph).
    b. Functional group composition (pie charts).
    c. Biomass (bar graph).
    d. Metrics (density, % dom. Taxa, SR, EPT richness, % Ephemeroptera, % Plecopetera, % EPT taxa, % Chironomid, % Predators, Margalef's Richness, Pielou's J, HBI, MTI, Long lived species taxa richness, intolerant species richness, % tolerant taxa).
    e. Species list with functional group designations

4. Periphyton/plankton
    a. Algal group composition (pie charts).
    b. Diatom species diversity (bar chart).
    c. Species list with functional group designations
    d. Biotic Integrity Indexes (total diatom species richness, total diatom generic richness, total number of divisions, % *Achnanthes minutissima)*.
    e. Ecological Diagnostics (% acidobiontic + % acidophilic, % alkalibiontic + % alkaliphilic, % mesosaprobic+ % oligosaphrobic + % saprophilic, % eutrophic).
    f. Zooplankton densities (bar chart).
5. Chlorophyll
    a. Chlorophyll *a*, *b* and total chlorophyll content (table, trend graphs).
6. Basic water quality, nutrients and metals
    a. Median or range values for basic WQ parameters (table, trend graphs).
    b. Range and median values of dissolved metals (table, trend graphs).
    c. Range and median values of nutrients (TP, SRP, NH4, NO2+NO3, TN).
    d. Thermograph data – daily maximum and daily average (line graphs).
7. PFC summary (if conducted., full report and worksheets)
8. Survey data summary (bank stability, habitat, greenline, cross-sections).
9. Photopoint shots
10. Site maps
11. QA/QC data

LINKS

For more information on the Bonneville Environmental Foundations, go to; http://www.b-e-f.org/accomplishments/projects.shtm

Click Here

KTOI Tributary Monitoring Protocol

The following detailed tributary monitoring protocols and activities are part of the KTOI's ongoing stream restoration and monitoring efforts in the Kootenai Subbasin, supported by the Bonneville Environmental Foundations (Trout Creek Idaho example)

1. Conduct Biological Assessments

    Quarterly *(Flood plain section, three main cross-sections: End of the month during March, June, September and December):*
    a. Staff gage reading
    b. Download thermographs
    c. Nutrients and metals: Collect a 500 ml water sample from each main cross-section.

d. Chlorophyll: Filter 1 L water sample per reach through a <70 um fiber filter from each of the three established main cross-sections. Wrap filter in foil and freeze until analyzed for chlorophyll. (Record volume of water filtered.). Measure chlorophyll a, chlorophyll b and total chlorophyll.
e. Taxonomy:
    i. Phytoplankton: Collect 120 ml water samples from each main cross-section and preserve with 1% Lugols solution. Conduct soft-bodied algae counts (300 cells/25 um units) and diatom counts (a minimum of 800 valves at 1000x magnification) to species. Record results in #/ml.
    ii. Periphyton: Scrape 3-3"x3" areas from variable substrates from each main cross-section. Preserve with Lugols solution to 1% by volume. Conduct soft-bodied algae counts (300 cells/25 um units) and diatom counts (a minimum of 800 valves at 1000x magnification) to species. Record results in #/m^2.
    iii. Zooplankton: At each main cross-section, filter 10L of water through a 35um (63 um optional) mesh net, rinse into plastic bottle and preserve with Lugols solution to 1% by volume. Conduct zooplankton counts using 40X for Crustacea and 100X for Rotifers. Count a minimum of 24 strips at 26mmx1.956mm strip size. Record results in #/L.
f. Basic water quality parameters: At each main cross-section, measure temperature, DO (mg/l and % saturation), pH, conductivity and turbidity with a Hach Session 156 probe.

Annually *(Flood plain section: late summer or fall depending on when initial bioassessment was conducted)*

a. Fish: Complete 3-pass depletion electroshocking (backpack shocker with blocknets at top and bottom of 50m reach), conduct a 4^{th} pass if >10% capture rate of previous pass is achieved; record fish species, length, weight and collect scales for aging.
b. Macroinvertebrates: Collect Hess samples in upper forested reaches (cobble/ gravel substrate) and Pederson dredges in lower flood plain reaches (sand/silt substrate; 1 each at top, middle and bottom of each sample reach representing different habitat types such as pool, riffle and run). Identification to genus and species where possible.
c. Photopoints: Re-shoot photopoints at least annually.

Every 5 years *(late summer to early fall):*

a. Survey cross-sections to document changes in stream contour (flood plain section)
b. Conduct stream bank stability surveys (flood plain section)
c. Conduct vegetation surveys (flood plain cross-sections; can be done every 1-2 years)
d. Conduct full-stream bioassessments
e. Conduct canopy cover estimates (% - flood plain section)
f. Conduct habitat surveys (gravel, woody debris, pool/riffle/run)
g. Establish staff gage at start of project and re-calibrate every 5 years

Specific ongoing BPA funded research, monitoring, and evaluation activities led by IDFG include:

- Evaluate burbot movement, spawning, and recruitment through the use of hypothesis tests using scientific designs approved by the Kootenai River Burbot Recovery Committee. The agency also evaluates the effect of winter hydro operations on the rate and timing of burbot spawning migration. IDFG will continue with a cooperative program with B.C. Ministry of Environment sampling the Kootenai River and portions of Kootenay Lake in evaluation of the status of burbot.

- The IDFG monitors and evaluates the size structure of the burbot population in the Kootenai River and Kootenay Lake, including periodic estimates of population size of adult and juvenile burbot in the Kootenai River and Kootenay Lake.

- The IDFG monitors and evaluates the blood level of testosterone, plasma chloride, and Estradiol-17B with respect to reproductive failure of burbot and compare their levels to a control population from Columbia Lake, B.C.

- Monitor and evaluate the size structure of the population of Kootenai River white sturgeon in the Kootenai River and Kootenay Lake. The effort includes periodic estimates of population size of adult and juvenile white sturgeon in the Kootenai River and Kootenay Lake.

- With radio and sonic telemetry, monitor the timing of movement of adult Kootenai River white sturgeon each spring and measure response to flow augmentation and temperature. This effort also collects information

pertaining to life history characteristics. The IDFG will continue subcontracting to the B.C. Ministry of Environment for telemetry and juvenile white sturgeon studies in Kootenay Lake.

- Deploy artificial substrate mats and monitor white sturgeon spawning events, locations, habitat (substrate, mid-column velocity, depth, and temperature), and intensity in response to experimental flows.

- Monitor and evaluate larval white sturgeon abundance/year class strength in response to experimental flows.

- Use small-mesh gillnets to monitor and evaluate wild and hatchery white sturgeon year-class abundance, growth, relative weight, and survival in the Kootenai River.

- Conduct a creel survey on the Kootenai River in 2006 to determine species composition of the angler catch, harvest, and trout exploitation.

- Use radio telemetry to monitor the timing of movement and habitat preferences of adult redband and bull trout and document spawning locations in the mainstem Kootenai River and tributaries.

- Monitor and evaluate sources (tributary and mainstem) of redband, cutthroat, mountain whitefish, and bull trout recruitment with screw traps, drift nets, and by snorkeling.

- Using hypothesis testing, the IDFG evaluates the availability of redband and bull trout spawning habitat and test the use of spawning habitat cribs to determine if habitat is a limiting factor to recruitment.

- The IDFG monitors the fish community, species composition, relative abundance, biomass, and trophic structure by electrofishing two, key large-scale index sites between rkm 246 and 276 and develop a database for future ecosystem rehabilitation studies.

Additional RM&E information for individual ongoing BPA funded projects in the Kootenai Subbasin is listed below by project:

BPA Project 198806400: Kootenai River White Sturgeon Studies and Conservation Aquaculture

1. Monitor, evaluate, and report genetic variability and diversity of hatchery white sturgeon juveniles produced and wild brood stock spawned in the Kootenai Hatchery. (USFWS Recovery Measure 2.23)

2. Monitor and evaluate survival, condition, growth, movement, and habitat use of hatchery reared juvenile white sturgeon released into the Kootenai River. (USFWS Recovery Measure 3.31)

3. Monitor and evaluate hatchery water quality (USFWS Recovery Measure 2.22)

4. Monitor and evaluate animal health of hatchery reared juvenile white sturgeon (USFWS Recovery Measure 2.24.242)

5. Monitor and evaluate juvenile and adult sturgeon and burbot in Kootenay Lake, BC

Research

1. Refine elements of white sturgeon conservation aquaculture program using research with direct management implications. (USFWS Recovery Measure 2.24)

1a. Investigate cryopreservation techniques, as well as assessment of viability of sperm collected in the field for Kootenai River white sturgeon.

1b. Develop and evaluate permanent tagging or marking technologies or techniques to identify larval, fingerling, and YOY white sturgeon to allow for early release. (USFWS Recovery Measure 2.24.243)

2. Investigate factors limiting sturgeon recruitment using research with direct management implications. (USFWS Recovery Measure 2 and 3)

2a. Determine mortality, growth, development, and deformity rates for sturgeon sac-fry reared under simulated river conditions and test for metals and organochlorine pesticides in substrates (USFWS Recovery Measure 3.34.342)

2b. Conduct analysis of blood and gametes from brood stock fish to determine contaminant levels of metal and organochlorine compounds contributed through gametes to offspring.

2c. Correlate survival rate of brood stock families to total parental contributions of metal and organochlorine compounds contributed to offspring through sperm and eggs.

2d. Measure and monitor the bioavailability of contaminants related to sediment, organic matter and food-base organisms in the Kootenai River (USFWS Recovery Measure 3.34.341)

3. Evaluate the feasibility of developing burbot donor stock sources for recovery of declining native burbot stocks in the lower Kootenai

4. Develop conservation aquaculture techniques for recovery of declining native burbot stocks in the lower Kootenai.

BPA Project 198806500: Kootenai River Fisheries Recovery Investigations

1. Monitor and evaluate experimental flows for sturgeon spawning and rearing, determine the minimum flow that will provide spawning and rearing habitat for Kootenai River white sturgeon and bring off a successful year class

15. Monitor and evaluate implementation of a recovery strategy for burbot as prescribed in the Recovery Strategy for burbot.

Research

2. Test Null Hypothesis: survival of larval sturgeon released over sand substrate is higher than larvae released over cobble substrate.

3. Determine how changes in Kootenay Lake elevation affects white sturgeon spawning location. Will cost share with USGS.

4. Evaluate the use of artificial substrates and instream structures to improve white sturgeon egg and larval survival and relocate sturgeon spawning.

5. Test null hypothesis that winter operation of Libby Dam does not affect burbot migration distance or travel rate. Measure test and control in travel time, km/day.

6. Test null hypothesis that high winter flows do not cause stress in burbot and impair reproductive fitness.

7. Test null hypothesis under laboratory conditions that various flows and temperatures do not cause stress in burbot and impair reproductive fitness.

BPA Project 199404900: Improving the Kootenai River Ecosystem

1. Evaluate the productivity within the Kootenai River before and after implementation of an experimental large-scale ecosystem improvement experiment (Biomonitoring Program)

a. Monitor algal biomass b. Monitor chlorophyll a concentration c. Monitor algal species composition d. Monitor macroinvertebrate biomass e. Monitor macroinvertebrate species f. Monitor fish density and biomass g. Monitor fish species/community dynamics

2. Monitor key water quality parameters, with an emphasis on macro-nutrients.

Research

1. Evaluate the feasibility of a Kootenai River controlled nutrient addition experiment.

BPA Project 200200200: Assess Feasibility of Enhancing White Sturgeon Spawning Substrate Habitat, Kootenai R., Idaho

1. Develop sediment-transport models, develop spawning habitat substrate improvement scenarios, and assess the feasibility of habitat enhancement

BPA Project 200200800: Reconnection of floodplain slough habitat to the Kootenai River

1. Evaluate potential slough sites to be reconnected and estimate the ecological benefit reconnection will provide for each potential site

2. Determine the structural and physical feasibility of reconnecting the potential slough sites. River hydraulic data, Surface water profiles, field boring of dike, geotechnical evaluation of the dike, structural concept and design.

3. Establish baseline conditions in the area to be reconnected.

4. Set up index sites and monitor primary production, nutrient concentrations, secondary production, and fish community.

BPA Project 200000400: Monitor and protect bull trout for Koocanusa Reservoir

1. Assess and monitor the metapopulation strength of transboundary (British Columbia and Montana) populations of bull trout in the Kootenay River above Libby Dam.

2. Monitor habitat and estimate bull trout fry and juvenile densities at permanent sites on the Wigwam, White and Bull rivers and Skookumchuck Creek

In addition to the above series of aquatic monitoring in the Subbasin, the Kootenai River Network (KRN) developed a Comprehensive Water Quality Monitoring Plan for the Kootenai River Basin.

LINKS

To access the Comprehensive Water Quality Monitoring Plan for the Kootenai River Basin, go to: http://www.kootenairivernetwork.org/pub/index.shtml

Click Here

Wildlife

Nongame Monitoring

This ongoing MFWP wildlife mitigation project evaluates the effects of habitat enhancements at Hungry Horse and Libby reservoirs on breeding bird communities to determine if enhancement prescriptions for big game species effectively rehabilitate habitat for bird species as well. Nongame birds, which are widely recognized as one of the best indicators of terrestrial habitat quality, inhabited all the habitats lost in both project areas. There is growing international concern over the status and trend in many western bird populations and their relationships with habitat management practices. In order to optimize benefits to all wildlife, we need to determine whether activities done to benefit big game animals also benefit other species groups that depend on those habitats. A final

For MFWP's pending proposal to evaluate the biological effects of the Northwest Power and Conservation Council's Mainstem Amendments on the fisheries upstream and downstream of Hungry Horse and Libby Dams, Montana, go to Appendix 116.

Click Here

summary report of this eight-year effort results will be used to review and develop new habitat enhancement proposals and methods for measuring wildlife benefits.

Population Monitoring

Big game, furbearer, and nongame populations in the Subbasin are monitored annually through a variety of surveys and inventories. State and tribal agencies conduct annual surveys of Subbasin species such as elk, mule deer, white-tailed deer, moose, mountain goats, and grizzly bears. MFWP also conducts breeding-bird surveys on each of its wildlife management areas as well as furbearer-track surveys during winter. Local organizations like the Montana Bald Eagle Working Group, Montana Loon Society, sportsman groups and other entities coordinate annual mammal counts, transportation-related mortality surveys, and bald eagle and common loon occupancy and productivity surveys. The IDFG coordinates bald eagle occupancy and nest surveys as well as surveys for wintering eagles. The National Audubon Society sponsors annual Christmas bird counts. There are annual breeding bird surveys conducted in the Kootenai Subbasin as part of the national surveys coordinated by the USFWS.

Research

MFWP has been conducting a 12-year study of white-tailed deer in coniferous forests of northwestern Montana to develop techniques to determine basic biological and ecological parameters for white-tailed deer and relate those parameters to characteristics of individual habitats and potentially limiting factors USFWS has been conducting an eleven-year study of grizzly bears in the Cabinet-Yaak grizzly bear recovery area. The purpose is to evaluate basic biological and ecological parameters pertinent to the recovery of this population. They also captured and transplanted four female grizzlies from British Columbia to the Cabinet Mountains for the purpose of bolstering the resident population and enhancing genetic diversity within this population.

BPA Project 199206100: Albeni Falls Wildlife Mitigation Project

Research, monitoring and evaluation will be guided by the Monitoring and Evaluation Plan for The Albeni Falls Wildlife Mitigation Project (AFWG 2001) and should be consistent with other Subbasin Plans (i.e., Intermountain Province). As stated in the AFWG 2001 M&E Plan:

1. *Tier I Trend* monitoring is sufficient to answer questions about the trend in population or habitat condition over a broad scale…On a programmatic

scale (the NPPC Fish and Wildlife Program) we believe that HEP analysis (U.S. Fish and Wildlife Service 1980a) falls into this category. Particularly for projects that endeavor to mitigate a finite ledger of HUs associated with losses from a specific hydropower project, HEP adequately meets the monitoring needs, at a programmatic level, to ensure mitigation goals are being achieved. Consequently, HEP will remain an integral part of our overall monitoring strategy.

2. *Tier II Statistical* monitoring is able to answer questions about population trends, community diversity, and species relative abundance in the context of local habitat condition or management action.

3. *Tier III Research* monitoring is the most sensitive level of monitoring. At this level we are able to answer questions about causal relationships between specific habitat attributes and population demographic parameters…However, if Tier II Statistical monitoring suggests a management problem that can not be adequately addressed by a review of the literature and through the managers experience, nothing in this M&E plan constrains a manager from developing a site-specific monitoring program at this intensity level to address specific problems."

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

Develop a holistic approach that assesses operational losses of ecological functions in the Kootenai River Watershed:

1. Review, analyze and select research designs for the assessment of operational losses

2. Assess the historic and current status and condition of floodplain areas in the Kootenai River and utilize operational loss assessment research design to initiate the process for regionally based estimation of operational losses

3. Develop a comprehensive floodplain strategy with the integration of local processes and planning efforts

4. Plan and secure management rights on identified priority habitats or potential to produce priority habitats

5. Apply an adaptive management process (refer to Evaluation Protocols section) to evaluate, monitor and promote the biological potential of the Kootenai River Watershed.

BPA Project 200200800: Reconnection of floodplain slough habitat to the Kootenai River

See the description above of projects 2002001100 and 199404900.

10.3.6. Future Comprehensive RM&E Plan

Upon completion of the ongoing Adaptive Environmental Assessment and Adaptive Management Workshop scheduled for the Kootenai River Subbasin agencies during July 2004, we will develop a comprehensive RM&E Plan for the Kootenai Subbasin that will incorporate an adaptive management (AM) process.

Montana Fish Wildlife & Parks has proposed to use quantitative biological models and field research to assess the biological consequences of various dam operation strategies on aquatic resources in Montana. The original models and published field research provide some of the tools required to assess biological impacts of operational changes called for by the Council's Mainstem Amendments. The proposed monitoring strategies expand on the existing models using additional empirical data to assess alternative operations in greater detail (see Appendix 116).

10.3.7. Data and information archiving and availability

Data generated from implementation of the Subbasin Plan will be made available, housed, and archived at the various following locations.

Montana

Montana (MFWP) maintains a series of electronic, web-based databases that make fisheries data from the Montana portion of the Kootenai Subbasin available:

1. Montana Fisheries Information System (MFish) contains an interactive database and map showing species distributions and population information:
   http://nris.state.mt.us/scripts/esrimap.dll?name=MFISH&Cmd=INST

2. The Montana Fishing Guide can be accessed at: http://fwp.state.mt.us/fishing/guide/default.aspx

3. Information and listings concerning Species of Species of Special Concern in Montana waters of the Subbasin can be viewed at: http://www.fisheries.org/AFSmontana/SSCpages/SSC.htm

4. Fish stocking information in Montana waters of the Subbasin can be accessed at: http://fwp.state.mt.us/fishing/stock02.asp

5. Project-specific fish and wildlife data are housed in databases and spreadsheets in MFWP's R-1 Office in Kalispell, MT.

Idaho

Idaho (KTOI, IDFG, UI) maintains a series of electronic, web-based databases that make fisheries data from the Idaho portion of the Kootenai Subbasin available:

1. UI–KTOI. Kootenai Subbasin Biomonitoring Program Interactive database. (http://ktoi.scsnetw.com) includes empirical data from KTOI fish and wildlife program. This relational database facilitates access to empirical data for statistical analyses. UI faculty and staff are available to guide its use and assist with analyses and interpretation.

2. An electronic database is also maintained by the IDFG, which includes Kootenai Subbasin data on bull trout, redband and cutthroat trout, mountain whitefish, white sturgeon, and burbot. The IDFG also maintains an interactive database (http://fishandgame.idaho.gov/tech/CDC/). The Idaho Conservation Data Center is part of the NatureServe network with more than 75 comparable programs in the United States, Canada, Latin America, and the Carribean. The Idaho Conservation Data Center collects, analyzes, maintains, and disseminates scientific information necessary for the management and conservation of Idaho's biological diversity.

3. Project-specific fish and wildlife data are housed in databases and spreadsheets at the KTOI headquarters and at Region 1 IDFG Headquarters.

British Columbia

British Columbia (BCMWLAP, UBC, DFO) maintains a series of electronic, web-based databases that make fisheries data from the BC portion of the Kootenai Subbasin available.

Data generation and availability

Quantitative and qualitative primary data generated by subbasin projects will have no restrictions on their availability once they are internally reviewed. All project data reside locally, in various electronic formats. Pubic access to data will be granted in a manner consistent with the reporting requirements of BPA and other funding agencies. Access is also available through public and scientific meetings and publication of peer-reviewed proceedings, papers, and reports. All project data will be compiled, analyzed, and reported in progress and annual reports to BPA and USFWS peer-reviewed publications, and various symposiums, conferences, and workshops (e.g. AFS, NAFWS, International Sturgeon Symposium, biannual Columbia Basin sturgeon workshop, Annual IKERT Meetings (International Kootenai/y River Restoration Team). Information will be used in project management and implementation and shared with others planning to implement conservation culture for declining native species.

10.3.8. Evaluation protocols

Evaluation protocols implemented in the Subbasin

An array of evaluation protocols have been implemented in past fish and wildlife projects. These include:

- Evaluation of stream form and sediment loading
- Effectiveness evaluations of remote site indicators (RSI) and artificial redds
- Evaluations of thermal, CPUE, Vegetative, invertebrate community indices for stream enhancement projects
- Spawning and rearing habitat evaluations
- Movement and habitat use evaluations for focal fish species

- Entrainment evaluation
- Reservoir and mainstem primary, secondary and tertiary productivity levels
- Community dynamics, trophic ecology evaluations
- Water quality evaluations in mainstem, tributary, and reservoir habitat
- Evaluation of genetic variability, diversity, and integrity of focal fish and important wildlife species
- Evaluate parameters of fish and wildlife populations (e.g. growth, survival, condition, relative abundance, density, biomass, age and size structures)
- Limiting factors evaluations
- Hatchery program evaluations
- Habitat protection and improvement evaluations
- Non-native species removal evaluations.
- Evaluation of alternative hydro operations

Adaptive Management and its relevance to Subbasin evaluation protocols.

The following paragraph (Walters 1997) briefly summarizes adaptive management: "Although some peculiar and myopic definitions of adaptive management have appeared in a few settings (see review in Halbert 1993), today we generally use the term to refer to a structured process of "learning by doing" that involves much more than simply better ecological monitoring and response to unexpected management impacts. In particular, it has been repeatedly argued (Holling 1978, Walters 1986, Van Winkle et al. 1997) that adaptive management should begin with a concerted effort to integrate existing interdisciplinary experience and scientific information into dynamic models that attempt to make predictions about the impacts of alternative policies. This modeling step is intended to serve three functions: (1) problem clarification and enhanced communication among scientists, managers, and other stakeholders; (2) policy screening to eliminate options that are most likely incapable of doing much good, because of inadequate

scale or type of impact; and (3) identification of key knowledge gaps that make model predictions suspect."

Although simulations can help guide large empirical experiments and ultimately the direction of management programs: (1) many simulation models are not routinely validated, and (2) it is usually the empirical ecological experiments themselves, guided by simulations, that provide the valuable feedback, empirical treatment effect data, upon which courses of future management action can be charted (P. Anders, S. P. Cramer and Associates, pers. comm.).

Walters (1997) continues: "Most often, knowledge gaps involve biophysical processes and relationships that have defied traditional methods of scientific investigation for various reasons, and most often it becomes apparent, in the modeling process, that the quickest, most effective way to fill the gaps would be through focused, large-scale management experiments that directly reveal process impacts at the space-time scales where future management will actually occur. Thus, the design of management experiments then becomes a key second step in the process of adaptive management, and a whole new set of management issues arises about how to deal with the costs and risks of large-scale experimentation (Walters and Green 1996). Indeed, AEAM modeling so regularly leads to recommendations for management experiments that practitioners like myself and colleagues at the University of British Columbia have come to use the terms "adaptive management" and "experimental management" as synonymous. In short, the modeling step in adaptive-management planning allows us, at least in principle, to replace management learning by trial and error (an evolutionary process) with learning by careful tests (a process of directed selection)".

Recommendations for habitat and biological objectives and RM&E activities will be generated, prioritized, and evaluated by agency personnel and others in the Subbasin.

Resulting future fish and wildlife project proposals and the iterative Adaptive Management process will generate additional evaluation protocols that will be incorporated into the Subbasin Plan.

10.4 Consistency with ESA and CWA requirements

The Kootenai River Subbasin Assessment includes a description of the status of subbasin water quality conditions and status, trends, and threats to listed species. Individual focal species assessments further describe threats and limiting factors faced by focal species in the Subbasin, as well as those listed under the Endangered Species Act (ESA).

Table 10.5 shows how the Subbasin habitat and biological objectives are reflective of and integrated with recovery goals of ESA recovery plans and where

Table 10.5. 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 10.5 (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	

BPA Projects (click for more information)

Focus Watershed Coordination in the Kootenai River Watershed (199608702)

Monitor and protect bull trout for Koocanusa Reservoir. (200000400)

Assess Feasibility of Enhancing White Sturgeon Spawning Substrate Habitat, Kootenai R., Idaho (200200200)

Reconnection of floodplain slough habitat to the Kootenai River (200200800)

Implement Floodplain Operational Loss Assessment, Protection, Mitigation and Rehabilitation on the Lower Kootenai River Watershed Ecosystem (200201100)

Kootenai River White Sturgeon Studies and Conservation Aquaculture (198806400)

Kootenai River Fisheries Recovery Investigations (198806500)

Improving the Kootenai River Ecosystem (199404900)

Mitigation for the Construction and Operation of Libby Dam (199500400)

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. More detailed information on how subbasin habitat and biological objectives are linked to ESA recovery plans can be found in focal species assessments and in individual objectives and strategies tables for bull trout and white sturgeon.

Recognizing the need for coordination and collaboration, the Kootenai Tribe of Idaho initiated and entered into an MOU with Region 10 EPA & Idaho Department of Environmental Quality to facilitate local community involvement in the TMDL Process.

Under a Joint Powers Agreement between the City of Bonners Ferry, Boundary County, and the Tribe the Kootenai Valley Resource Initiative (KVRI) was formed. KVRI is a diverse, community-wide group comprised of the Tribe, local government (city & county), private citizens & landowners, federal and state agencies, environmental advocacy groups, and representatives of business and industry within the area. This group provides a forum for several issues and utilizes a number of subcommittees (including the TMDL subcommittee) to work with the group as appropriate to accomplish the tasks at hand. KVRI has been recognized by the IDEQ as the Watershed Advisory group (WAG) for the TMDL and the Implementation plan on the Lower Kootenai & Moyie Rivers.

The strategies outlined in the TMDL Implementation Plan will integrate with the common goals and objectives established by this management plan. The work will be coordinated with local stakeholders and enhance efforts toward ecosystem restoration in the basin.

10.5 Prioritization of Strategies (Measures/Projects) in the Kootenai Subbasin

Background

As part of the Subbasin Planning process, planners were asked by Bonneville Power Administration and the Northwest Power Planning and Conservation Council to present an approach for prioritizing management strategies to assist the Council in making recommendations for specific projects for BPA funding.

Kootenai Subbasin planners recognize that achieving the objectives in the subbasin plan is not the sole responsibility of the Bonneville Power Administration (as guided by the Northwest Power Act and the Council's 2000 Fish and Wildlife Program). Complementary action by other governmental agencies and funding sources, including Canadian entities where appropriate

and citizens of the Northwest, will be needed to fully achieve all of the objectives. Consequently, projects proposed for BPA funding through the NWPCC Fish and Wildlife Program must meet all of the prioritization criteria to be considered further.

Tier I (Coarse-scale) Prioritization Criteria

The following criteria are designed to ensure that all proposed projects and measures address BPA's responsibilities under the Northwest Power Act).

1. The project protects, mitigates, or enhances fish and wildlife affected by hydropower development within the Columbia Basin (Section 4(h)(5).

2. The project complements the activities of federal, state, and Tribal fish and wildlife managers (Section 4(h)(6)(A) and is consistent with the objectives and strategies in the Kootenai Subbasin Plan.

3. The project is based on and supported by the best available scientific knowledge 4(h)(6)(B).

4. The project is consistent with the legal rights of Indian Tribes 4(h)(6)(D)

After applying Tier 1 criteria, the highest priority projects will be ongoing projects that address urgent and high priority objectives in the Kootenai Subbasin Plan, consistent with the biological objectives in the Council's 2000 Fish and Wildlife Program (Resident Fish Losses, Substitution for Anadromous Fish Losses, and Wildlife Losses). Upon their approval during Independent Scientific Review Panel and Columbia Basin Fish and Wildlife Authority review, these measures, as well as the Long-Term Funding Agreement as a whole, should be prioritized for funding by BPA as mitigation for impacts of the Federal Columbia River Power System.

Tier II Prioritization Criteria

If all Tier 1 criteria are met, Subbasin Planners will use the following prioritization criteria to guide BPA funding in the Kootenai Subbasin:

1. Projects that provide long-term protection will be given a higher priority than projects that provide shorter-term protection, all other factors being equal.

2. Terrestrial projects that also provide benefit for aquatic focal species (and vice versa) will be considered a higher priority than strategies that only benefit terrestrial or aquatic species or habitats separately.

3. Projects that increase the survival and reproductive success of fish species native to the project area will be given a higher priority. Special consideration will be given to projects that benefit fish species in depleted or special conservation status, including ESA.

4. Projects that increase the area of productive habitat accessible or utilized by native fish species present in the project area will be given a higher priority, as will projects that provide benefits to multiple species or that have other beneficial watershed productivity implications.

5. Projects that are measures identified in specific fish management, conservation, or recovery plans will be given a higher priority.

6. Proposed projects with techniques and methodologies that have a high degree of likelihood of achieving proposed results under the full range of normally experienced operating conditions will be given a higher priority. Projects that demonstrate cost effectiveness in achieving project purposes (relative to similar projects and alternative means of achieving the same proposed result) will be give a higher priority.

7. Projects that provide additional opportunities for biological benefits will be given a higher priority.

8. Projects that make maximum effective use of program funds by involving other non-federal funding sources in the proposed project and funding from all sources in related restoration activities will be given a higher priority. Project proposals that demonstrate thorough project coordination with appropriate federal, tribal, state, local, and private entities including local landowners will be given a higher priority.

9. Projects that can be completed and yield proposed benefits in a timely manner will be given a higher priority.

10. Restroation and protection projects that are proposed for HUCs identified in this plan as near-term opportunities (Class 1, 2, and 2.5 waters) will be given a higher priority than restroation and protection projects proposed for HUCs not so classified. Within Class 2 waters, streams and lakes with ESA-listed species will have a higher priority for restoration than those without ESA-listed species.

Consistency with and support by additional ongoing prioritization processes within the Kootenai Subbasin.

In addition to the Tier I and II prioritization criteria, projects and activities within projects will be prioritized to ensure consistency with the following on going projects and plans:

1. White Stureon Recovery Plan. Responsible entity: U. S. Fish and Wildlife Service.

2. Bull Trout Draft Recovery Plan. Responsible entity: U. S. Fish and Wildlife Service.

3. Stream Restoration Project (lower Subbasin). Responsible entities: Kootenai Tribe of Idaho, Bonneville Environmental Foundation, and Bonneville Power Administration.

4. Habitat Evaluation and Recovery Strategy (HERS) for White Sturgeon. Responsible entity: U. S. Army Corps of Engineers

5. International Kootenai River Ecosystem Restoration Team (IKERT)/ IKERT/RDRT/Adaptive Management. Responsible entity: Kootenai Tribe of Idaho (lead) in a collaborative project with a number of other agencies.

6. Burbot Conservation Strategy. Responsible entities: Kootenai Tribe of Idaho in a collaborative process with the Kootenai Valley Resource Initiative Burbot Committee.

7. Reconnection Feasibility Project. Responsible entity: Kootenai Tribe of Idaho.

8. Wetland Conservation Strategy. Responsible entities: Kootenai Tribe of Idaho in a collaborative process with Kootenai Valley Resource Initiative Wetland Committee.

10.6 References

To avoid redundancy and reduce the overall size of the plan, references for the Management Plan are included in the references section of the Kootenai Subbasin Assessment (see links column).

LINKS

References for the Management Plan are included in the references section of the Assessment; go to:

Click Here