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Cost Savings Associated with the Upper Colorado River Basin Endangered Fish Recovery Program, Instream Flows, and Prospects for the Future

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[1] Opinions expressed are those of the authors and do not necessarily represent those of Colorado State University.

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Acknowledgements

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EXECUTIVE SUMMARY

This report investigates the role of instream flows as part of a program to protect and recover certain water-dependent endangered species. For the purposes of this report, instream flows are defined as non-consumptive, in-channel flows of water. We examined two case studies of endangered fish species programs that included instream flows, one on the upper Colorado River and one on the San Juan River. Cost savings with cooperative recovery programs are calculated. Scenarios involving increased instream flows are evaluated to estimate what the cost savings might be to water developers from additional instream flow appropriations and acquisitions by the Colorado Water Conservation Board (CWCB).

First, this report examines the collaborative Upper Colorado River Endangered Fish Recovery Program. The Recovery Program has successfully pursued its twin goals of endangered fish species recovery, and continued water development and management activities. It has streamlined Endangered Species Act (ESA) Section 7 consultations. In sum, more than 1,800 individual water projects have been consulted on by mid-2010 using the Recovery Program as the compliance vehicle. The Recovery Program:

- Saves Colorado's water users (municipalities, water districts, irrigation districts) several million dollars in study costs and replacement of water depletions associated with ESA compliance. These savings include a streamlined Section 7 consultation for individual depletions of less than 4,500 acre-feet per year. Based on interviews with water districts, the time to conduct Section 7 consultations for depletions in excess of 4,500 acre feet has been cut from 4 years to about a year, and the cost reduced from roughly $2.4 million to $250,000 for each consultation on medium to large projects.
- Provides flexibility to identify and secure large blocks of stored water for providing increased stream flows, which has resulted in lower costs to meet the U.S. Fish and Wildlife Service's (FWS) flow recommendations. In the case of Front Range water users meeting just one such flow obligation, we estimate a reduction of $27 million in opportunity costs of providing water.
- Was critical in securing nearly $208 million in federal and state funding that has saved water users tens of millions of dollars that would have been needed to directly fund non-flow recovery efforts, such as improving water delivery system efficiencies, fish hatcheries, fish screens, fish passages, and habitat development, etc.
- Has resulted in significant savings in staff time and expenses for all parties by reducing legal costs. No lawsuits have been filed on ESA compliance provided by the Recovery Program since it was established in 1988.
- Recognized the CWCB's unique role in providing legal protection of instream flows needed for recovery, such as instream flow and stored water rights.

Since the maintenance of instream flows is one of the key elements of the Recovery Program, protecting and increasing instream flows has been an important element in realizing the cost savings listed above.

Second, scenarios are presented to provide a sense of what the cost savings would be to water providers if the CWCB was able to provide additional senior and/or junior instream flow water rights to meet some or all endangered fish species habitat needs. If CWCB is able to acquire senior water rights and convert them to an instream flow, such that these flows would avoid listing of a species, then there would also be Section 7 ESA consultation savings to water providers. For existing listed species, any water CWCB acquires and dedicates to instream flows would result in minimum cost savings of about $5,000 per acre-foot to West Slope water providers, and $10,000 per acre-foot to Front Range water providers, **if** the providers would be required to offset their river diversions on a project by project basis. The cost savings would increase if quantities of water larger than 10,000 acre-feet are needed to meet FWS instream flow recommendations.

1. Introduction and Methods

Historically, economic development and growth in the western United States, including Colorado, depended largely on access to water. A legal framework evolved over time to prioritize and allocate water among competing users within a single state, and later among multiple states. Unappropriated water remaining in a river channel was considered wasteful; instead, water needed to be diverted out of the streambed to be considered for beneficial use.

Recent years have seen a growing awareness of the important role of maintaining water in streams and rivers, or "instream flow." This benefits Colorado's natural environment and burgeoning outdoor recreation industry, which in turn greatly benefits Colorado's economy (Loomis 2008). In 1973, Colorado's legislature recognized the value of instream flows in river channels so as to preserve the natural environment. Concurrently, with the establishment of Colorado's Instream Flow and Natural Lake Level Program, the federal government enacted the Endangered Species Act (ESA) to help stem the tide of species extinction.

Given the relationship of: 1) water rights in Colorado and water allocations under interstate compacts; and 2) the implementation of the ESA, it is necessary to select a specific geographic area to analyze the interaction of these two monumental legal and institutional regimes. Using a chronological approach, this report describes and analyzes the interplay between water resources management and development, and efforts to protect the environment by recovering four endangered fish species in the Upper Colorado River Basin.

Shortly after the ESA was enacted in 1973, three non-game fish species in the Upper Colorado River Basin were listed as endangered, with a fourth species listed soon after. This set the stage for potentially calamitous lawsuits that would have pitted state water law and interstate water compacts against the ESA. The potential outcome of this litigation was questionable, given the U.S. Supreme Court's ESA decision that stopped work on the almost completed Tellico Dam in Tennessee, despite earlier significant federal funding (Tennessee Valley Authority v. Hill, 437 U.S. 153, 1978). In that case, the ESA's ecological goals effectively trumped economic development goals. The diverse stakeholders in the Upper Colorado River Basin recognized the pitfalls of a litigious approach to the ESA and instead worked to develop a proactive Recovery Program. The consensus-based Recovery Program created an alternative administrative structure to both actively pursue recovery of the four endangered species and provide for water use and development to meet human needs. No changes in the ESA, its regulations, interstate compacts, or state water law were needed to implement the Recovery Program.

Report Objectives

This report examines the flexibility of Colorado's water right system, operating under the constraints of interstate water compacts, to secure and deliver both base flows and peak flows for endangered fish to meet the two goals of the Recovery Program: recovery of the four endangered fish species and continued development and management of water to meet human needs. The report uses a chronological approach to put water law and water development activities into perspective vis-à-vis the ESA. Per discussions with the CWCB, two Recovery Program sub-projects – the Upper Colorado's 15-Mile Reach,[2] and the Elkhead Reservoir enlargement in the Yampa River Basin -- were selected to:

a) better understand the CWCB's role in the Recovery Program;
b) better understand the Recovery Program's ability to recover the species in a cooperative manner that also allows for water development;

[2] The 15-Mile Reach is a reach of the Colorado River that extends from the confluence of the Gunnison River upstream 15 miles to the Grand Valley Irrigation Company Diversion Dam near Palisade, Colorado.

c) quantify the time and cost savings to water users and federal and state agencies from this proactive approach to endangered species recovery; and
d) identify potential cost savings to water developers from possible CWCB provisions of instream flows.

Research Methodology
This analysis was accomplished by a review of published primary and secondary literature and materials. Phone and in-person interviews were conducted with several of the Recovery Program's participants, including two water districts, the U.S. Fish and Wildlife Service (FWS), the U.S. Bureau of Reclamation (USBR), the CWCB, and representatives of the water users (see Appendix A for a list). These individuals were given an opportunity to review the draft report and several provided comments. The report was also available for public comment during the summer of 2010. Because the no Recovery Program scenario was a counterfactual scenario, there were naturally some differences of opinion about what the costs might have been to individual water users and projects if the Recovery Program had not been in place.

In this report, CWCB instream flows are defined as non-consumptive in-channel water rights, which are appropriated and adjudicated under state law. Hereafter, CWCB-provided flows will be referred to as instream flow water rights. These CWCB instream flow water rights are different from the FWS recommended instream flows, which are often treated more as instream flow targets or goals.

2. Water Law in the Upper Colorado River Basin

a) Colorado Water Law

Water in Colorado is subject to a complex and evolving legal regime of state law and interstate compacts. A cursory understanding of this legal environment that dictates how water is allocated to and between competing users and uses is essential to understanding how this system interacts with the ESA and efforts to recover endangered fish. In particular, it is critical to have some knowledge of: 1) the basic tenets of Colorado's prior appropriation system of water law; 2) trans-mountain water diversions from the Upper Colorado River; 3) the interstate compacts that allocate Colorado River water between the Upper and Lower Basin, and between individual states in those basins; and finally, 4) the eventual recognition of protecting instream flows as a beneficial use under Colorado's water rights system.

b) Colorado's Prior Appropriation System

Colorado's Constitution states that any unappropriated water remaining in a stream or river is public property and dedicated to the use of the people of the state, subject to appropriation (Colorado Constitution Art. XVI § 6). Similarly, "[t]he right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied" (Colorado Constitution Art. XVI § 7). Traditionally, Colorado's water law encouraged individuals to appropriate water by diverting it from streams and rivers for a limited number of beneficial uses. Other than municipal water supply, early beneficial uses were largely for private activities, such as agriculture and mining.

Two basic types of water rights are relevant to this report: 1) direct flow, which diverts water directly from a stream to its place of use (CRS 37-82-101 et seq.); and 2) storage rights, which hold water in a reservoir for later use (e.g., CRS; 37-87-101 et seq.). In times of water shortage, those with earlier, senior adjudicated water rights are entitled to satisfy their entire water right before any water is available to satisfy subsequent, junior water rights. Currently, most of Colorado's major rivers are over-appropriated, which means that at some times of the year not all water rights can receive their entitlement.

Agricultural uses account for a significant percentage of most senior rights. In 2005, it was estimated that water withdrawals in Colorado were: 6.6 percent for municipal and domestic use; 91 percent for

agriculture; 1 percent for industrial/commercial uses; and 1 percent for thermoelectric power (U.S. Geological Survey 2009). However, it is important to note that a significant amount of water flows out of Colorado to meet commitments imposed by interstate compacts.

c) Trans-mountain Diversions

To meet rapidly growing water needs on the eastern slope of the Rocky Mountains, Front Range appropriators filed water rights on western slope rivers and streams, built reservoirs to capture and store spring run off, and constructed an intricate infrastructure to move that water across and under the Rocky Mountains. Germane to our report is that significant transmountain diversions occur from rivers that originally flowed into the Colorado River watershed. Front Range water users, including Denver Water and the Northern Water Conservancy District, divert more than 700,000 acre-feet of Colorado River Basin water.

d) The Law of the Colorado River

In addition, as an overlay to the prior appropriation system, Colorado has entered into several interstate compacts that allocate Colorado River water among various states. In the Upper Colorado River Basin, Colorado's prior appropriation system is constrained to some extent in order to comply with the compact requirements that benefit the downstream states of Arizona, California, and Nevada.

e) Instream Flow Protection

It was not until 1973 that Colorado's legislature recognized the public and environmental value of protecting instream flows in rivers and streams. In 1973, Colorado's legislature "recogniz[ed] the need to correlate the activities of mankind with some reasonable preservation of the natural environment" and granted the CWCB the exclusive authority to file for and hold instream flow water rights in Colorado (CRS 37-92-102(3)).

In addition to their benefits to aquatic systems, the instream flows also generate economic benefits (Loomis 1998, 2006, 2008; Roberts and Grossman 2008). Economic activity directly associated with increased instream flows includes more use by recreational anglers and rafters, and increasing commercial rafting and outdoor guide services that create businesses and hire employees to meet those needs. Initial estimates project that a slight increase in instream flows would annually generate an additional $4.4 million in income, and support an additional 340 jobs in Colorado (Loomis 2008).

The CWCB obtains instream flow water rights either by appropriating and adjudicating new or junior water rights, or by acquiring existing decreed water, water rights or interests in water for instream flow use to preserve or improve the natural environment. Water may be conveyed to the CWCB on a voluntary basis by "purchase, bequest, devise, lease, donation, exchange, or other contractual agreement" (CRS 37-92-102(3)). Using acquired water, the CWCB can: (1) protect stream flows in areas of the state where water may not be available for a new junior instream flow water right; (2) extend the amount of time water is legally available to existing junior instream flow water rights; and (3) develop creative, flexible approaches to stream flow protection. Both appropriated and acquired instream flow water rights are decreed by the water courts and administered in the state's priority system. In the context of providing flows to sustain species at risk for listing, the CWCB's water acquisitions can provide significant benefits by changing existing senior water rights to instream flow use, and using that water to improve the natural environment to a reasonable degree. This results in the protection of higher flows than an appropriated instream flow water right, which is limited to the minimum necessary to preserve the natural environment to a reasonable degree.

The CWCB receives several offers of water rights for acquisition each year, and the staff conducts detailed hydrologic and water right analyses to confirm the yield of the proffered water. Staff then works with the water rights' owner and the Colorado Attorney General's Office to develop an acquisition

agreement for the CWCB's consideration, and if accepted, works to gain water court approval of the change to instream flow use. The statutes require that the Board determine within 120 days what terms and conditions are acceptable for each acquisition agreement. More information about the CWCB and Colorado's Instream Flow Program can be found at http://www.cwcb.state.co.us/.

Given the number of over-appropriated rivers and streams, it can be challenging to acquire water rights for instream flow use in the amounts and locations needed most.

3. Legal Background of the ESA in the Upper Colorado River Basin

The ESA was enacted originally in 1973 (Endangered Species Act 16 U.S.C. 1531-1544, 87 Stat. 884), to conserve endangered and threatened species facing extinction, and to create a means to conserve the ecosystems on which they depend (ESA section 2(b)). While the ESA includes a number of provisions regarding listing and critical habitat designation, a less well known but critical component is the section that requires cooperation among relevant agencies in conservation efforts. In particular, the FWS, the federal agency charged with ESA administration in the Upper Colorado River Basin, is required to cooperate with state and local agencies to resolve water resource issues in concert with endangered species conservation (ESA section 2(c)(2)). This cooperation may include agreements with other states (ESA section 6(b)).

In the Upper Colorado Basin, the ESA posed a threat to continued water development by indicating that water was needed for threatened and endangered fish species survival. Water users claimed that reserving water for these species would hamper their ability to develop water resources for irrigation, municipal water supply, industrial development, or related beneficial uses authorized under state law and Colorado's compact entitlements. The situation potentially pitted water development opportunities authorized under the law of the river and state water law against the ESA, which Congress authorized subsequent to the compacts. This threat was largely reduced by the advent of the Recovery Program.

Further, water developers were concerned about the ESA's Section 7 consultation requirement with the FWS for all water projects that involve some degree of federal agency action for permitting, easements, or funding to ensure that project-related actions will not jeopardize threatened and endangered species (Pitts 2006; US General Accounting Office 1987; US Fish and Wildlife Service 1987). Project-by-project, Section 7 consultations may result in significant additional costs, dramatic reduction in project scope, and lengthy delays to the projects. This concern was greatly reduced by the advent of the Recovery Program.

4. The Upper Colorado River Basin: Integrating the ESA with Water Management and Development

4.1 First Steps of the ESA Process

Listing: The Colorado pikeminnow and humpback chub were both listed as endangered on March 11, 1967 (32 Fed. Reg. 4001), and were "grandfathered" in under the ESA. Subsequently, two species were listed as endangered under the ESA Section 4 process: the bonytail on April 23, 1980 (45 Fed. Reg. 27713), and the razorback sucker on October 23, 1991 (56 Fed. Reg. 54957).

Recovery Plans: The first recovery plan was established for the Colorado pikeminnow on March 16, 1978. Plans have been finalized for the four species, with recovery goals revised on August 1, 2002 (Upper Colorado Endangered Fish Recovery Program 2007, part 2 p. 1).

Critical Habitat: The FWS initiated efforts to designate critical habitats for the Colorado pikeminnow, humpback chub, and "other" species in 1975, but failed to designate critical habitats for any of the endangered fish until forced by litigation, resulting in a court order directing the FWS to propose critical habitats for the razorback sucker. (Colorado Wildlife Federation v. Turner, 1992 WL 467984, 23 E.L.R.

20402 D. Colo. 1992). The FWS issued a final critical habitat designation for all four species in the Upper Colorado on March 21, 1994. Water was recognized as one of several primary constituent elements of critical habitat, including the delivery of a specified level of flows to a specific location, in accordance with a hydrologic regime recommended for each species.

The on-the-ground implication of these decisions is that Section 7 consultations under ESA would be required of each and every water development project that had any federal connection. These consultations require that the federal agency charged with permitting the water project talk to the FWS about whether the project poses a threat to the continued existence of the species, how the project might be modified (including downsizing) to reduce the impacts to the species, and how the remaining impacts are to be mitigated. In most cases, the water developer is involved because they must provide the information needed by the federal permitting agency and the FWS to conduct the consultation.

In a 1983 draft proposal to conserve the listed fish species at that time, the FWS proposed one-for-one mitigation that involved replacing an acre-foot of water in the river for every acre-foot to be diverted, so there would be no net reduction in flows. However, this FWS proposal was never implemented.

Because of the three distinct and deeply rooted legal regimes involved (state water laws, Colorado and Upper Colorado River Compacts, and the ESA), the impacted parties were faced with a strategic choice in how they would react to this situation, with few alternatives available. A litigation approach, however, would be lengthy and expensive, with significant funds spent on legal fees and an uncertain outcome.

Briefly, prior to the Recovery Program being adopted, the situation under the ESA for the Upper Colorado River Basin's federal and non-federal water developers and users was:

1) the FWS held that water project depletions anywhere in the Upper Colorado River Basin, even far upstream of designated a critical habitat, would jeopardize the endangered fish;
2) a FWS draft report in 1983 proposed that water projects in the Upper Colorado River must replace depletions on a one-for-one basis to avoid jeopardy;
3) each individual water development project would be reviewed under the ESA alone and be individually responsible for replacing their depletions; and
4) no proactive, non-flow recovery alternatives were available to supplement or offset proposed depletions to avoid jeopardy.

4.2 The Upper Colorado River Basin's Endangered Fish Recovery Program: A Cooperative Public-Private Partnership

Faced with this complex and contentious situation, as well as hundreds, if not thousands of potential Section 7 consultations, the interested federal agencies, states, water users, and environmentalists voluntarily came together to negotiate a solution to the potential conflicts between the requirements of the ESA and water development and management, in accordance with state water laws and interstate compacts. The product of these negotiations was the Upper Colorado River Endangered Fish Recovery Program, which seeks to recover the four endangered fish while also respecting state water law, recognizing Colorado, Utah and Wyoming rights under interstate water compacts, and equitably distributing Recovery Program costs (Pitts 2000).

The geographic reach of the Upper Colorado River Recovery Program includes the entire Upper Colorado River Basin upstream of Lake Powell. This specifically includes the main stem of the Colorado River and its tributaries, such as the Blue River, Eagle River, Roaring Fork River, and Gunnison River. It also includes the Green, White, and Yampa Rivers, where the Elkhead Reservoir expansion occurred, and tributaries thereto.

The Recovery Program rests on two over-arching documents designed to streamline and accelerate the ESA's Section 7 consultation process for federal and non-federal water projects, while maintaining strong recovery efforts. These documents are:

1) the Recovery Implementation Program for the Endangered Fish Species in the Upper Colorado River (RIP) (USFWS 1987); and
2) the Recovery Implementation Program Recovery Action Plan (RIPRAP) (Upper Colorado River Endangered Fish Recovery Program 2007). As the Recovery Program's long range plan, this document is updated annually.

As warranted, these two basin-wide documents are supplemented with even more detailed, sub-basin specific Programmatic Biological Opinions (PBO), and hundreds of individual biological opinions. (Upper Colorado Endangered Fish Recovery Program 2007; USFWS 1999).

4.2.1. Elements of the Recovery Program

On January 21, 1988, a cooperative agreement to participate in and implement the principles included in the Upper Colorado Basin Recovery Implementation Plan was signed by the Secretary of the Interior, the governors of three Upper Basin states (Colorado, Wyoming, and Utah), and the Department of Energy's Administrator for the Western Area Power Administration. The agreement adopts the Recovery Program's five interrelated program elements:

1) habitat management, including providing adequate flows for fish recovery;
2) habitat development and maintenance, including fish ladders, fish screens at water diversion structures and canals, and floodplain restoration;
3) stocking of endangered fish species by building and operating hatcheries, and stocking fish;
4) control and management of nonnative species and sportfishing; and
5) research, monitoring and data management (USFWS 1987).

The Recovery Program was extended to 2023 by Secretary of Interior Salazar, the governors of Colorado, Utah, and Wyoming, and the Western Area Power Administration on August 27, 2009.

This multi-faceted approach to species recovery recognizes that meeting recommended flows is necessary, but not the only component of species recovery. In other words, the fish could not recover without adequate stream flows, but recommended flows alone will not recover the species. This recognition of the need for an integrated, multi-faceted recovery approach is at the heart of the Recovery Program's ESA Section 7 consultation process for water depletions.

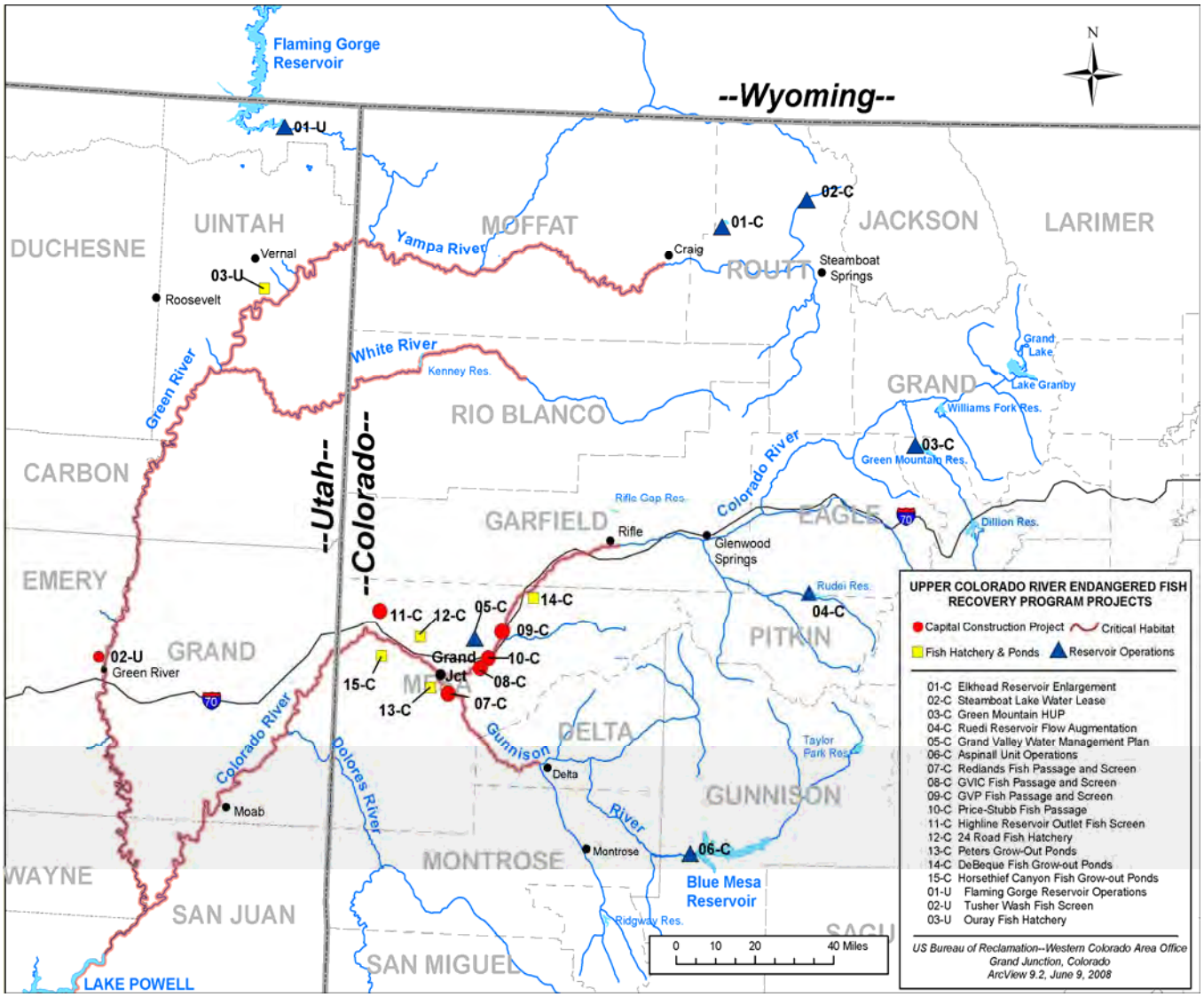
Figure 1 shows the number and distribution of many of the Recovery Program's capital construction habitat development and maintenance projects, fish hatcheries and voluntary reservoir operations to provide flows for endangered fish. It also highlights the location of critical habitat.

Administratively, the Recovery Program uses a collaborative, consensus based decision-making process, is coordinated by a program office staffed by FWS employees, and has a high-level Recovery Implementation Committee to oversee implementation. The Committee includes senior representatives from federal agencies, non-governmental agencies, water users, power customers, environmentalists, and state agencies.[3] Each member of the Recovery Implementation Committee has an important role in and the legal authority necessary for the Recovery Program's overall success. No participant cedes any of its authority or is required to take any action in conflict with that authority.

[3] The Committee includes senior representatives from: a) U.S. Fish and Wildlife Service, b) Bureau of Reclamation c) Colorado River Energy Distributers Association; d) environmental organizations; e) Western Area Power Administration; f) Upper Basin water users; g) State of Colorado; h) State of Utah; i) State of Wyoming; and j) National Park Service.

The Recovery Implementation Committee is supported by a management committee responsible for ensuring that the Recovery Program is effectively prioritizing needs and activities to address fish recovery. The management committee develops and updates the Recovery Program's long-term work plan (Recovery Action Plan), and develops a proposed annual budget. The management committee also oversees the activities of various technical operational committees and sub-committees (Hopfl 1994).

Figure 1. Map of Upper Colorado River Recovery Program Area and Projects.



4.2.2 The Role of Recommended Flows in the Recovery Program

Provision and protection of recommended flows have played key roles in the Recovery Program. As discussed in detail in Section 5 below, provision of recommended flows through the Program have saved numerous individual project sponsors and federal water users many hundreds of thousands, if not millions, of dollars in expenditures for studies and analyses to comply with the ESA Section 7 consultation process (Pitts 2000).

Among other things, the Recovery Program established a means of providing water and other property interests to protect and augment stream flows to meet flow recommendations. In particular, the FWS develops flow recommendations for listed species; then, the Implementation Committee works with the FWS and other experts to determine strategies to meet those recommended flows consistent with state law and compacts. Accordingly, when conducting ESA Section 7 consultations, the FWS considers provision of water and other Recovery Program activities as offsetting depletion impacts. In short, "[t]hrough this approach, depletion impacts of proposed water and water-related projects would not likely jeopardize endangered species if the program is implemented and project proponents participate in and contribute toward conservation measures under this program" (USFWS 1987 at pp. 1-7). This goal is restated as, "[t]he primary impetus for developing this Recovery Program was to provide a mechanism to resolve the Section 7 conflict in the Upper Basin."

The focus of our report is on the recommended flow portion of the habitat management element of the Recovery Program. It is important to realize that quantifying flow needs is a new and inexact science and there is no single universally accepted methodology or tool to establish recommended flow regimes on all rivers (Bleed 1987; Instream Flow Council 2002). The Recovery Program exemplifies the adaptive management approach that is recommended to achieve species recovery. The Recovery Program has made significant financial investments in water supply augmentation, habitat development, non-native fish control, fish screens, fish passages, research, and monitoring of fish populations. In addition, the Recovery Program includes binding commitments from all stakeholders to ensure that adequate water and financial resources are available for recovery activities (*See* Instream Flow Council 2002).

In annually evaluating the Recovery Program's continued viability as a reasonable and prudent alternative for ESA Section 7 consultations, the FWS considers the following factors:

1) actions that result in a measurable population response, a measurable improvement in fish habitat, legal protection of flows needed for recovery, or a reduction in the threat of immediate extinction;
2) status of fish populations;
3) adequacy of flows provided for recovery; and
4) magnitude of project impacts (Upper Colorado RIPRAP 2007).

The Recovery Program and RIPRAP served as the reasonable and prudent alternative under ESA Section 7 consultations in the Upper Colorado River from 1988 to the present. As shown in Table 1, the Recovery Program and RIPRAP have allowed for more than 300,000 acre-feet of new water depletions, involving more than a thousand projects in Colorado. In late 1996, the Recovery Program's Management Committee recommended that the FWS develop Programmatic Biological Opinions (PBO) to cover each major drainage basin. The PBO for the Colorado River, upstream of the Gunnison confluence, covers more than one million acre-feet of existing depletions and up to 120,000 acre-feet of new depletions from federal and interrelated non-federal actions (Pitts 2000; USFWS 1999).

Table 1 Upper Colorado River Endangered Fish Recovery Program Summary of Section 7 Consultations by State 1/1988 through 12/31/2009					
		HISTORIC DEPLETIONS	**NEW DEPLETIONS**	**TOTALS**	
State	Number of Projects	Acre-feet/year	Acre-feet/year	Acre-feet/year	Depletion Fees
Colorado	1111	1,915,321.75	205,917.04	2,121,238.79	$893,562.80
Utah	198	517,669.95	75,616.45	593,286.40	$622,187.70
Wyoming	164	83,498.31	33,427.58	116,925.89	$243,395.45
Multi-State (Regional)	238	(Regional)	(Regional)	0.00	0.00
TOTALS	**1,711**	**2,516,490.01**	**314,961.07**	**2,831,451.08**	**$1,759,145.95**

Source: Personal Communication, Angela Kantola, Assistant Director, Recovery Program, U.S. Fish and Wildlife Service, Lakewood, Colorado. February 22, 2010.

Under the 15-Mile Reach PBO, individual ESA Section 7 consultation requirements for users of federal project water (e.g., water out of federal dams) and non-federal project sponsors have been dramatically simplified. Essentially, the project sponsor must:

1) sign a Recovery Agreement that pledges that the sponsor will not interfere with recovery activities;
2) pay a one-time "depletion fee" to the National Fish and Wildlife Foundation, which will be transferred to the Recovery Program. In 2000, the depletion fee was $14.36 per acre-foot of depletion and was indexed to inflation. As of 2010, the fee is $18.99. There is no fee for annual depletions less than 100 acre-feet;
3) agree to reinitiation of ESA Section 7 consultations if found to be necessary at a later date; and
4) request jointly with the FWS that discretionary federal control be retained for all consultations under the PBO.

Based on the success of the 15-Mile Reach PBO, the RIPRAP included developing PBOs for other sub-basins in the Upper Colorado River Basin, and PBOs have been developed for the Yampa River (USFWS 2005) and the Gunnison River (USFWS 2009).

4.2.3 The CWCB's Role in the Recovery Program

Recognizing the complexity of recommending flows to conserve critical habitats, the Recovery Program adopted a process by which the FWS identifies and recommends flows needed by listed species. Then the Implementation Committee requests that the appropriate state agency identify the means to provide those flows. In Colorado, the CWCB serves this function. The CWCB helps develop the appropriate means to provide the flows, and in that process, considers cost, implementation methods, timeframes, and other requirements. CWCB then informs the Recovery Program, which considers the

appropriateness of the proposal and incorporates it into the RIPRAP. The CWCB oversees implementation of the recommendation, and is usually responsible for protecting the flows. The PBO requires a periodic review every five years of whether the CWCB should appropriate and protect additional instream flow water rights in order to aid in the recovery of the listed fish species.

The CWCB and the FWS have a long-standing Memorandum of Agreement (MOA) that explicitly recognizes the need to protect flows for the endangered fish. The MOA also recognizes the CWCB's authority to appropriate water rights, or acquire water, water rights, or interests in water to preserve the natural environment to a reasonable degree, and benefit the listed fish in the Upper Colorado River.

West Slope and Front Range water users, along with the USBR, strive to meet recommended water flows. Water users who want to rely upon the Recovery Program as a Reasonable and Prudent Alternative (RPA) for a project covered by the PBO must sign a binding "Recovery Agreement" specifying their responsibility to support the Recovery Program. Blocks of stored water in both private and federally managed reservoirs assist in meeting the flow targets, and some of these flows are protected by instream flow water rights held by the CWCB. In addition, the State Engineer's office plays a key role in ensuring that reservoir releases for endangered fish and CWCB's instream flow water rights actually reach and flow through critical habitats without being diverted by others.

It should be noted that the CWCB has instream flow water rights in the 15-Mile Reach that were established to protect water for endangered fish, per the Recovery Program. The Recovery Program itself has worked to secure large amounts of water dedicated to fish recovery in the Colorado and Yampa Rivers. Roughly 30,000 acre-feet are being provided through efforts of east and West Slope water providers and the USBR in the Colorado River. In the Yampa River, as part of the Elkhead project, the Recovery Program, the USBR, other cost-share participants, and a CWCB loan to the Colorado River Water Conservation District funded an additional 5,000 acre-feet of water storage for endangered fish on the Yampa River (with options to lease an additional 2,000 acre-feet) as part of an 11,750 acre-foot reservoir enlargement. The CWCB owns the 5,000 acre-feet of storage space and water, and protects the releases of that water to and through the critical habitat reach on the Yampa River for the endangered fish. The Colorado River Water Conservation District will use the remaining 6,750 acre-feet of stored water to satisfy future water demands.

The CWCB also contributes to the Recovery Program's success in other ways, including:

1) participating in Colorado's coordinated reservoir operations to increase spring and summer flows in the Colorado River for endangered fish;
2) tracking water depletions and participating in studies, research, and hydrologic modeling;
3) negotiating contracts with the USBR and the FWS to provide 21,650 acre feet of unsold water out of the Ruedi Reservoir, to be available for the FWS to augment base and peak flows through 2012 for endangered fish (CWCB has a contract right for this water);
4) serving as a cooperating agency on projects such as the Aspinall re-operations;
5) holding two instream flow water rights totaling 881 cfs on 15.7 miles of the Colorado River that protect water benefitting the Recovery Program; and
6) contributing to Recovery Program cost-share funding.

5. Economic Cost Savings of Upper Colorado River Recovery Program Components

This section provides an overview of costs of the current recovery effort, and provides the background for calculating the cost savings by using the coordinated interagency approach to endangered fish recovery. This section also provides background for calculating potential cost savings with additional CWCB instream flow water rights.

5.1 Federal and State Funding for the Recovery Program

To increase the likelihood of increasing native fish species populations and the likelihood of eventual delisting, the Recovery Program has consistently sought annual programmatic federal funding to leverage each partner's contributions, both financial and in-kind (Hansen 2001). In 2000, the Upper Colorado and San Juan River Basins' Endangered Fish Recovery Programs Act (Public Law 106-392 (October 30, 2000)) was enacted to expand the federal programmatic authorization for the Recovery Program's activities. The law created a series of federal funding streams to support Program activities, including an authorization of $100 million (with $82 million designated for the Upper Colorado) to the USBR. The money supports capital construction projects, such as fish passage ways around dams, fish screens on canals, fish hatcheries, and canal check structures to make the canals efficiently deliver a higher proportion of water diverted. Many of these projects have already been completed (see Upper Colorado River Endangered Fish Recovery annual Program Highlights for more details).

Through 2010, the Recovery Program as a whole has expended nearly $208 million from federal, state, and water user sources, or nearly $10 million per year on priority Upper Colorado River projects (2009-2010 Program Highlights). Table 2 shows how the Recovery Program distributed these funds among its different components in Fiscal Year 2010. As indicated in Table 2, instream flow is a major part of the Recovery Program, as it represented 33 percent of the annual expenditures in Fiscal Year 2010. These percentages vary from year to year, with expenditures on instream flow protection being as low as 8 percent in Fiscal Year 2008, and as high as 36 percent in Fiscal Year 2000.

Table 2 -- Expenditures of Upper Colorado River Fish Recovery Program (Fiscal Year 2010)

Non Native Fish Management	17%
Education, Public Involvement	2%
Propagation	21%
Habitat Restoration	9%
Instream Flow Protection	33%
Program Management	11%
Research & Monitoring	7%
Total	**100%**

5.2 The Recovery Program's Goal is Species Recovery, which Provides Long Term Economic Benefits

One of the key advantages of the Recovery Program and PBOs over a business-as-usual, project-by-project Section 7 consultation approach is that the Recovery Program's goal is species recovery, rather than just maintenance of current low populations. The goal of the Recovery Program is to delist all four species by 2023. The Recovery Program has made strides in increasing instream flows for listed fish, and additional actions to increase instream flows are underway. One example of completed improvements to irrigation infrastructure is in the Grand Valley (Grand Junction area), where the conserved water is being made available to meet recommended flows. Another example is the expansion of the Elkhead Reservoir, with a portion of the stored water dedicated to instream flow. In the absence of the Recovery Program and PBOs, the FWS indicates Section 7 consultations may have

required individual water diverters to replace their depletions on a one-for-one basis, and hence only maintain current flow levels for the species, not increase them. While this may prevent further declines in the species population, it is unlikely that simply maintaining the current flow regime would support fish population increases necessary for down-listing or delisting species entirely.

The Recovery Program, as its name implies, is a comprehensive program that aims for species recovery. The Recovery Program provides a coordinated set of actions to address flows needed for fish. The Recovery Program also addresses other threats to endangered fish, such as non-native predator fish, the need for particular types of habitats, and supplementing natural reproduction with hatchery production. Together, the Recovery Program's coordinated activities have stabilized and potentially increased the populations of some of the endangered fish species, rather than having the FWS and individual water users rely solely on Section 7 consultations as the primary regulatory mechanism to protect these four endangered fish species from the impacts of water depletions.

By focusing on species recovery, rather than just preventing further declines in species population, the Recovery Program has three long-term economic benefits. First is increasing the likelihood of species down-listing or delisting, which would reduce the need for regulatory oversight. Second are the increased benefits that society can enjoy from larger, healthier populations of at-risk species (Richardson & Loomis 2009). Third, the Recovery Program allows water development for the east and west slopes to occur more quickly, with less consultation costs than without the Recovery Program. The Recovery Program provides greater regulatory certainty for water users than individual consultations on water projects.

5.3 The Recovery Program Reduces Costs Through Flexibility and a Basin-Wide Approach to Meet Flow Recommendations.

The Recovery Program's basin-wide approach reduces the costs of providing recommended flows. There are two sources of cost savings: 1) flexibility afforded to program participants to meet recovery flow targets; and 2) economies of scale that lower per unit costs of meeting recovery flow objectives through a few large projects instead of hundreds of small projects.

Flexibility to meet the FWS flow recommendations provides substantial potential for cost savings. The Recovery Program allows the use of a combination of reoperation of existing reservoirs, the enlargement of other reservoirs (e.g., Elkhead), and improvements in irrigation canal system efficiencies to meet flow recommendations. This flexibility allows participants in the Recovery Program as a group to search for the most cost-effective combination of actions and allocate their water contributions via low-cost options first. For instance, improving canal efficiencies may be a relatively inexpensive option compared with other options, such as raising dam heights.

The second source of cost savings is through economies of scale. Because the Recovery Program has a basin-wide approach, it can build a few large projects, rather than each individual project building their own to offset their project depletions. Such an individual-by-individual water user approach would have higher per unit costs. As a whole, the Recovery Program takes advantage of both principles to lower the overall cost of meeting flow recommendations.

5.4 Cost Savings Associated with the Program's Tiered Water Depletions Criteria

Figure 2 illustrates how the Recovery Program has standardized and streamlined the Section 7 consultation process in the Upper Colorado River basin. This has the added advantage of providing more certainty and predictability to water developers about what will be expected of them in building new or expanding existing projects.

The Recovery Action Plan and sub-basin specific PBOs have created a tiered system to evaluate and consult on proposed water depletions. The following diagram illustrates how Section 7 consultations can

be performed in the Upper Colorado Basin under a PBO, or for individual consultations. “Section 7 consultation” refers to the typical time period (number of days) the FWS and water diverter would interact once a federal agency provides information requesting a formal consultation. “Fees” refers to whether a one-time depletion fee of $17 an acre-foot must be paid into the Recovery Program.

Figure 2. Time and Financial Costs of Section 7 Reviews under the 15-Mile PBO

	0 AF	100 AF	4,500 AF	in excess of 4,500 AF
Sec.7 Consultation	2-3 days	21-30 days	135 to 300 days	
One-time Fees	none	$17/AF	$17/AF	

As seen in Figure 2, for small water diversions, such as stock ponds or permits for small (e.g., ranchette) water diversions, the Section 7 consultation can take place in a few days, without elaborate hydrological modeling, and with no depletion fee. As detailed below, this tiered approach represents significant savings for the water user, the federal action agency, and the FWS, since the FWS no longer has to write a separate Biological Opinion on every small diversion.

The streamlined Section 7 review for projects over 100 acre-feet, but less than 4,500 acre-feet, also saves water users and the FWS substantial time. Since the Recovery Program RPA, diverters do not have to develop individual RPA’s. Instead, the water user simply pays the $17 one time fee for each acre-foot of water diverted. Based on discussions with the FWS and the USBR, the time to complete a Section 7 consultation has been reduced on these projects from a minimum of 30 days or more to 30 days or less.

5.4.1 Cost Savings for Small Water Users and the FWS under the Tiered Approach

The Recovery Program and PBOs serve as the RPA, and as such, individual projects and project proponents avoid the possibility of having to replace their diversions one-for-one, as the FWS might have required had the Recovery Program or PBOs not been in place. The Recovery Program is largely funded by the USBR from power revenues, the FWS, and three states, so that water users pay about 1 percent of the Recovery Program costs. However, in the aggregate, the water users provide significant quantities of water, averaging about 48,000 acre-feet (Recovery Program Highlights for 2007-2008). However, as detailed below, the Recovery Program saves water users and agencies significant time and money, as well as allowing over 300,000 acre-feet of new diversions (Recovery Program Highlights for 2007-2008). This amount of diversion is substantially in excess of what would likely be possible had the Recovery Plan not been in place.

6. Evaluating the Cost Savings from the Recovery Program Including the Instream Flow Components, and the Role of the CWCB

This section has two purposes. The first is to estimate the cost savings that occurred from the Upper Colorado River Recovery Program, including its instream flow component. The second is to use these per unit savings (Section 7 FWS-ESA consultation and per acre-foot of water) to project what cost savings may result from new CWCB instream flow decrees. This analysis gives a picture of the reduced costs of endangered species protection that stem from protecting and increasing instream flows.

To provide an estimate of the cost savings of the Recovery Program’s instream flow components, we focused on two Recovery Program projects: 1) the 15-Mile Reach of the main stem Colorado River; and 2) the Elkhead Reservoir Enlargement in the Yampa River sub-basin. It is difficult to separately estimate

the cost savings from each of the Recovery Program's five elements, as it is their integrated nature that makes the Recovery Program a RPA under ESA. However, if the Recovery Program as a whole results in cost saving, and instream flow protection is a critical element in the Recovery Program, then the instream flow program contributes to those cost savings. We estimated the cost savings to Colorado water users, and state and federal agencies from PBOs developed under the Recovery Program and potential cost savings from additional CWCB-provided instream flows.

6.1 Potential ESA Section 7 Cost Savings that Could Be Achieved Through Use of the Recovery Program on Projects Exceeding the 4,500 Acre-Feet Depletion Tier

Two case studies, one of which is outside the Upper Colorado Recovery Program, give a sense of the costs of endangered species protection without the benefits of the Recovery Program and its instream flow components. The first, the Ute Water Project, was in the Upper Colorado Basin. The second, the Animas La-Plata, was a federal project undertaken by the Bureau of Reclamation on the San Juan River. The Animas La-Plata project underwent the ESA Section 7 consultation process without the benefit of a Recovery Program. These two case studies help illustrate the time and cost savings resulting from both having the programmatic process in place and following it.

6.1.1 Ute Water Conservancy District - Non-Federal Project

In 1994, the Ute Water District proposed building a replacement pipeline from Plateau Creek to utilize 28,600 acre-feet of water. This consultation preceded the 15-Mile Reach PBO, and the proposed new depletion was greater than the 3,000 acre-foot limit for which the FWS had determined the Recovery Program progress was sufficient to serve as the RPA (the amount was raised to 4,500 acre-feet in 2001). Diverting the proposed amount of water would deplete water in the 15-Mile Reach of the Colorado River because this project's return flows would come in below the 15-Mile Reach. This reach has been designated as a critical habitat for the four endangered fish. Because the pipeline required an easement over Bureau of Land Management (BLM) land, a Section 7 consultation was initiated.

The Section 7 consultation required a number of iterations of hydrologic model runs and stakeholder meetings. The initial consultations suggested that Ute Water District would have to make up or replace its diversions on the 15-Mile Reach to as much as 18,600 acre-feet (Stibrich and Charles 2000). To refine this estimate, the District spent two years further developing its water model, which ultimately estimated that 11,000 acre-feet of water would have to be replaced in the 15-Mile Reach (Stibrich and Charles 2000). During this time, a series of Recovery Program meetings were attended by a wide range of stakeholders, and led to the creation of a PBO for the 15-Mile Reach and the Colorado River Basin, upstream of the Gunnison River. The first 3,000 acre-feet of this replacement water would be covered under the RIPRAP (Stibrich and Charles 2000). But when Ute Water diversions grew in size where additional replacement water would be required beyond the initial 3,000 acre-feet (expected in 2015), the FWS required Ute Water to re-consult before further depletions were authorized (Stibrich and Charles 2000).

The permit was issued in 1999, a full four years after the initial request began. The Ute Water District estimated that it spent $2.4 million on the ESA Section 7 consultation, much of which was spent to develop and refine a hydrologic model of the river basin (for a discussion of the model, see Stibrich and Charles 2000). The $2.4 million in direct costs do not include the District's internal costs in personnel time and travel, nor do they include the internal personnel and travel costs to other federal agencies, Colorado agencies, or stakeholders to participate in the prolonged negotiations.

Under the Upper Colorado River Basin PBO, which allows up to 120,000 acre-feet of new depletions, the Ute Water District estimates that a similar but new 28,600 acre-feet diversion would likely take a year, and cost approximately $250,000. This would have eliminated three years of delay and associated costs.

Federal and state agencies would also have reduced staff expenses from the shorter review period. The cost savings would be around $2.15 million.

6.1.2 Animas-La Plata – USBR Project

The Animas-La Plata is a large water project located in southwestern Colorado and northwestern New Mexico. Congress originally authorized the project in 1968 to include 191,200 acre-feet of water storage for municipal/industrial use and irrigation. While the project has been controversial for numerous reasons, the focus here is on the ESA Section 7 consultation.

In 1990, the FWS issued a draft PBO that concluded the full 191,200 acre-foot depletion would jeopardize the existence of the endangered Colorado pikeminnow. At that time, no RPA existed. In 1991, the FWS issued a final PBO that approved a scaled-down project of 57,100 acre-feet of water, and required the establishment of an endangered fish recovery program for the San Juan River as the RPA, among others. The decision to proceed was challenged in court, and project construction halted (USBR 2008). Ultimately, the project did not move forward until 1998 (USBR 2008). Had a Recovery Program similar to the Upper Colorado River been in place, it may have saved the USBR up to several years of delay, and resulted in significant cost savings.

An estimate of the possible savings to the USBR from having a Recovery Program in place are difficult to accurately assess, since the delays described above were a combination of ESA related opposition and general project opposition. The first step is recognizing the USBR spent two years, from 1990 to 1991, on the Animas-La Plata Project's ESA Section 7 consultation, versus what might have happened with a Recovery Program. While depletions of that magnitude would not be considered routine, even under the San Juan River Basin Recovery Implementation Program that was eventually put in place, the cooperative approach might have cut the Section 7 consultation time in half. Likewise, based on the fact that no litigation regarding ESA compliance for water projects has occurred under the Upper Colorado River Recovery Program, a similar approach in the San Juan basin could have reduced the potential for environmental litigation and eliminated some of the additional delay.

6.1.3 Findings from Ute Water Conservancy District and Animas-La Plata Case Studies

Drawing on these two case studies, as well as interviews with several participants, we can gain a sense of the total cost savings realized due to the Recovery Program over the last 10 years. Given that there were 1,540 Section 7 consultations from 1998 to 2007 (with 1,079 in Colorado), the cost savings and time savings from the Recovery Program are enormous. Many of the small and medium size projects up to 4,500 acre feet would have likely been seriously delayed or possibly cancelled, since the FWS simply does not have the personnel to process 1,000 Section 7 consultations in a reasonable amount of time. With the Recovery Program, more than 1,000 of these Section 7 consultations meet the requirements for the streamlined consultation and payment of the one-time $17 per acre-foot depletion fee. In addition, since the Upper Colorado River Basin PBO allows for up to 120,000 acre feet of depletions, in principle up to four projects the size of the Ute Water District could have been covered under the procedures outlined in the PBO, with 5,600 acre-feet available for smaller projects. Rather than taking 4 years, the Section 7 consultation for projects larger than 4,500 acre feet is estimated to take one year and cost approximately $250,000.

Applying this $2.15 million per project cost savings to three similar sized projects that could be permitted within the 120,000 acre-foot total depletions yields nearly $6.5 million in cost savings. Likewise, applying a three-year-per-project time savings to three additional large projects would yield nine years of avoided time delay. At the other end of the project size range, up to 17 additional moderately sized projects,

larger than the 4,500 acre-feet cut-off (e.g., 5,000 acre feet), could be permitted within the Recovery Program's 120,000 acre-feet depletion cap, and still leave 5,000 acre feet left over for smaller projects. If the Section 7 consultations on these 17 additional projects had been similar in expense and time length to the Ute Water District, then the total savings would be about $36 million. Most likely during the next several decades, the project sizes put forward will be a mix of Ute Water District sized projects (28,000 acre-feet plus) and smaller projects, so the cost savings would fall in between these two estimates of $6.5 and $36 million. Since instream flow is an element of the Recovery Program, some portion of the $6.5 million cost savings is indirectly related to providing and protecting flows. Without the agreement by the federal government to obtain water in accordance with state law, and the agreement by the states and water users to find water for endangered fish in accordance with state law, the Recovery Program would not exist. The Program resolved the fundamental conflict between providing water for endangered fish and state water law (Tom Pitts, personal communication, 2010), and has saved water users significant amounts of money in ESA compliance costs.

6.2 Cost Savings from Flexibility and Economies of Scale from Basin-Wide Approaches to Meet Flow Recommendations

The Recovery Program's basin-wide approach reduced the costs of providing more than 60,000 acre-feet of flows. There are two distinct sources of cost savings: 1) flexibility afforded Program participants to meet recovery flow targets through cooperative efforts as part of the Recovery Program, rather than on an individual basis as might be required if there were no Program; and 2) economies of scale that lower per unit costs of meeting recovery flow objectives through a few large projects instead of hundreds of small projects.

Examples of the portfolio approach to meeting flow recommendations include the following: since 1998, cooperative efforts by Colorado State Parks and the CWCB resulted in an agreement with the FWS to release up to 3,300 acre-feet of water annually from Steamboat Lake into the Yampa River for endangered fish in the Yampa. As part of the Recovery Program, the CWCB has 5,000 acre-feet of storage in the enlarged Elkhead Reservoir, with options to lease another 2,000 acre-feet to support endangered fish recovery in the Yampa River. Coordinated water releases from the Ruedi and Wolford Mountain Reservoirs has made 30,000 acre-feet of water available for instream flows. Structural improvements to the Government Highline Canal near Grand Junction improved canal efficiency, resulting in reduced diversions of 28,000 acre-feet of water that will remain in the Colorado River and be legally protected for endangered fish.

The most direct example of the cost savings associated with the flexibility to meet FWS flow recommendations is to compare the cost to East Slope water providers to meet their negotiated share of Colorado River flows with and without this flexibility. As one part of meeting future flow needs of the endangered fish, 10,825 acre-feet of water needs to be provided to the Colorado River (the "10825 Water Supply"). This is being split between East Slope water providers and West Slope water providers. However, water on the East Slope or Front Range often costs roughly $10,000 an acre-foot to develop (e.g., Glade Reservoir), or sells for roughly $10,000 an acre-foot (e.g., Colorado Big Thompson water). In contrast, all but two estimates out of the nine alternatives to provide a 10,825 acre-feet water supply range in cost from $2,000 an acre-foot to about $5,000 an acre-foot. This is substantially less than the $10,000 per acre-foot costs that the Front Range water users would incur if they were not part of the Recovery Program analysis. Specifically, cost savings to Front Range water providers is in the magnitude of $27 million (their water share or 5,412.5 acre-feet times $5,000 per acre-foot cost savings). This cost savings gets passed onto Front Range water users, including farmers and cities that use West Slope water. The water cost savings grow as the Recovery Program increases the amount of water devoted to instream flow, and are likely to grow over time as water becomes scarcer. For example, once these less expensive West Slope projects are implemented, the remaining water development

opportunities are likely to be more expensive, and may require retirement of agricultural land to provide that water. Thus, the cost savings afforded by the flexibility in the Recovery Plan may grow larger over time.

6.3 Possible Future Benefits of CWCB Instream Flow Water Rights Decrees

This section applies the estimated cost savings developed using the Upper Colorado River Recovery Program to possible future CWCB instream flow water rights decrees. The scenarios developed are not meant to be solely related to the Upper Colorado River Basin, but could apply to creeks, streams, and other large rivers, as well as other rare threatened and endangered fish besides the four listed species in the Upper Colorado River.

While there are many factors that lead to species endangerment besides inadequate instream flows (e.g., non-native species), we focus on the role of instream flows because providing water for maintaining instream flows was proposed by the FWS on new water diversions in the Upper Colorado River basin prior to the Upper Colorado River Recovery Program. Specifically, the FWS proposed that for every acre-foot of new water depletions, an acre-foot of water be committed to replace those depletions to maintain flows in the river (e.g., a quasi No-Net-Loss-of-Flows approach to recovery). The other potential cost savings from establishing CWCB instream flows is the avoidance or streamlining of Section 7 consultations.

First, we developed four scenarios:[4]

1) Scenario 1: CWCB acquires **senior** water rights and protects them as instream flows in a river for fish that are already listed as threatened or endangered.

2) Scenario 2: CWCB acquires **senior** water rights and protects them as instream flows in an amount that makes possible avoiding listing of the fish species as Threatened or Endangered under ESA. This is a hypothetical scenario for the four currently listed species covered by the Recovery Program, but provides some insights for what might have been saved **if** adequate flows could have been secured and protection or augmentation of flows alone was deemed sufficient to avoid listing. The insights gained may be applicable on other rivers for other species.

3) Scenario 3: CWCB appropriates and protects new **junior** instream flow water rights in a river for fish that are already listed as threatened or endangered.

4) Scenario 4: CWCB appropriates and protects new **junior** instream flow water rights that make it possible to avoid listing of the fish species as threatened or endangered under ESA.

We do not mean to imply that scenarios one and three are mutually exclusive or cannot be used in some combination of senior and junior water rights to reduce the amount of replacement flows required of new diversion. It may be more likely that the CWCB could acquire senior water rights to protect instream flows in combination with junior instream flow rights to meet a FWS flow recommendation. This combined use of senior and junior rights is especially likely to be needed to generate sufficient water to avoid listing of a species as described in scenarios two and four.

The water cost savings and Section 7 consultation cost savings are summarized in Table 3. It is likely in all the scenarios that the CWCB water right acquisition would only provide a portion of the replacement water needed for new diversions by existing and new diverters. Thus, these CWCB instream flows would

[4] Note that these scenarios are hypothetical in nature regarding potential actions of both the FWS and CWCB and are meant to explore the potential for cost savings.

reduce, but typically not entirely eliminate, the amount of water that the FWS might recommend existing and new diverters would need to replace.

The total amount of savings in scenarios one and three depends on the quantity of acre-feet of water acquired and the net instream flows, after accounting for the fact that only the consumptive use portion may be protected as instream flow downstream of the historic point of return flows. The full diversion amount typically can be protected as instream flow from the historic point of diversion down to the historic point of return flows. This net amount of instream flow could be credited by FWS against the amount of replacement flows the FWS might request of existing and new diverters if a recovery program similar to the Upper Colorado Recovery Program was not in place.

It is important to note that different species and different streams and rivers will require different flow amounts necessary to recover listed species or avoid listing altogether. In the examples below, we are using costs based on about 10,000 acre-feet being required, as was discussed in the 10,285 water supply program discussed above. This amount of water may be adequate for recovery of some species in smaller rivers. However, in the situation of recovery of species, such as the four listed species in large rivers or the mainstem Colorado River, this might require upwards of a cumulative 400,000 acre-feet. If this were the case, the costs of providing that water would be several times higher than providing 10,000 acre-feet of water. No doubt significant land fallowing could be required, and in some cases, even direct competition with cities for water might occur.[5] Any buyer of water, whether CWCB, a recovery program, a non-profit conservation organization, or a water district would have to pay these increasing costs, if increasing water quantities are desired. If the CWCB was to purchase water rights and convert them to instream flows to aid recovery, it would incur costs that water developers may have otherwise been required to incur to replace their water depletions. If the CWCB was able to acquire sufficient water for instream flows to avoid listing of a species, then not only would the water cost savings be realized to the water developer, but in addition the Section 7 consultation costs would be avoided. As detailed above in Section 6.1.3., based on the Ute Water District case, the savings from avoiding Section 7 consultations can be substantial. Thus, even if there were no net savings to the citizens of Colorado from having the CWCB purchase water, versus a water developer having to purchase water, if sufficient water was acquired by the CWCB that could avoid species listing, then the state water acquisition would be providing the extra cost savings from having water developers avoid Section 7 consultations.

The text below lists other critical assumptions which would have to be met and the calculations for water values per acre-foot. We strongly urge the reader to review the assumptions and basis for calculations presented in this table before relying on or quoting cost savings in this table.

[5] In California, instream flows for fish and lake levels for birds were pitted against Los Angeles' diversion of water for municipal and industrial purposes. After a California Supreme Court case and a state Environmental Impact Report, significant quantities of water were reallocated to these environmental uses at the expense of urban uses in Los Angeles—see Loomis, 1995 for more information about this Mono Lake case. These same types of issues are currently being litigated in California involving the Delta smelt.

Table 3. Summary of Type and Potential Amount of Cost Savings from CWCB Instream Flow Decree (see text below for explanation of the derivation of all figures)

Scenario	Water Cost Saving per AF from a reduction in the replacement water quantity needed by new diversions in the range of 10,000 AF.	Savings per AF from Reduced Section 7 Consultation	Likelihood that Scenario could be achieved
CWCB acquires **senior** instream flows in a river for fish that are already listed under ESA	$2,000-$5,000 for new West Slope diverters $10,000 for new East Slope diverters	$75/AF	Somewhat likely depending upon availability of water rights for acquisition
CWCB acquires **senior** water rights that avoid listing of the fish species under ESA.	$2,000-$5,000 for new West Slope diverters $10,000 for new East Slope diverters	$84/AF	Somewhat* likely depending upon availability of water rights for acquisition
CWCB protects **junior** instream flows in a river for fish that are already listed under ESA	$2,000-$5,000 for new West Slope diverters $10,000 for new East Slope diverters	$75/AF	Likelihood would depend on availability of water for appropriation
CWCB protects **junior** instream flow rights that avoid listing of the fish species under ESA.	$2,000-$5,000 for new West Slope diverters $10,000 for new East Slope diverters	$84/AF	Likelihood would depend on availability of water for appropriation

***** More likely to avoid listing if lack of flows was the primary or key factor in the decision to list and flow protection and/or augmentation is critical to recovery. Less likely to avoid listing if other non-flow factors (e.g., non-native fish) were more important than flow in decision to list.

Scenario 1: CWCB acquires senior water rights and protects them as instream flows in a river for fish that are already listed as threatened or endangered.

(a) Water Cost Savings:

Assumptions: (i) FWS would require any new diverters or diversions to dedicate one acre-foot of water to meet target flows for each acre-foot diverted; (ii) FWS would accept CWCB's instream flow (converted from a senior water right(s)) as protecting flows that would otherwise be diverted; and (iii) the amount of the cost savings would be dependent on the total net instream flow amounts that the water right acquired by the CWCB would yield after being changed in water court to instream flow use.

Analysis of Water Cost Savings: Cost savings would be the water diverters' avoided costs of not having to off-set their new diversions. If the CWCB instream flow protection reduced the need for replacement water that the West Slope users otherwise would have to provide, then the cost savings per acre-foot would be on the order of $2000 to $5000 an acre-foot, if about 10,000 acre-feet or less is required. This is based on the cost of developing additional water for the Upper Colorado River Recovery Program's "10825 Water Supply". If the CWCB instream flow protection reduces the need for replacement water that East Slope water users (e.g., Denver Water) otherwise would have to provide, then the cost savings per acre-foot would be on the order of $10,000 an acre-foot. This is based on the cost of developing additional water from Glade Reservoir on the East Slope, purchasing from the Colorado Big Thompson

(CBT) water market (Howe 2008), or purchasing agricultural land for the conversion of water use. The rationale for these East Slope cost savings is that if East Slope water users do not have to replace their diversions one acre-foot for one acre-foot, it may mean the net yield of water on a particular water project will be higher, reducing the need to participate in new reservoir development on the East Slope (e.g., Glade), purchase water from CBT, or purchase agricultural lands and convert those water rights. However, if East Slope water users could meet their ESA water requirements via reduced water yield from their intermountain diversions at less cost than these three options, then the cost might be somewhat less than the $10,000 an acre-foot. These costs per acre-foot are not quantified due to lack of data.

While these cost savings would be significant, so would the costs to the CWCB of purchasing senior water rights. To determine whether there is an overall net savings would require an estimate of the cost of acquiring senior water rights. This acquisition cost will be specific to the exact stream/river reach where the water is needed by threatened and endangered fish, and remains to be quantified in a more site-specific case study.

(b) Reduced FWS Section 7 Consultations

Assumption: the FWS would accept the CWCB senior instream flow right as a RPA, rather than requiring each diverter to produce their own alternative, that often requires use of expensive hydrologic models.

Estimated Section 7 Consultation Cost Savings Analysis: The Section 7 consultation could be streamlined, resulting in both monetary and time savings. Streamlined Section 7 consultation is estimated to take about one year and costs about $250,000, based on discussions with Ute Water Conservancy District on the West Slope. This contrasts with Ute Water Conservancy District's actual experience, where its project's large new water depletions were not covered by a suitable RPA, PBO, or other prior agreements with the FWS. In this case, the Section 7 consultation took 4 years and cost $2.5 million. Thus, if the assumption that the FWS would treat a CWCB senior instream flow right as a RPA is met, the cost savings to water users and their customers for each Section 7 consultation would be on the order of $2.25 million and three years. On a per acre-foot basis, the cost savings are the reduction in the cost per acre-foot without a RPA ($2.4 million divided by Ute's 28,600 acre-feet--$84 per acre-foot) minus the estimated costs per acre-foot with the RPA ($250,000 divided by 28,600 acre-feet--$9 an acre-foot). This amounts to $75 an acre-foot in savings.

Scenario 2: CWCB acquires senior water rights and protects them as instream flows in an amount that makes possible avoiding listing of the fish species as threatened or endangered under ESA.

(a) Water Cost Savings

Assumptions: In the absence of the CWCB's senior instream flow rights, (i) the FWS would have listed the species, as no plan was in place to avoid continued decline in the population of the species and insufficient flows would be available for the fish; (ii) if the species had been listed, the FWS would have required any new diverter or diversion to dedicate one acre-foot of water to meet FWS flow recommendations for each acre-foot diverted; and (iii) the FWS would accept the level of instream flow protection provided by the CWCB with the senior water right(s) as protecting flows in an amount sufficient to maintain a viable population of the species, resulting in a FWS opinion that a certain level of future diversions would not threaten the continued existence of the species. If these assumptions are met, the cost savings would be the water diverters' avoided costs of having to replace their diversions.

Estimated Water Cost Savings: Cost savings are equal to those in Scenario 1 above. As in Scenario 1, these cost savings would need to be compared to CWCB water acquisition costs to determine if there is an overall net cost savings.

(b) Elimination of FWS Section 7 Consultations

Assumption: With CWCB's senior instream flow rights in place, the FWS would not have listed the species because the CWCB's water rights are sufficient to avoid continued decline in the population of the species. Hence, no Section 7 consultation would be required.

Estimated Cost Savings from Elimination of FWS Section 7 Consultations

Eliminating Section 7 consultations would result in savings in both monetary and time costs. Based on the Ute Water Conservation District example, the savings would be an estimated $84 per acre-foot based on the full costs of Section 7 consultation without a RPA.

Scenario 3: CWCB appropriates and protects new junior instream flow water rights in a river for fish that are already listed as threatened or endangered.

(a) Water Cost Savings (Similar to Scenario 1):

Assumptions: (i) the FWS would require any new diverter to dedicate one acre-foot of water to instream flow for each acre-foot diverted; (ii) water is available for instream flow appropriation by the CWCB; (iii) the FWS would accept CWCB's **junior** instream flow decree as protecting flows in an amount sufficient to maintain a viable population of the species; (iv) that these **junior** flows (possibly in combination with CWCB acquisition of some senior water rights) are sufficient to prevent further decline in the species and still allow senior water users who have not fully exercised their diversion rights to do so without requiring one acre-foot replacement for one acre-foot diversion.

Water Cost Savings: If these assumptions are met, the water costs savings would be as given in Scenario 1 and shown above in Table 3, i.e., $2000 to $5000 per acre-foot for West Slope diverters and $10,000 per acre-foot for East Slope diverters, in the range of 10,000 acre-feet provided.

(b) Reduced FWS Section 7 Consultations

Assumption: the FWS would accept the CWCB **junior** instream flow right as a RPA. Meeting this assumption would seem unlikely in river basins which have a substantial portion of flows covered by senior water rights. In such a case, it is possible that the CWCB could acquire senior water rights to protect instream flows in combination with its junior instream flow right to meet the FWS flow recommendations.

Estimated Section 7 Cost Savings Analysis: The Section 7 consultation could be streamlined, resulting in savings in both monetary and time costs. IF FWS accepts CWCB **junior water rights as a RPA,** then CWCB Scenario 3 Section 7 consultation cost savings is identical to Scenario 1, at $75 per acre-foot. If the FWS would not accept CWCB junior water rights as a RPA, then there would be little or no cost savings.

Scenario 4: CWCB appropriates and protects new junior instream flow water rights that make possible avoiding listing of the fish species as threatened or endangered under ESA.

(a) Water Cost Savings (Same as Scenario 2):

Assumptions: A primary assumption in this scenario is that given existing senior diversions, a new junior CWCB instream flow water right would protect flow sufficient to prevent species listing. However, a combination of a new instream flow right and the acquisition of senior water rights to protect as instream flows might be needed to provide the required level of flow protection. In absence of the CWCB's junior instream flow right: (i) the FWS would have listed the species, as no plan was in place to avoid a continued decline in the population of the species; (ii) if the species was listed, the FWS would have required any new diverter or diversion to dedicate one acre-foot of water to instream flow for each acre-foot diverted; and (iii) the FWS would accept CWCB's **junior** instream flow decree as protecting flows in

an amount sufficient to maintain a viable population of the species, that would otherwise be diverted, resulting in a FWS opinion that a certain level of future diversions would **not** threaten the continued existence of the species. If these assumptions are met, one cost saving would be the water diverters' avoided cost of having to replace their diversions.

Estimated Water Cost Savings
If the above assumptions are met, the cost savings are as shown in Scenario 1, 2, and 3.

(b) Estimated Cost Savings from Elimination of FWS Section 7 Consultations

Assumptions: With the CWCB's **junior** instream flow right, the FWS would not have listed the species due to the CWCB's water rights being sufficient to avoid continued decline in the population of the species. Hence, no Section 7 consultation would be required.

Estimated Section 7 Cost Savings Analysis:
Eliminating Section 7 consultation would result in savings in both monetary and time costs. Based on the Ute Water Conservation District example, the savings would be an estimated $84 per acre-foot based on the full costs of Section 7 consultation without a RPA.

6.3 Trade-offs in Obtaining Senior versus Junior Water Rights

Overall, this economic analysis suggests the importance of acquiring senior water rights for instream flow use in river basins that are nearly fully appropriated. While these senior water rights cost significantly more, the likelihood and magnitude of ESA cost savings is much greater than with junior water rights. In some sense, this is a benefit to cost comparison. The per unit cost savings presented in this report could be used, along with an estimate of the reduction in number of acre-feet of water replacements or reduction in the number of Section 7 consultations, to determine if the added costs of purchasing more senior water rights is worth the benefits in the form of costs savings to water users. The cost of acquiring water rights for instream flows will increase if large (100,000 acre feet plus) quantities of water are needed for instream flows.

6.4 Summary of Cost Savings

The CWCB's acquisition and protection of either or both senior and junior instream flows has the potential to result in substantial savings to new urban and agricultural diversions that are likely over the next several decades. The cost savings generated by CWCB acquisition of water and its use of this water for instream flow could reduce a need for new water diversions to replace their diversions on an acre-foot-by-acre-foot basis. As shown in Table 3, these cost savings represent about $10,000 per acre-foot for East Slope diverters and between $2,000-$5,000 per acre foot for West Slope diverters in the range of 10,000 acre-feet of water for flows. There also would be savings of $75 to $84 per acre-foot from reduced Section 7 consultations under ESA. If the CWCB can acquire sufficient instream flows to avoid listing, there is also a large time savings and reduction in staff costs to diverters from not having to comply with many of the details involved in ESA related regulations. The dollar value of this time savings to other stakeholders is not quantified.

7. Conjunctive Benefits of Endangered Fish Flows for Other Uses.

Flows sent down the Colorado and Yampa Rivers for the endangered fish provide many other benefits to Colorado residents, in addition to the recovery of endangered fish. The Colorado River, through Glenwood Canyon, is the second most popular rafting river in the state. Many residents and non-residents from around the U.S. raft on the Colorado River through Glenwood Canyon. Commercial rafting alone contributes $4.7 million in income annually in Colorado. Instream flows for fish protect about 10 percent of the flows in the Colorado River. According to Loomis (2008), these fish flows are estimated to

contribute $286,000 in income (wages, business income, etc.) each year. The Yampa and Green Rivers are the fifth most popular rafting rivers in Colorado, contributing nearly a million dollars in income to Colorado. Instream flow protections for fish in the Yampa River (e.g., Elkhead Reservoir, etc.) would contribute $30,000 in income per year to Colorado from commercial rafting (Loomis 2008). There would also be recreational fishing benefits along the Yampa and Green Rivers as well that would occur from the additional flows.

APPENDIX A: INDIVIDUALS INTERVIEWED AS PART OF THIS PROJECT

NAME	TITLE	ORGANIZATION	LOCATION	INTERVIEWED
Angela Kantola	Asst. Director	Recovery Program, DOI-USFWS	Lakewood	Phone
Carol DeAngelis	Area Manager	DOI-BoR	Grand Junction	In-Person
Brent Uilenberg	Tech. Ser. Div. Mgr.	DOI-BoR	Grand Junction	In-Person
Randy Seaholm	Former Chief, CWCB Water Supply Protection Section	DNR-CWCB	Denver	Phone
Ray Tenney		CRWCD	Wolford Res.	In-Person
Larry Clever	Manager	Ute Water Conserv. District	Grand Junction	In-Person
Erin Light	Division Engineer	DNR-State Engineer Office	Steamboat Springs	In-Person
Al Pfister	Area Manager.	DOI-USFWS	Grand Junction	In-Person
Patty Gellat	Biologist	DOI-USFWS	Grand Junction	Phone
Tom Pitts	Upper Basin Water Users Representative	Colorado Water Congress, Utah Water Users Association, Wyoming Water Association	Loveland	In-Person

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