DRAFT
REPORT

Nonconsumptive Toolbox

Colorado Water
Conservation Board

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Acronyms

BLM	U.S. Bureau of Land Management
CPW	Colorado Parks and Wildlife
CWCB	Colorado Water Conservation Board
HB	House Bill
IBCC	Interbasin Compact Committee
ISF	instream flow
RICDs	Recreational In-Channel Diversions
SWSI	Statewide Water Supply Initiative
Toolbox	Nonconsumptive Needs Toolbox

Colorado Water Conservation Board

Nonconsumptive Needs Toolbox

Introduction

In 2005, the Colorado General Assembly passed the Colorado Water for the 21st Century Act[1] (House Bill [HB] 05-1177) (**Figure 1**). The Act established a framework to provide a permanent forum for broad-based water discussions. The process created a voluntary, collaborative process to help the State of Colorado address its water challenges. The Act also created nine basin roundtables and an Interbasin Compact Committee (IBCC). Because environmental and recreational attributes are important to the State of Colorado and to the quality of life for Colorado's citizens, the Water for the 21st Century Act explicitly called out the need to plan for future environmental and recreational uses in water supply planning. Environmental and recreational uses of water are referred to as nonconsumptive uses in the Water for the 21st Century Act.

Based on the recommendations of its Nonconsumptive Subcommittee, the IBCC recommended the following nonconsumptive implementation activities on November 30, 2011:

1. Action request for the basin roundtables:

    a. Develop Nonconsumptive Implementation Plan: Building on information previously compiled for the Statewide Water Supply Initiative (SWSI) 2010, identify nonconsumptive geographic and/or seasonal gaps and then suggest and prioritize projects and methods that can fill those gaps in a strategic manner. Using the Toolbox described below, the projects should identify initial cost estimates, potential partners, and whether any entity has agreed to take the lead.

    b. Initiate three to five nonconsumptive projects: Using the basin's Nonconsumptive Identified Projects and Processes list, determine how to implement three to five projects or methods that meet identified nonconsumptive needs.

> **37-75-104 (2)(c)** … develop a basinwide consumptive and nonconsumptive water supply needs assessment, conduct an analysis of available unappropriated waters within the basin, and propose projects or methods, both structural and nonstructural, for meeting those needs and utilizing those unappropriated waters where appropriate. Basin roundtables shall actively seek the input and advice of affected local governments, water providers, and other interested stakeholders in establishing its needs assessment, and shall propose projects or methods for meeting those needs.
>
> **37-75-102** … this article is not intended to restrict the ability of the holder of a water right to use or dispose of that water right in any manner permitted under Colorado law.

Figure 1. Excerpts from HB 05-1177, Colorado Water for the 21st Century Act

[1] http://cwcbweblink.state.co.us/weblink/0/doc/105662/Electronic.aspx?searchid=8e74cfe0-f62c-48bb-9fd7-8b193489faf0

c. Identify one or more pilot projects that integrate nonconsumptive projects/needs with consumptive projects/needs. The pilot project can count as one of the three to five nonconsumptive projects as long as it clearly meets a nonconsumptive needs gap.

d. Define technical questions related to nonconsumptive needs that need to be answered in your basin. These are questions that can be queried in the nonconsumptive database, such as how many projects are supporting a particular attribute, or additional technical questions such as those concerning how a portfolio may affect flows in a given reach, etc.

2. The Colorado Water Conservation Board (CWCB) will develop a Toolbox for nonconsumptive needs, starting with a list of what resources are already available to inform the above discussions and how to access those resources; this will include summaries of a mapping exercise in the Southwest Basin and a modeling exercise in the Yampa-White-Green Basin.

Overview of the Nonconsumptive Needs Toolbox

The Nonconsumptive Needs Toolbox (Toolbox) was created to support efforts of the basin roundtables and other stakeholders to develop projects and methods to meet nonconsumptive needs and the Toolbox has two main objectives:

1. To serve as a guide for basin roundtables as they develop their nonconsumptive implementation plans. The tools and resources can help roundtables and other stakeholders develop and execute their long-term nonconsumptive implementation plans and specific projects in a strategic fashion to meet the nonconsumptive needs each roundtable identified.

2. To be a clearinghouse for data and information generated in Phases I and II of the nonconsumptive needs assessment process by compiling the work of the roundtables in one place.

The Toolbox framework is organized around four steps (**Figure 2**), which may provide some of the resources and information to encourage comprehensive planning for nonconsumptive needs in each basin. The Toolbox also aids in identifying needs for project implementation, analyzing information, devising plans, and making decisions in light of existing water policies, laws, and regulations. It provides a framework to evaluate existing information and identify opportunities and challenges toward implementation of nonconsumptive projects. The Toolbox includes tools that can be applied during project planning and implementation, programs that can be used to meet nonconsumptive needs, and cost estimates for common project types.

The Toolbox is a guidance or resource document and contains some of the resources and procedures that may support the assessment of nonconsumptive needs and projects. Other current and future resources and evaluation tools that are not described herein may also provide valuable support in the assessment of nonconsumptive needs. Each tool may or may not be applicable, in its current form, to any site-specific set of facts in question.

This is not a policy document of the CWCB. The intent of the document is to provide a compilation of information for use by the basin roundtables and others as they address nonconsumptive needs and implementation of nonconsumptive projects and methods. As the basin roundtables or project proponents consider use of the tools described in this document they will need to consider the applicability and limitations of the tool that may apply to the issue they are addressing.

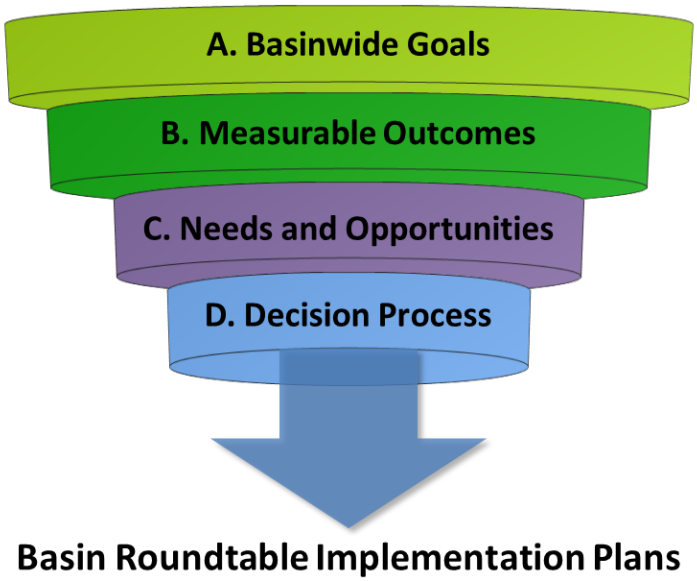

Figure 2. Overview of the Nonconsumptive Implementation Planning Process

Using the Toolbox consists of the four fundamental actions. Each action outlines a step in producing a comprehensive basin roundtable implementation plan. These actions are discussed in more detail and serve as the organizing framework for the Toolbox.

Step A. **Basinwide Goals:** Develop basin-level goals for the mapped attributes identified in the Statewide Nonconsumptive Needs Assessment Focus Area Map.

Example: Maintain population of native fish species so that none are listed in our basin.

Step B. **Measurable Outcomes:** Establish quantifiable, measurable outcomes for nonconsumptive targets and attributes

Example: Sustain 10 populations of bluehead sucker in 10 different river locations.

Step C. **Needs and Opportunities:** Using the project and methods database, identify needs and opportunities for protecting targets and attributes and strategically plan to meet those nonconsumptive needs.

Example: Based on analysis of existing levels of protection and where attributes occur, only five populations of bluehead sucker are protected. As a result, we need to protect an additional five populations to meet our established measurable outcomes.

Step D. **Decision Process:** Use the decision template to determine what actions need to be taken to meet nonconsumptive needs and implement projects.

Example: For one of the five locations where protection of bluehead sucker populations is limited, moving through the decision template may lead to the determination that reservoir reoperation could achieve desired outcomes.

While these actions are called "steps," not every roundtable will start at the top and work their way down the list sequentially. For some roundtables it may be appropriate to focus on one or two of the steps. Also, each of the steps may inform the other three and there may be interaction between the steps.

The Toolbox can be utilized to help develop near-term and long-range plans for meeting goals and implementing projects on the ground. At the basin scale, the tools can be used to help develop a basinwide strategic approach for meeting nonconsumptive needs and developing specific measurable outcomes for environmental attributes and conservation targets. At the local level, water resource managers may be able to use the tools and other resources to directly address specific project needs.

Step A. Basinwide Goals

The first step toward devising a basin roundtable implementation plan is to develop basinwide goals that specify environmental and recreational targets. These goals will serve as the foundation for a strategic framework to guide current and future nonconsumptive project planning.

Examples of basin-scale goals and objectives include:

- Improve conditions in the basin for all fish species on the federal candidate species list to prevent additional threatened and endangered species listings
- Maintain all habitat for fish species on the state imperiled list in the basin
- Maintain important fishing and whitewater opportunities in the basin

To improve conditions usually entails a restoration project. These projects are often more expensive than projects that protect or maintain existing conditions, but may be needed for high priority attributes or locations. In areas with competing water needs, management actions or limited protection may be the only way to balance multiple uses of a river or stream.

In order to help determine the goals, roundtables may turn to the nonconsumptive needs maps, which indicate what species and attributes are in the basin and where they are. To date, basin roundtables have conducted an extensive inventory, analysis, and synthesized mapping effort to establish baseline data and catalog nonconsumptive attributes across the state (**Figure 3)**. The mapping information was summarized in the SWSI 2010 Final Report, Section 2, Figure 2-3; the complete Section 2 can be downloaded from the CWCB website.[2] For this effort, the basin roundtables utilized environmental and recreational mapping to identify nonconsumptive focus areas in their basins. The focus area maps developed by each basin roundtable are based on a common set of environmental and recreational attributes and denote where Colorado's important water-based environmental and recreational attributes are located. Additional scientific information that relates to the environmental attributes identified by the roundtables is detailed in **Appendix A**.

[2] http://cwcb.state.co.us/water-management/water-supply-planning/Pages/SWSI2010.aspx

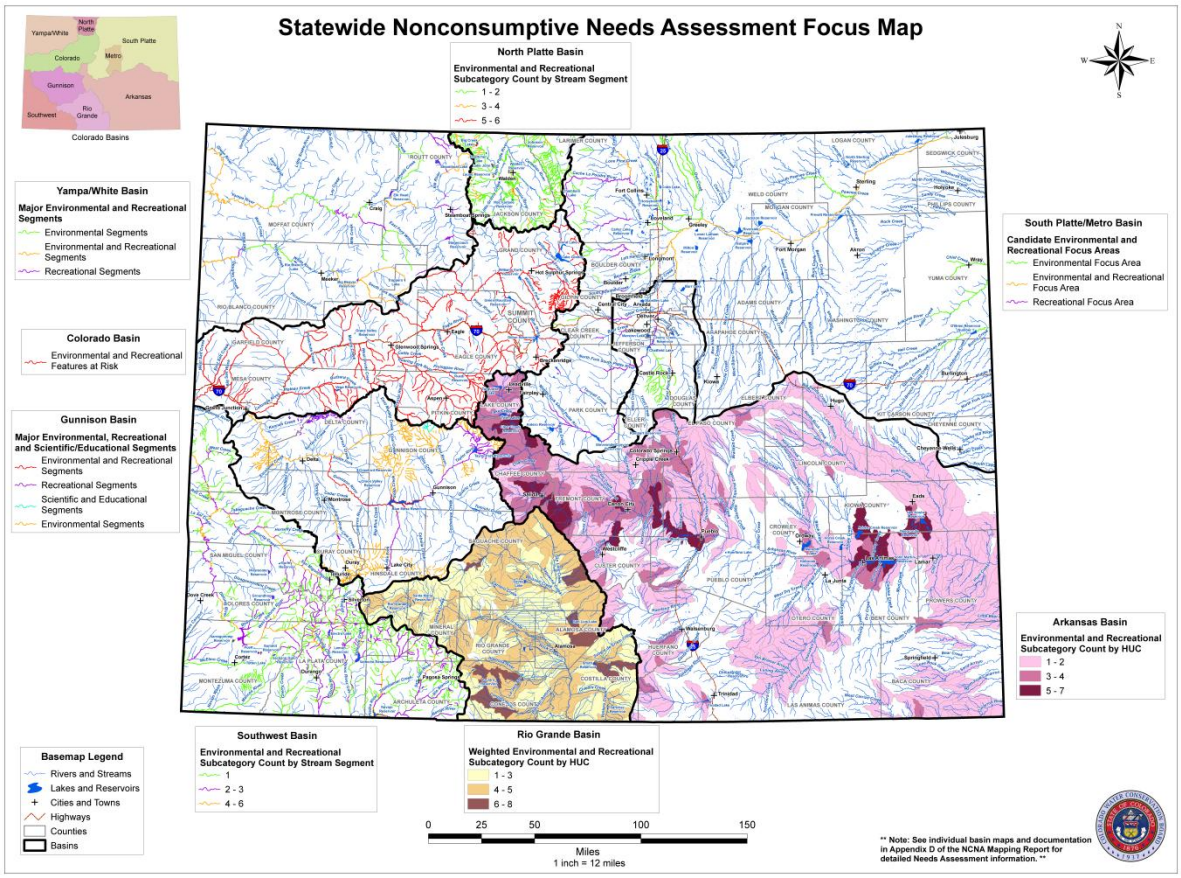

Figure 3. Statewide Nonconsumptive Needs Assessment Focus Area Map

The statewide map, the individual basin maps, and accompanying information can be found on the CWCB SWSI 2010 website, under SWSI 2010 Full Final Report, Appendix C.[3] The basin maps are designed in such a way that users can select a stream reach or focus area and determine what species and other attributes are associated with it. Directions for how to use these "geo pdfs" are available in Section 2 – Nonconsumptive Needs Assessments.[4]

This map information along with the Colorado Parks and Wildlife (CPW) species management plans and the Colorado Natural Heritage Program's goals, can serve as tools for developing goals and objectives at the basin-scale for nonconsumptive attributes. After the basin roundtables develop goals and objectives, the next step is to identify measurable outcomes for their goals.

The focus area maps developed by each basin roundtable are based on a common set of environmental and recreational attributes and represent where Colorado's important water-based environmental and recreational attributes are located. The maps are reflective of stakeholder input for the focus areas and also reflect stream reaches and subwatersheds with higher concentrations of environmental and recreational qualities. These maps were generated to provide information to the basin roundtables on important environmental and recreational areas in their basins but were not intended to dictate future actions. It should be noted, and as will be shown in this section, that this

[3] http://cwcb.state.co.us/water-management/water-supply-planning/Pages/SWSI2010.aspx
[4] http://cwcb.state.co.us/water-management/water-supply-planning/Documents/SWSI2010/SWSI2010Section2.pdf

effort has not identified all streams as important. The Nonconsumptive Needs Assessments are not intended to create a water right for the environment and will not diminish, impair, or cause injury to existing absolute or conditional water rights. The CWCB developed the environmental and recreational focus area mapping for the following purposes:

- The maps are intended to serve as a useful guide for water supply planning to enable coordination on future projects and to help avoid future conflicts between meeting consumptive, environmental, and recreational needs
- The maps can assist in identifying the status of environmental and recreational water needs, including reaches where needs are being met, where additional study is needed, and where proposed implementation projects in the basin have been identified
- The maps can help basins plan for the water needs of species of special concern so that they do not become federally listed as endangered or threatened in the future
- The maps can provide a basis for collaborative efforts for future multi-objective projects

Step B. Measurable Outcomes

Once environmental and recreational attributes have been identified and basinwide goals established, the next step of formulating a nonconsumptive implementation plan is to formulate measurable outcomes for environmental and recreational attributes based on the basin roundtable goals. A measurable outcome is a statement that articulates—in measurable or quantifiable terms—the desired state of an attribute as a result from an action or decision, such as:

- Maintain 80 percent of cutthroat trout habitat or population levels in subbasin Y
- Increase habitat or population levels for candidate species by 15 percent in the basin
- Protect the two populations of northern redbelly dace in subbasin X

Measurable outcomes should be identified at both the local-scale (project level) and at the basin-scale (regional strategy). The process of developing measurable outcomes should involve stakeholders with a diverse range of interests. Projects should be planned both proactively and strategically to address current and future issues. Basin roundtables should encourage a comprehensive suite of projects to meet basinwide goals, develop an approach to identifying the most important projects, and emphasize adaptive management around clear, measurable environmental goals. Actions should be based on sound science. The results of these actions should be monitored to measure results and inform future projects.

Listed below are some of the organizations and programs that can serve as resources and examples as each has identified specific measurable outcomes:

- Colorado Natural Heritage Program
- The Nature Conservancy
- Southern Rocky Mountains – An Ecoregional Assessment and Conservation Blueprint
- 2006 Central Shortgrass Prairie Ecoregional Assessment and Partnership Initiative
- American Whitewater Flow Surveys
- Colorado's Wildlife Action Plan
- Colorado Recovery and Conservation Plans
- Range-wide Conservation Agreement and Strategy

- Upper Colorado River Endangered Fish Recovery Implementation Program
- Routt County Livability Index

The specific measurable outcomes developed by these organizations and programs are detailed in **Appendix B**. Other programs and examples also exist and the examples above should not be interpreted as an endorsement by the CWCB of the specific goals, objectives or processes of the above programs.

The examples of measurable outcomes described in **Appendix C** can assist the basin roundtables in developing goals and objectives for their attributes as well as developing measurable outcomes. Many methods to measure nonconsumptive outcomes have been developed and as the basin roundtables or project proponents consider use of the tools described in this document they will need to consider the applicability and limitations of the tool that may apply to the issue they are addressing.

To determine the outcomes of a project, baseline information is often required. Technical and scientific tools can be used to help define ecological baselines, such as current flow levels through a fishery or existing riparian habitat. The information used to identify scientific baselines can also be utilized in establishing metrics to evaluate whether a desired outcome is being achieved. Some commonly used tools for collecting scientific information for environmental and recreational attributes are detailed in **Appendix C**. Baseline environmental data such as streamflow, water quality, fish survey, the extent and condition of riparian habitat are often not available to establish baseline conditions or allow the measurement of outcomes. In many instances, the collection of additional field information may be required to establish the baselines and outcomes described in Appendix C.

Step C. Needs and Opportunities

Once attributes have been assessed for the basin and measurable outcomes established, the next step is for basin roundtables to survey existing and planned projects and methods and identify needs and opportunities to meet measurable outcomes. This step in the planning process is focused on conducting analysis to identify gaps in nonconsumptive needs, determine protection statistics, and consider project funding sources to devise comprehensive roundtable implementation plans. Roundtables may want to explore the existing and planned projects and methods for a given attribute before determining measurable outcomes (Step B).

As a follow-up to the focus mapping, in January 2010 CWCB developed a survey to collect information on existing and planned nonconsumptive projects, methods, and studies for Phase II from nonconsumptive project proponents. The responses from this effort were put into a database and mapped. Roundtables can work with CWCB staff to ask questions about the locations of planned and existing projects and level of protection for a given attribute. This will help roundtables focus on locations that may be most strategic for executing nonconsumptive projects and methods.

This data gathering effort was parallel to a similar survey used to gather data from municipal project proponents, and is summarized below.

The nonconsumptive survey data was compiled into a nonconsumptive needs projects and methods database.[5] Studies were included, as they may recommend or inform the implementation of projects

[5] http://cwcb.state.co.us/environment/non-consumptive-needs/Documents/NCNAMappingAppendices.pdf

or methods that will provide protection or enhancement of environmental and recreational attributes. This survey was distributed through CWCB's basin roundtable and email list.

On February 10, 2010, CWCB conducted a workshop in Silverthorne, Colorado to discuss the Phase II efforts and to collect information on nonconsumptive projects, methods, and studies from the workshop attendees. In addition, CWCB gathered information from additional individuals and organizations to follow up with the data collection effort. Since the February 2010 meeting, an additional 57 meetings were held to gather data on additional projects, methods, and studies, as shown in **Table 1**. CWCB and the technical team supplemented the survey data with information from CWCB's grant programs, instream flow (ISF) program, and levels of protection afforded by land management practices on public and private lands.

Table 1. Summary of Basin Roundtable Nonconsumptive Project and Methods

Basin Roundtable	No. Projects and Methods in Focus Areas	No. Projects and Methods Outside Focus Areas	Total No. Projects and Methods[1]
Arkansas	40	0	40
Colorado	168	35	203
Gunnison	44	15	59
Metro	See South Platte	See South Platte	See South Platte
North Platte	41	7	48
Rio Grande	59	0	59
South Platte	54	53	107
Southwest	84	10	94
Yampa-White	22	16	38
TOTAL	**512**	**136**	**648**

[1] Total does not include all CWCB-funded projects and ISFs

In addition to identifying the spatial extent and status of the identified projects and methods, CWCB also examined what type of protection the project or method may provide to a given environmental or recreational attribute. CWCB has classified the projects as having direct or indirect protections based on a given environmental or recreational attribute. The definitions used for direct and indirect protections are as follows:

- **Direct Protection** – Projects and methods with components designed intentionally to protect a specific attribute. For example, ISFs provide direct protection of fish attributes. Additionally, restoration of a stream channel would provide direct protection of aquatic species.
- **Indirect Protection** – Projects and methods with components that were not designed to directly protect the specific attribute but may still provide protection. For example, flow protection designed to benefit a fish species may also indirectly protect riparian vegetation that is located in the protected stream reach. Other examples include protective land stewardship or a wetland or bank stabilization effort that could indirectly protect aquatic species.

These direct and indirect protections can be analyzed by river, basin, or at the statewide level as they relate to environmental and recreational attributes. **Figure 4** shows an example of an analysis for cutthroat trout, state threatened and endangered warm water fish, and riparian and wetland areas. In this example, cutthroat trout have the highest percentage of direct protections (38 percent). Riparian and wetland areas have the highest percentage of stream miles with no known protections (73 percent) and very few miles with direct protections (4 percent). With this baseline information collected, the next step is for the basin roundtables to analyze those data to develop measurable outcomes to achieve their goals related to these attributes.

In combination, the Focus Maps and the projects and methods database provide a point from which roundtables and other stakeholders can devise a strategic, comprehensive plan that sets targets and measurable outcomes for protecting nonconsumptive attributes. To start, roundtables should ask what they want to achieve for each of the river segments on their Focus Maps. Is the measurable outcome to sustain all attributes in all focal segments? Are there some attributes or segments that are more important than others? Are there attributes that will be maintained or improved only on an opportunistic basis?

Next, maps of projects and methods for each basin can be superimposed on top of the Focus Maps. **Figure 5** provides an example map from overlaying the projects and methods database on the Focus Maps for a portion of the Southwest Basin. Segments shown in red are roundtable-identified focus segments that have no known protections on them. Roundtable members or other stakeholders may want to identify what types of projects or methods could be implemented on these segments to sustain the nonconsumptive values. **Appendix D** contains similar maps for all basins.

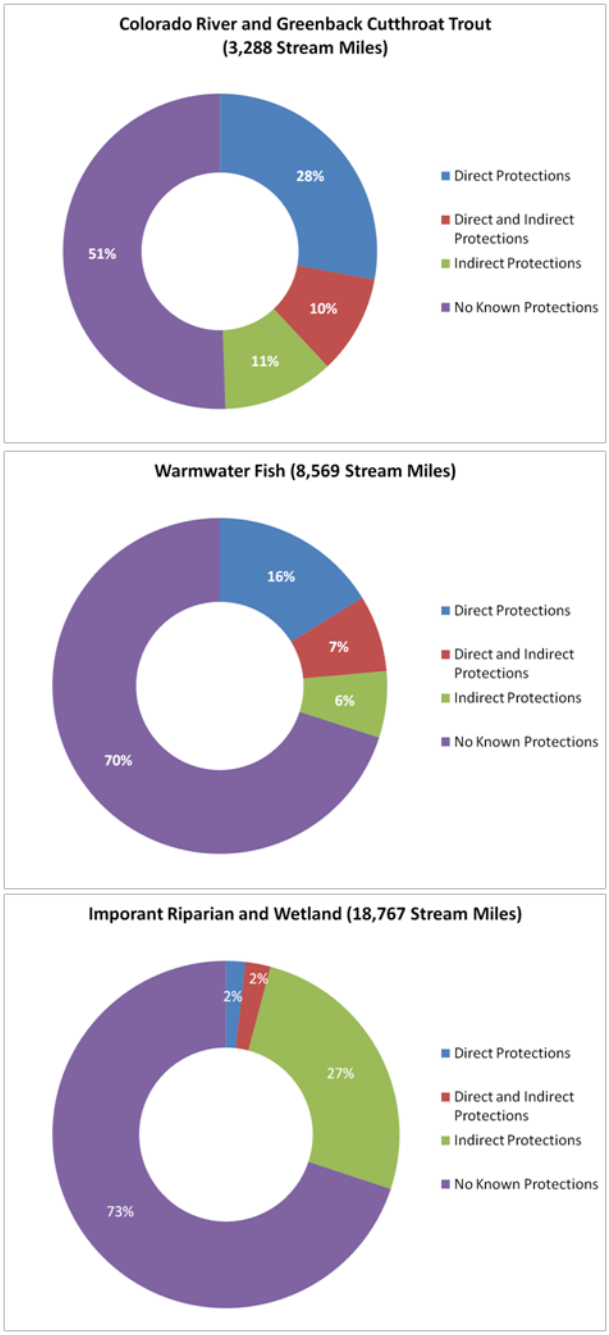

Figure 4. Statewide Direct and Indirect Protections

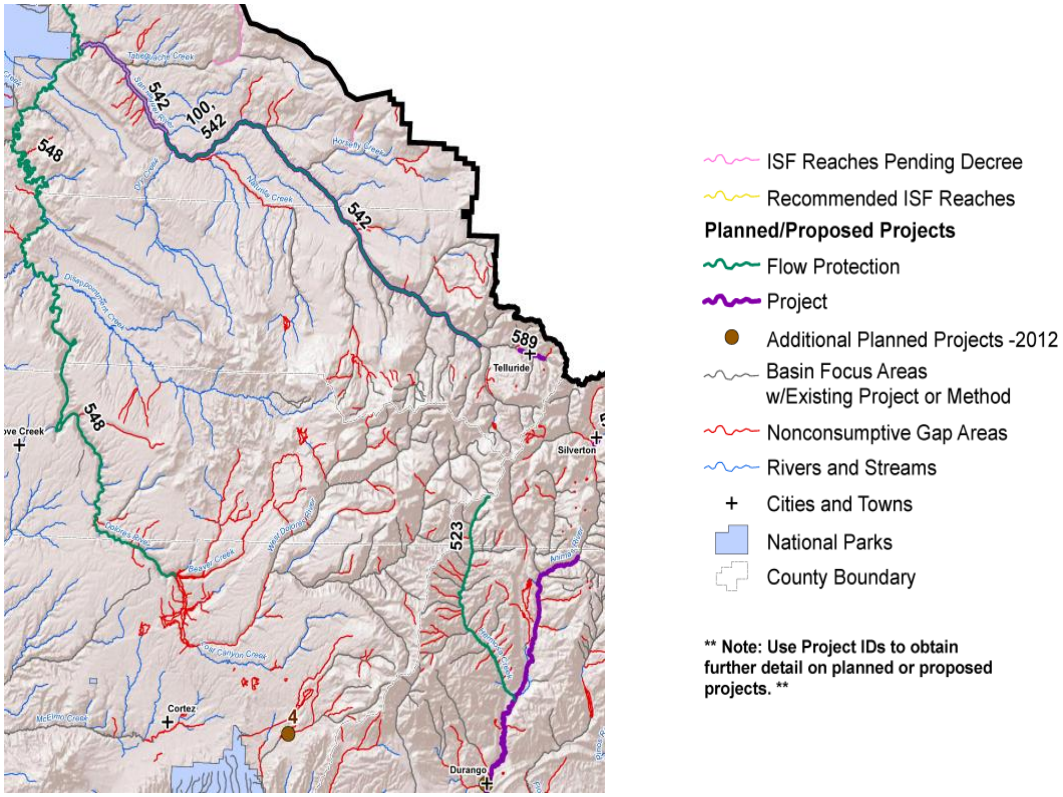

Figure 5. Close-up of Mapping Detail in the Southwest Basin

This overlay enables the users to ask a series of questions such as:

- For each focus segment, are there protections in place for the attributes?
- If protections are in place, are they sufficient to maintain/sustain the attributes?
- If protections are either insufficient or are not present, what additional action can be taken to maintain the attributes?

Step D. Decision Process

The decision tree in **Figure 6** can be used to identify what should be done to ensure the long-term maintenance of an environmental or recreational attribute on a specific stream reach, which may have been identified through Step C. These actions should support basinwide goals (Step A) and measurable outcomes (Step B). The decision tree was developed in partnership with the Colorado Basin Roundtable to assist in determining what types of projects or methods may be needed in a given reach. It emphasizes the types of protection or restoration that may be needed for a given water body. Examples of restoration activities include improving habitat, water quality, or flow conditions in a given reach. For water body protection, projects and methods could include policy mechanisms or voluntary agreements. The flow chart illustrates that there are many different options for developing nonconsumptive implementation plans and completing projects and methods for nonconsumptive needs in the future.

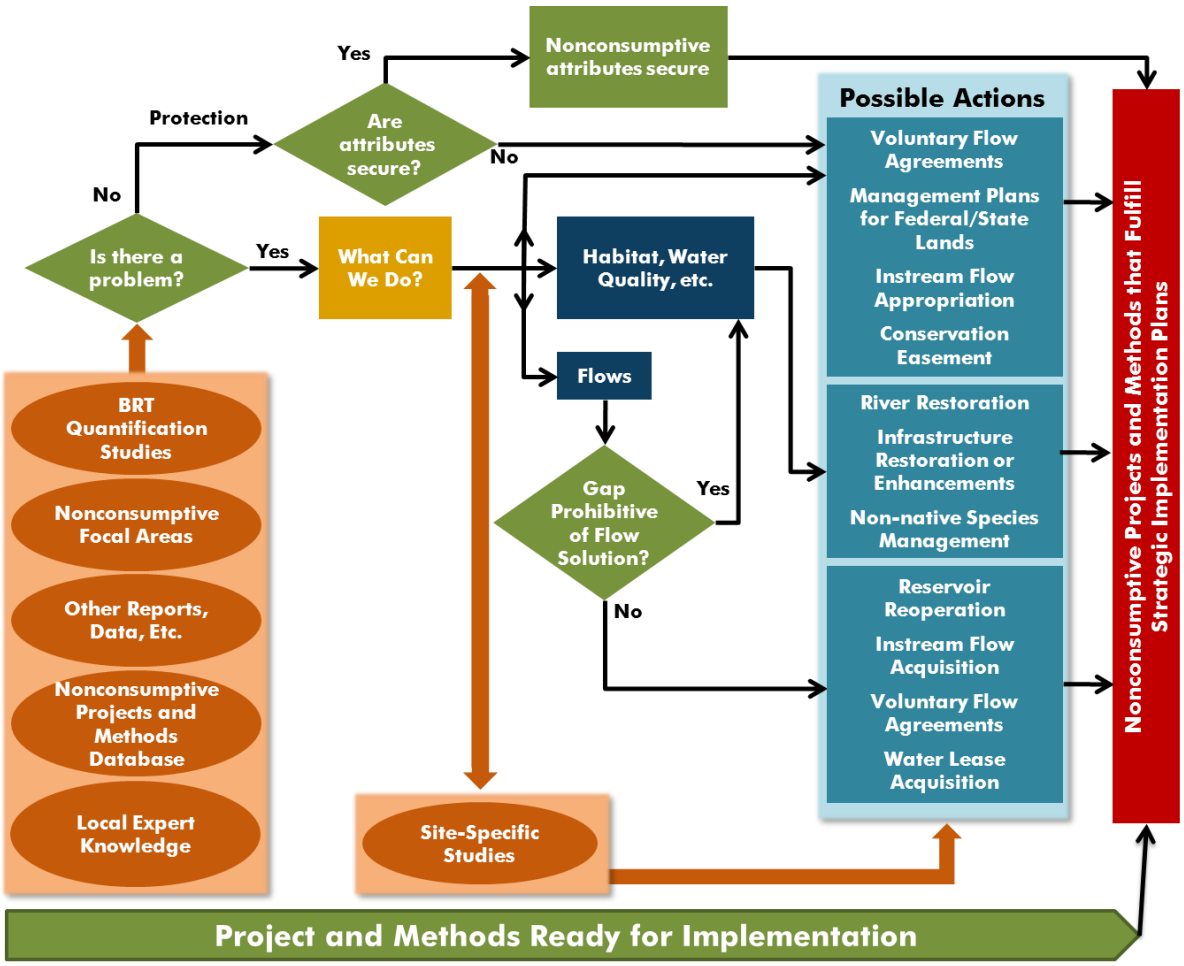

Figure 6. Decision Tree for Planning and Implementing Nonconsumptive Projects

If a roundtable chooses to develop its implementation plan, this decision tree might be applied to a mapped focus area where an environmental or recreational attribute is present. In this case, the decision tree could guide the practitioner to an understanding of what actions are needed in relevant focus segments or locations across the entire watershed. Alternatively, the decision tree can be used on an individual stream segment to identify what should be done in that segment.

Although significant information has been gathered, there may be segments or locations with environmental or recreational attributes where there remains insufficient information to answer the first question in the decision tree: Is there a problem? In this case, the science tools can be used to understand what attribute(s) may be at risk, but actual monitoring of ecological and recreational indicators may be required to identify the extent to which an attribute exists, if an attribute is of concern and the actual factors impacting the attribute.

The template in the following section illustrates how to walk through the decision tree to make choices about possible actions to meet nonconsumptive needs. This template demonstrates the process by first isolating each node in the decision tree and describing its intention. At each node, one or more tools can help with understanding where and how one can proceed to meet nonconsumptive needs. The template indicates the level of information that should ideally be used in developing each project.

Immediately following the template is a series of example "challenge statements." These challenge statements enter the decision tree at the node labeled "Is there a problem?" The challenge statement itself provides the answer to that question, thereby assuming that much is already known about the attributes in the stream, river, wetland, or reservoir being considered.

There are various funding options to support implementation of nonconsumptive projects and methods. These funding sources are described in **Appendix E**. **Appendix F** contains case studies that utilize the template below to provide examples on implementing nonconsumptive projects and methods. **Appendix G** summarizes existing programs that are available to assist in the implementation of nonconsumptive projects and methods at the local, state, and federal level.

Example Decision-Making Template to Use in Basin Implementation Plans

Collect background on environmental and recreational attributes, protections, and gaps.

STEP 1: Challenge/Problem Statement: Identify the problem and create a challenge statement that identifies the attributes affected.

STEP 2: Decision-Making Process: Participation by a broad group of stakeholders is a vital component of assuring that the problem is adequately identified or that the attributes are secure. The stakeholder group would help determine whether additional work is needed to clarify the issue or contributing factors.

A. **Assembling Stakeholder Group:** Develop a plan to engage diverse stakeholders, including, but not limited to, watershed groups, agricultural water users, water suppliers, municipal entities, and conservation groups.

B. **Issue Clarification / Contributing Factors:** Refer to site-specific studies, pilot projects, stakeholder review processes, reliance on expert opinion, etc. to clarify the issues and identify contributing factors.

STEP 3: Identify Measurable Outcomes: What can we do? What are the local-scale measurable outcomes? How do these fit into basin- and state-level goals? What tools can we use? A measurable outcome is a statement that articulates—in measurable or quantifiable terms—the desired state of an attribute as a result from an action or decision.

C. **Identify Attributes:** What are the observed and measured ecological or recreational attributes of the reach? Is there adequate protection of those attributes?

D. **Choosing the right tool(s) to address the challenge:** After reviewing and evaluating available tools, seek stakeholder agreement on which tool is (1) most appropriate to address the challenge or problem, and (2) will achieve the best results.

- **Tool 1:** Describe the tool and why it was chosen, e.g., channel reconfiguration
- **Tool 2:** Describe the tool and why it was chosen, e.g., ISF

STEP 4: Categorize Information Needs.

E. Identify possible actions: Describe science and what types of ecosystem structure/function needs to be addressed.

STEP 5: Implementation Process: This may need to be repeated for each tool.

Implementation Plans

F. Planning/Assessment: Describe planning/assessment process, including any site-specific studies that are needed and the costs associated with it, including potential sources of funding.

G. Design: Describe the design process, including any site-specific studies that are needed and the costs associated with it, including the sources of funding. Design may include several steps, such as 30 percent, 60 percent, and final design.

H. Permitting: Permitting process, including the costs associated with it and the sources of funding. Include a list of the local, state, and federal permits that were needed.

I. Construction: Describe construction process, including the costs associated with it and the sources of funding.

Monitoring: Include the scope, final results and the benefits of the project. Describe pre-, post-, and long-term project monitoring. Include pre- and post-project photos.

Nonconsumptive Projects and Methods

Example Challenge Statements

The following challenge statements are provided as examples for practitioners who are ready to determine what types of actions are most desirable to restore or maintain specific attributes. Each example serves as a type of "story problem" and then moves through the decision tree to determine what types of methods might serve to meet a measurable outcome. These challenge statements are based on the assumption that the practitioner already has some understanding of existing baseline conditions. The decision tree guides practitioners through project planning and the implementation process after baseline conditions have been inventoried and environmental and recreational attributes have been assessed.

1) There is a degraded population of an imperiled aquatic species (federal- or state-listed threatened or endangered species, candidate for federal listing, state-listed species of special concern) or recreational fishery:
    a. Include existing protections of these species in your implementation plan.
    b. Is the problem habitat-related? If so, what types of habitat improvements are needed? Some examples include:
        i. Riparian habitat improvements – bank restoration that affects temperature or water quality concerns, such as bank stabilization and vegetation plantings.
        ii. Instream habitat improvements – restoration, such as j hooks, pool rocks, assisting with rock embeddedness.
        iii. Reservoir reoperation – modify reservoir operations to address habitat needs; examples include re-timing of releases or adjusting the temperature of releases, as needed.

c. Is the problem flow-related? If so, what types of flow adjustments are needed? Some examples include:

   i. Infrastructure restoration/enhancement – install a more efficient headgate or ditch system so less water needs to be diverted.

   ii. Voluntary flow agreement/reservoir reoperation – Work with local water provider stakeholders to determine if there is an opportunity to re-time reservoir operations or create additional flows for the degraded aquatic species.

   iii. Instream flow acquisition – Work with a willing local water rights holder to donate, lease, and/or sell all or a portion of their water right. These water rights can only be held by the CWCB, so it is necessary to work with CWCB staff.
   NOTE: The Colorado Water Trust is a nonprofit whose mission is to help with flow-related restoration efforts and may be able to help.

d. Is a flow solution not feasible due to lack of available water?

   i. Channel Reconfiguration – Modify the channel morphology to accommodate lower flows while still providing for a healthy stream.

2) There is a healthy population of an imperiled aquatic species or recreational fishery:

   a. Include existing protections of these species in your implementation plan.

   b. If additional protection is needed, consider:

      i. ISF or natural lake level appropriation – work with CWCB (1) to establish an ISF; (2) to increase an existing ISF water right to meet the needs of the imperiled aquatic species; or (3) to acquire water for ISF use. CPW or the U.S. Bureau of Land Management (BLM) may be partners who can help conduct site-specific flow studies necessary for an ISF appropriation or increase.

      ii. Land management protections – if the attribute is located on state or federally owned land that is not currently being managed to protect the attribute, consider working with the state or federal owner to incorporate protective measures into the land management plan. If the reach is on privately owned land, contact the land owner to explore the possibility of establishing a conservation easement.

      iii. Wild & Scenic River Stakeholder Group process – if the reach containing the attribute is on the Wild & Scenic eligible or suitable list, consider working with an existing Wild & Scenic River Stakeholder Group to consider alternatives to a Wild & Scenic designation for protection of the attribute. If a stakeholder group is not currently in place, consider working to establish one.

      iv. Gold Medal stream designation – work with CPW to establish the reach as a Gold Medal fishery.

      v. Voluntary flow agreement – consider working with existing water rights owners to develop an agreement to establish voluntary flow improvement mechanisms.

3) There is a degraded rare riparian or wetland plant community:

   a. Include existing protections of this plant community in your implementation plan.

   b. Is the problem habitat-related?

i. Riparian/wetland habitat improvements – bank restoration that affects temperature or water quality concerns, such as bank stabilization and vegetation plantings.

c. Is the problem flow-related?

i. Infrastructure restoration/enhancement – see 1.b.i.

d. Is a flow solution not feasible due to lack of available water?

i. Channel reconfiguration – Modify the channel morphology to accommodate the new low-flow channel and still provide for a healthy stream.

4) There is an outstanding example of a riparian or wetland plant community:

a. Include existing protections of these species in your implementation plan.

b. If the plant community is not protected, consider:

i. Management plan with government entity that owns the property – If the property is owned by CPW, the U.S. Forest Service, or the BLM, consider working with them to protect the area.

ii. Conservation easement – If the property is privately owned, a conservation easement could be considered. Conservation easements can even specify how the water is managed on the property.

iii. ISF or natural lake level – See 1.c.iii.

5) There is a reach of river that is overused by anglers or boaters:

a. Develop fee/license structure.

b. Educate commercial outfitters and clients on best practice.

c. Improve access point infrastructure (this could help with riparian habitat as well).

d. Develop better access to neighboring streams that are currently underutilized.

6) There is an outstanding recreational (boating or fishing) river reach:

a. Include existing protections of the recreational values in your implementation plan.

b. If it is not protected, consider:

i. Wild & Scenic alternatives.

ii. Federal or state management plans.

iii. Recreational In-Channel Diversions (RICDs).

iv. Access easements.

v. Improved access infrastructure.

vi. Work with CPW to designate a recreational area (i.e., the Arkansas Headwaters Recreational Area through state parks).

7) There is an underutilized recreational reach, which has the potential to attract needed tourism dollars to a particular community:

a. Improve access points.

b. In-channel improvements – Develop a whitewater park (if boating related) or improve fishery.

c. Develop and distribute a guide to publicize the recreational reach.

d. Gold Medal Trout Fishery Designation.

References

Colorado Water Conservation Board (CWCB). 2011. Statewide Water Supply Initiative 2010. CDM Smith, Denver, Colorado.

Stalnaker et al. 1995. The instream flow incremental methodology: a primer of IFIM. Biological Report No. 29, National Biological Service, U.S. Department of the Interior, Fort Collins, Colorado.

Appendix A

Scientific Information Related to Environmental Attributes

Appendix A

Scientific Information Related to Environmental Attributes

Nonconsumptive implementation plans should identify clear measures of success and monitoring protocols to define when an ecosystem is sufficiently protected or has recovered. Meeting environmental and recreational needs will in most situations in Colorado, require managing for nonconsumptive needs while also meeting current and future consumptive needs. Thus, basin roundtables need to consider both consumptive and nonconsumptive water needs, and may need to have ongoing mitigation to manage the environment as part of an integrated, adaptive planning approach. Because many nonconsumptive attributes depend on healthy waterways, this section highlights some of the basic physical and biological attributes that need to be considered when planning to maintain or restore a functioning freshwater ecosystem.

Generally, but not always, the factors that support environmental attributes also support recreational attributes. For example, a sustainable, healthy wild trout fishery is most likely in an environment that also has healthy riparian areas. There are situations, however, where nonconsumptive attributes conflict. For example, a native cutthroat trout population cannot be sustained in the same place as a recreational brown trout fishery. Moreover, the Voluntary Flow Program in the Arkansas River Basin balances flows that provide benefits to the "blue ribbon" trout fishery with ideal boating flows (which do not match with fishery objectives). These examples illustrate the importance of a comprehensive plan with clearly identified goals across all attributes and segments in a basin.

Formulating a plan to meet nonconsumptive needs requires understanding the ecological, hydrological, and physical conditions needed to sustain environmental and recreational attributes. It is also essential to identify and understand the policies and regulations that are in place to support those conditions. The following section briefly describes the scientific factors to consider when planning projects to maintain and protect environmental and recreational attributes. The section is organized into two categories—water quantity and habitat. Under water quantity, streamflow conditions, environmental flows, and connectivity are described. The habitat category includes water and habitat quality parameters, such as geomorphic setting, catchment condition, channel dynamics, streamside and floodplain vegetation, flow variability, nonnative species, bank stability, and instream heterogeneity.

Water Quantity

Streamflow

An overarching master variable of a river is its flow regime. Streamflow, or discharge, is the volume of water that moves over a designated point over a fixed period of time, often expressed as cubic feet per second (cfs). Flow is a function of water volume and velocity. The flow of a stream is directly related to the amount of water moving off the watershed into the stream channel. It is affected by weather, increasing during rainstorms and decreasing during dry periods. It also changes during different seasons of the year, increasing in the spring and early summer due to snowmelt and decreasing during the summer months when evaporation rates are high and vegetation is actively growing.

Streamflow is important because of its impact on water quality and on the living organisms and habitats in the stream. Stream velocity, which increases as the volume of the water in the stream increases, determines the kinds of organisms that can live in the stream (some need fast-flowing areas; others need quiet pools) and affects the amount of silt and sediment carried.

Streamflow also affects the quality, quantity, and timing of river-related recreation such as whitewater boating or recreational fishing. As flows increase, different paddling opportunities and challenges exist within ranges of flows on a spectrum—too low, minimal acceptable, technical, optimal, high challenge, and too high (Whittaker et al. 1993; Whittaker & Shelby 2002). Ensuring sufficient flow during late summer is particularly important for fisheries so that fish passage is maintained and temperatures remain within tolerance levels for fish, most notably trout, which are particularly sensitive to high temperatures.

Environmental Flows

Environmental flows are defined as the water regime provided within a river or wetland to maintain ecosystems in which flows are regulated and competing water uses occur. Thus, an environmental flow is the amount of water that can be allocated to maintain an ecosystem following a process of environmental, social, and economic assessment (**Figure A-1**).

The environmental flows concept has been derived from the Natural Flow Paradigm (Poff et al. 1997), which recognizes flow as vital to sustaining ecosystems and a key driver of aquatic ecosystems. Intuitively, it might seem that all of the natural flow, in its natural pattern of high and low flows, would be needed to maintain a near-pristine ecosystem (Dyson et al. 2008). However, many managers and scientists believe that some portion of flow could be removed without measurable degradation of the ecosystem. Multiple approaches and tools exist to determine how much flow is needed to sustain ecological and recreational attributes (some are described in **Appendix C**). These approaches and tools can assist in finding an acceptable balance between a desired ecosystem condition and other social and economic needs for water.

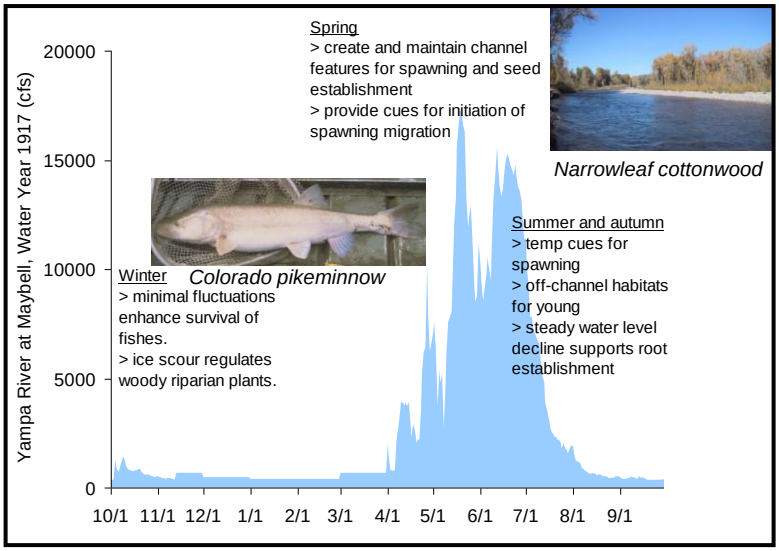

Figure A-1. Flow Dynamics and Ecological Relationships

Timing, or flow management, can be as critical to stream health as quantity of flow (**Figure A-1).** Variable high-flow events restore the following functions—channel maintenance, sediment transport, spawning and migration cues, scouring of riparian and upland vegetation in the channel, and reduction of invasive species. For these reasons, instream flow prescriptions are needed to preserve the ecological health of a river. Reduced stream flow can significantly degrade aquatic and floodplain habitat; may cause loss of fish and wildlife; cause increased erosion, sedimentation, and concentrations of pollutants; and lead to either the loss or increase of river recreation opportunities.

Excess flows can negatively affect instream uses, fish life cycles, riparian habitat, riverbank health, sediment loading, and the safety of recreational rafters and anglers.

Connectivity

Connectivity is defined as the maintenance of lateral, longitudinal, and vertical pathways for biological, hydrological, and physical processes (Annear et al. 2004). Connectivity is a measure of the degree to which water, organisms, and suspended elements can move across the fluvial system landscape (**Figure A-2**). It refers to the flow, exchanges, and pathways that move organisms, energy, and materials through a watershed. For a river system, this continuum of hydrological, biological, and chemical interactions and connections is described along the same four dimensions used to describe the hydrologic system (Annear et al. 2004):

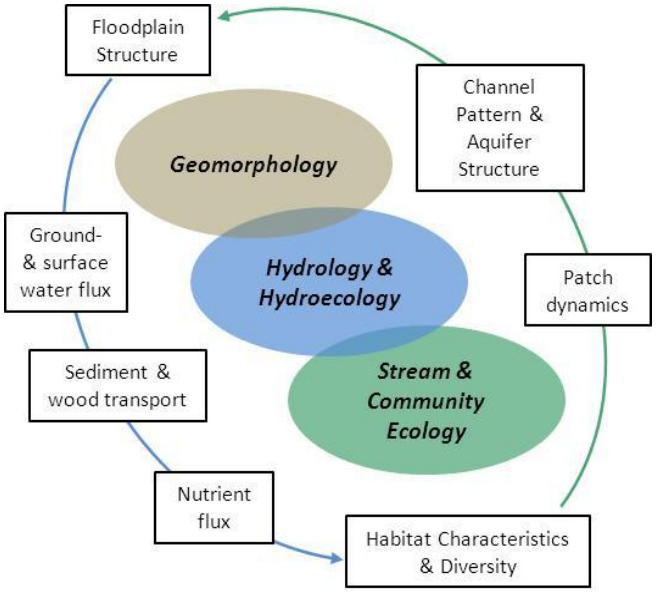

Figure A-2. Dimensions of Hydrologic Connectivity

- Longitudinal (upstream and downstream)
- Lateral (channel to floodplain)
- Vertical (below surface, in the sediment surrounding the channel)
- Temporal (continuity over time)

In some cases connectivity may be almost continuous, such as a mainstem river, or discontinuous, such as ephemeral tributaries, wetlands, or oxbows that are recharged during times of flood. Many native fish use inland waterways to migrate to different habitat at key stages in their life cycle, such as to breed, avoid predators and competitors, and to find feeding grounds. It is vital to ensure fish have access to these different habitat areas.

Longitudinal connectivity. Describes the degree of connection along the main direction of flow (upstream – downstream) for water, sediment, aquatic organisms, and other elements in the river. Some materials, such as sediment, may enter the system mainly as upstream inputs. Other elements, such as woody debris, may develop mainly within the system and either move downstream or remain close to the location they formed (**Figure A-3**). Longitudinal connectivity within a channel can be reduced by levee construction, channel incision, culverts, headgates, diversion practices, or reduced floods downstream from dams (Gergel et al. 2002).

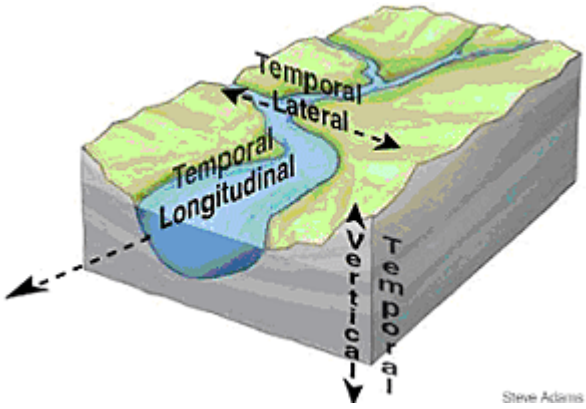

Figure A-3. Longitudinal, Lateral, and Vertical River Connectivity *Source: Minnesota DNR*

Lateral connectivity. Describes the degree of connection from the channel to the floodplain (i.e., across the landscape). Water and suspended elements in a stream floodplain system move out onto the floodplain only during flood events. The frequency and duration of flows affects lateral connectivity to a much larger degree than longitudinal connectivity because the degree of lateral connection is based upon the flow stage of the system. Human-induced lateral hydrological barriers include water storage or diversion activities that reduce peak discharges. The reduced peaks reduce the system's stage, which also decreases floodplain productivity, nutrient exchange, and dispersal of biota between the river and floodplain wetlands (Jenkins and Boulton 2003).

Vertical connectivity. Describes the mixing and interaction of surface water with groundwater in the sediments below the river in a biologically active zone known as the hyporheic zone (Poole et al. 2006). This zone is where water percolates through the soils adjacent to the open streambed and important microbial activity and chemical transformations occur. Vertical hydrological connectivity is less readily apparent in rivers, and its reduction through human actions is less obvious than disruptions to longitudinal and lateral connectivity. Vertical connectivity can be reduced by physical barriers that reduce permeability such as siltation and the clogging of pore spaces of streambed gravels (Hancock 2002), or physical changes that reduce hydraulic gradients, such as straightening and simplifying channel form or decreased flow dynamics.

Temporal connectivity. Describes the continuous physical, chemical, and biological interactions rivers display over time according to a rather predictable pattern. These temporal changes are important to the functioning of the ecosystem and underpin most river ecosystem processes (Kondolf et al. 2006). Over time sediment shifts, meanders form, bends erode, oxbows break off from the main channel, and channels shift and braid. A stream rises and falls according to seasonal patterns, depending on rain and snowmelt. Throughout most of Colorado, free-flowing rivers experience high water in spring/early summer, falling flows through the summer, moderate flows in fall, and base flows in winter. The watershed has adjusted to these normal fluctuations, and many organisms have evolved to depend on them. Temporal connectivity can be particularly important in ephemeral streams of Colorado's eastern plains (Falke et al. 2010).

Habitat

Geomorphic Setting

The geographic location, or geomorphic setting, of a river or wetland may determine habitat functions and the location within a watershed may determine the hydrologic or water quality functions. The shape of a river or stream channel from bank to bank and along its length determines: 1) how water in the channel flows, and 2) the amount of habitat available for aquatic and riparian wildlife. The channel shape also contributes to the stability of the stream section as a whole. As such, geomorphic setting is another master variable, affecting temperature, the amount of pools and riffles, and whether high flows create backwater habitat or replenish riparian plant communities. Ultimately, the geomorphology of a river or stream determines if the amount of water flowing through the reach is sufficient to sustain environmental attributes. The importance of geomorphic setting has been described at some length in the appendices on the relationship between riparian areas and flow in the Watershed Flow Evaluation Tool studies for the Colorado Basin[6] and the Yampa-White Basin[7].

[6] http://cwcb.state.co.us/water-management/basin-roundtables/Pages/ColoradoBasinRoundtable.aspx
[7] http://cwcb.state.co.us/water-management/basin-roundtables/Pages/YampaWhiteBasinRoundtable.aspx

Water Quality

Water quality refers to the physical, chemical, and biological characteristics of water (U.S. Environmental Protection Agency Water Quality website).[8] Water quality factors include the amount of sediment, salts, nutrients, metals, and other pollutants; the amount of available oxygen for aquatic species; and temperature. Changes in water quality can be caused by pollution from both point sources (such as industrial and treated sewage discharges) and diffuse sources (such as stormwater runoff from agricultural and urban areas). Physical factors (such as climate, geology, slope, and soil type) combine with the consequences of past and current land uses to affect the rate and volume of runoff from land and the flow in the waterway. Other factors that affect how much soil, nutrients, and other pollutants are carried by runoff into the waterway include the presence and quality of streamside and floodplain vegetation, ground cover, and agricultural and grazing practices. Flow dynamics are important for maintaining habitat, aquatic biodiversity, channel form, bank stability, and help to prevent the development of algal blooms.

Habitat Quality

"Habitat quality" incorporates all aspects of physical and chemical constituents along with biotic interactions. The definition of "habitat" can be narrowed to the quality of the instream and riparian habitat that influences the structure and function of the aquatic community in a stream. The natural and physical habitat structure, and associated hydraulic characteristics, can contribute to variations in species composition and abundance both within the stream channel and in the adjacent riparian zone (Peck et al. 2003).

Nonnative species. The presence of nonnative species, including plants, animals, and microscopic organisms, is often a result of altered habitat conditions. While some nonnative aquatic species are relatively innocuous and do not compete with native species, many are successful at invading and spreading in an area, outcompeting native species, disrupting food chains, and changing nutrient cycles. In Colorado, predation or competition by nonnative fish species is a serious threat to the endangered and imperiled fish species and perhaps the most challenging to manage. Without natural checks on populations, invasive nonnative species thrive and can dominate an area. These changes can be harmful to both the ecosystem and local economy. For example, smallmouth bass pose a major threat to reproduction by endangered fish on the Yampa River, and the recent presence of quagga mussels threatens to harm recreational fisheries in reservoirs. Quagga mussels can potentially clog water delivery systems. In addition, nonnative plant species, such as tamarisk and Russian olive, can reduce species diversity in riparian habitats. Other nonnative plant species crowd out stream channels or small lakes, directly reducing habitat for fish and other aquatic species.

Bank stability. The stability of a river bank depends on a number of factors such as the size, geometry, and structure of the bank; the properties of the bank material; the hydraulics of flow in the adjacent channel; presence of vegetation; and climatic conditions (Thorne 1982). Riverbank erosion is a natural process, but often, human activities can have a significant impact on the rate of change (Chakraborty and Choudhury 2009). For example, the construction and operation of a reservoir can have a substantial effect on the stability of the river channel downstream from the dam. Primary changes introduced by a dam include a reduction in the river's sediment load and an alteration of the flow regime. Such artificially introduced changes may trigger an adjustment by the river as it attempts

[8] http://water.epa.gov/scitech/swguidance/standards/

to re-establish an approximate equilibrium between the channel and the discharge and sediment load being transported.

Riparian plant communities. The riparian zone—the interface between terrestrial and aquatic habitats along streams and rivers—is a key component of river ecosystems, providing many ecological, aesthetic, and economic benefits (Arthington et al. 2006). The presence and quality of riverbank and floodplain vegetation can significantly influence instream water quality and habitat structure. Riparian vegetation composition, structure, and abundance are governed to a large degree by flow regime and flow-mediated fluvial processes (Merritt et al. 2009). Floods maintain the active channel area and the surface and vegetation disturbance needed for diversity. Water provided to riparian areas during floods helps to maintain vegetation that is not able to persist in surrounding dry landscapes. River regulation typically reduces flood disturbance and sediment supply, permitting invasion by exotic plants (e.g., tamarisk) and slowing changes in plant communities that occur over time after a disturbance.

Instream heterogeneity. Habitat complexity (heterogeneity) is a primary factor affecting diversity of fish assemblages and the quality and quantity of physical habitat available to aquatic organisms in rivers and streams (Bunn and Arthington 2002). Habitat conditions are generally characterized in terms of current velocity, depth, composition of the stream bed, and instream cover, such as large woody debris, undercut banks, boulders, etc. (Bovee et al. 1998). Many riverine organisms have evolved life history strategies that correspond to the natural flow regime and are especially sensitive to changes in the magnitude, duration, frequency, timing, and rate of change of flow conditions (Richter et al. 1996).

References

Annear, T., I. Chisholm, H. Beecher, A. Locke, P. Aarrestad, C. Coomer, C. Estes, J. Hunt, R. Jacobson, G. Jobsis, J. Kauffman, J. Marshall, K. Mayes, G. Smith, C. Stalnaker, and R. Wentworth. 2004. Instream Flows for Riverine Resource Stewardship, Rev. Ed. Cheyenne, WY: Instream Flow Council. 267 pp.

Arthington, A.H., S.E. Bunn, N.L. Poff, and R.J. Naiman. 2006. The challenge of providing environmental flow rules to sustain river ecosystems. Ecological Applications 16: 1311–18.

Bovee, K.D., B.L. Lamb, J.M. Bartholow, C.B. Stalnaker, J. Taylor, and J. Henriksen. 1998. Stream habitat analysis using the instream flow incremental methodology. U.S. Geological Survey, Biological Resources Discipline Information and Technology Report USGS/BRD-1998-0004. viii + 131 pp.

Bunn, S.E. and A.H. Arthington. 2002. Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity. Environ Manage 30: 492–507.

Chakraborty, D. and D. Choudhury. 2009. Investigation of the behavior of tailings earthen dam under seismic conditions. Am. J. Eng. Applied Sci., 2: 559-564. DOI: 10.3844/ajeassp.2009.559.564Collier et al., 1995.

Dyson, M., G. Bergkamp and J. Scanlon (eds). 2008. Flow – The essentials of environmental flows, 2nd Edition. Gland, Switzerland: IUCN. Reprint, Gland, Switzerland: IUCN, http://data.iucn.org/dbtw-wpd/edocs/2003-021.pdf.

Falke, J.A., K.D. Fausch, R. Magelky, A. Squires, D.S. Durnford, L.K. Riley, and R. Oad. 2010a. The role of groundwater pumping and drought in shaping ecological futures for stream fishes in a dryland river basin of the western Great Plains, USA. Ecohydrology. doi:10.1002/eco.158.

Gergel, S.E., M.D. Dixon, and M.G. Turner. 2002. Consequences of human-altered floods: levees, floods, and floodplain forests along the Wisconsin River. Ecological Applications 12:1755–1770.

Hancock, P. 2002. Human impacts on the stream-groundwater exchange zone. Environ Manag 29:761–781.

Jenkins, K. M., and A. J. Boulton. 2003. Connectivity in a dryland river: short-term aquatic microinvertebrate recruitment following floodplain inundation. Ecology 84:2708-2723.

Kondolf, G.M., A.J. Boulton, S. O'Daniel, G.C. Poole, F.J. Rahel, E.H. Stanley, E. Wohl, A. Bang, J. Carlstrom, C. Cristoni, H. Huber, S. Koljonen, P. Louhi, and K. Nakamura. 2006. "Process-based ecological river restoration: Visualizing three-dimensional connectivity and dynamic vectors to recover lost linkages." Ecology and Society, 11(2), 5.

Merritt D.M., M.L. Scott, N.L. Poff, and D.A. Lytle. 2009. Theory, methods, and tools for determining environmental flows for riparian vegetation:riparian vegetation flow response guilds. Freshwater Biology, doi: 10.1111/ j.1365-2427.2009.02206.x.

Peck, D.V., J.M. Lazorchak, and D.J. Klemm (editors). Unpublished draft (2003). Environmental Monitoring and Assessment Program -Surface Waters: Western Pilot Study Field Operations Manual for Wadeable Streams. U.S. Environmental Protection Agency, Washington, D.C.

Poff, N.L., J.D. Allan, M.B. Bain, J.R. Karr, K.L. Prestegaard, B.D. Richter, R.E. Sparks, and J.C. Stromberg. 1997. The natural flow regime. BioScience 47:769-784.

Poole, G.C., J.A. Stanford, S.W. Running, and C.A. Frissell. 2006. Multiscale geomorphic drivers of groundwater flow paths: subsurface hydrologic dynamics and hyporheic habitat diversity. Journal of the North American Benthological Society 25(2):288-303.

Richter, B.D., J.V. Baumgartner, R. Wigington, and D.P. Braun. 1996. How much water does a river need? Freshwater Biology 37:231-249

Thorne, C.R., 1982. Processes and mechanisms of river bank erosion. In: Hey, R.D., Thorne, C.R., Bathurst, J.C. (Eds.), Gravel-bed Rivers. Wiley and Sons, Chichester, UK, pp. 227–259.

Whittaker, D., B. Shelby, W. Jackson, and R. Beschta. 1993. Instream flows for recreation: a handbook on concepts and research methods. U.S. Department of Interior, National Park Service, Anchorage, AK

Whittaker, D. and B. Shelby. 2002. Evaluating instream flows for recreation: applying the structural norms approach to biophysical conditions. Leisure Sciences 24(3):363-374.

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Appendix B

Examples of Measurable Outcomes

Appendix B

Examples of Measurable Outcomes

The emergence of new, complex water resources challenges has stimulated the development of a variety of new approaches to systematically plan, prioritize, and implement environmental actions. Measurable outcomes serve as a way to articulate, in determinate or quantifiable terms, the desired state of an attribute or target for nonconsumptive project planning. Measurable outcomes allow for stakeholders and basin roundtables to identify specific outcomes and track measures of success for local-scale projects and strategic basin roundtable implementation plans. The following annotated list includes several examples of organizations and programs that have identified specific measurable outcomes and adopted adaptive management frameworks for project planning.

Colorado Natural Heritage Program's Natural Heritage Ranking System

The Colorado Natural Heritage Program's (CNHP) Natural Heritage Ranking System[9] has conducted inventories for rare animals, plants, wetlands, riparian areas, and plant communities across multiple scales. Their ranking system identifies those species and ecosystems most in need of protection and quantifies minimum requirements to maintain those attributes. Species and ecosystems are ranked on the global, national, and subnational/state/province levels. From these data, CNHP has developed Colorado's Biodiversity Scorecard,[10] giving a comprehensive overview of the status of Colorado's biological wealth. CNHP is using species distribution modeling to refine and economize efforts to search for previously unknown populations. CNHP's work has been incorporated into Colorado Parks and Wildlife's "Colorado's Comprehensive Wildlife Conservation Strategy (CWCS)"[11] to help identify criteria and develop lists of species of greatest conservation need. **Table B-1** depicts these criteria. The species with the greatest conservation needs identified by CNHP represent the diversity and health of the state's wildlife most in need of attention.

Table B-1. Criteria Used to Develop List of Species of Greatest Conservation Need in CWCS

Inclusion Criteria	***Meeting any of the following:***
	Listed as federal candidate, threatened or endangered species under the ESA
	Classified as state endangered or threatened species, or species of special concern
	Global ranking scores of G1, G2, or G2 by the CNHP
	Identified as conservation priorities through a range-wide status assessment or assessment of large taxonomic divisions
	Assigned state ranking scores of S1 and S2 AND a global ranking score of G4 by the CNHP
Exclusion Criteria	***Species meeting the inclusion criteria were eliminated from the Species of Greatest Conservation Need listing if they met any of the following:***
	Occurs peripherally in Colorado but is common elsewhere AND for which management actions in Colorado are likely to have no population-level effects
	Very common but were placed on lists due to economic considerations (e.g., Mallard)

[9] http://www.cnhp.colostate.edu/about/heritage.asp
[10] http://www.cnhp.colostate.edu/download/documents/2011/Scorecard_march1_2012_final.pdf
[11] http://wildlife.state.co.us/SiteCollectionDocuments/DOW/WildlifeSpecies/CWCS_FinalReport2006.pdf

Nature Conservancy's Specific Conservation Targets

The Nature Conservancy's Ecoregional Planning[12] process identifies specific conservation targets (i.e., the species, communities, and ecological systems that characterize the natural diversity of an ecoregion) and sets measurable conservation goals that specify the number and distribution of conservation targets that must be preserved in order to conserve the biological diversity of an ecoregion. Within this process, data on the location and condition of specific individual occurrences of conservation targets is then used to identify a portfolio of areas of biodiversity significance that meet the specified conservation goals to ensure the long-term survival of the ecoregion's natural diversity (Groves et al. 2000). The ultimate goal of ecoregional planning efforts is to conserve the biodiversity representative of an ecoregion—to keep the common species common and prevent extinction or decline of rare species. Because it is impractical to plan individually for each native species (there are over 3,000 species of native plants alone), conservation goals are typically set by species only for imperiled species while common species are maintained by conserving ecosystems or habitats. The targets occur at a variety of scales, from local to regional (TNC 2001).

An Ecoregional Assessment and Conservation Blueprint[13] was published for the Southern Rocky Mountains in partnership with several conservation organizations and indicates that approximately 30 percent of a species historical rank should be preserved in order to maintain species viability. **Table B-2** is adapted from the report and indicates several conservation objectives depending on global rank and distribution within the Southern Rocky Mountains. The 2001 Southern Rocky Mountain report goes on to indicate where several individual species are in relation to these objectives. Some fish species examples are included in **Table B-3** below. According to this approach and the data, the Rio Grande, Greenback, and Colorado River cutthroat trout species have a sufficient number of populations to sustain species viability, while the roundtail chub, Colorado pikeminnow, and razorback sucker do not.

Table B-2. Species Viability
Quantifies numbers needed for viable species populations at different levels of rarity and species distributions

Conservation Category	Definition	Conservation Objectives	Conservation Goal Set by EDU
G1-G2/T1-T2	Endangered, threatened, imperiled	All viable/restorable occurrences up to 25	All occurrences per Ecological Drainage Units (EDU)
G3-G5 with Endemic Distribution	Vulnerable (rare/uncommon), apparently secure (uncommon but not rare), secure (common, widespread, and abundant)	At least 20 viable occurrences	At least 3 per EDU
Limited Distribution	50-90% of species' distribution is w/in ecoregion and species is limited to 2-3 ecoregions	At least 20 viable occurrences	At least 3 per EDU
Disjunct Distribution	Species distribution likely represents significant genetic differentiation from populations; > 2 ecoregions separate this target distribution from its range	At least 15 viable occurrences	At least 3 per EDU
Widespread Distribution	10-50% of species distribution occurs w/in ecoregion and in more than 3 ecoregions	At least 10 viable occurrences	At least 2 per EDU

[12] http://conserveonline.org/workspaces/cbdgateway/cap/index_html
[13] http://conserveonline.org/coldocs/2002/02/SRMreport.pdf

Table B-2. Species Viability
Quantifies numbers needed for viable species populations at different levels of rarity and species distributions

Conservation Category	Definition	Conservation Objectives	Conservation Goal Set by EDU
Peripheral Distribution	Less than 10% of species distribution occurs within ecoregion	At least 5 viable occurrences	At least 2 per EDU
Regional-Wide-ranging Species		At least 1 viable population. Case by case evaluation	Initial focus on core habitat and landscape linkages

Table B-3. Conservation Goals/Results by Target
Shows a section of the Southern Rocky Mountain Report's Appendix 14[14]

Scientific Name	Common Name	SRM Goal	Known Amount in Portfolio	Known % Goal Met
GILA ROBUSTA	ROUNDTAIL CHUB	25	5	20%
ONCORHYNCHUS CLARKI PLEURITICUS	COLORADO RIVER CUTTHROAT TROUT	20	135	675%
ONCORHYNCHUS CLARKI STOMIAS	GREENBACK CUTTHROAT TROUT	25	32	128%
ONCORHYNCHUS CLARKI VIRGINALIS	RIO GRANDE CUTTHROAT TROUT	20	101	505%
PTYCHOCHEILUS LUCIUS	COLORADO PIKEMINNOW	20	4	20%
XYRAUCHEN TEXANUS	RAZORBACK SUCKER	25	3	12%

The 2006 Central Shortgrass Prairie Ecoregional Assessment and Partnership Initiative[15] also used the NatureServe/Natural Heritage Program ranking system to identify native species, plant communities, and ecological systems representative of the ecoregion to focus planning and conservation efforts. The process identified 146 animal and plant species that are state- and/or federally-listed, or are considered imperiled, endemic, or declining. Also included are species assemblages (black-tailed prairie dog animal community), shorebird aggregation areas, 117 natural plant communities, 21 terrestrial ecological systems, and 79 aquatic ecological systems that represent common species. The ultimate goal of the Assessment and Partnership Initiative is to conserve the biodiversity representative of the ecoregion—to keep the common species common and prevent extinction or decline of rare species. A set of "conservation targets" was selected, occurring at a variety of spatial scales from local to regional. Three levels of biological organization (terrestrial and aquatic ecological systems, natural plant and animal communities, and species) represented biological diversity, and were the focus of conservation planning and action. **Table B-4** provides a summary of initial goals for groups of targeted species and species assemblages (Neely et al. 2006).

Table B-4. Conservation Goals
Targeted species, expressed as three risk levels for developing various conservation scenarios

Distribution	High Risk Scenario	Moderate Risk Scenario	Low Risk Scenario
	Number of Viable Occurrences (post 1985)		
G1-G2 Species	All viable	All viable	All viable
G3-G5 Species			
Endemic	21	42	80
Limited	10	21	42
Disjunct	5	10	21
Widespread	5	10	21
Edge of Range	2	5	10

[14] http://conserveonline.org/coldocs/2002/02/SRMreport.pdf
[15] http://conserveonline.org/workspaces/csp/report/csp_final

American Whitewater's [Flow Studies]

American Whitewater's[16] flow studies document water volumes necessary for a range of whitewater flows between minimum acceptable and optimum, using methodologies to obtain the supporting preference data. The flow studies are designed to give paddlers and river enthusiasts an opportunity to identify their preferred flows for a range of recreational experiences. Recommendations from these studies identify important boating reaches and quantify minimum, optimum, and maximum flows in those reaches to support whitewater recreation.

As with many nonconsumptive attributes, streamflow is only one of the many variables that may affect recreational resources. Other factors that affect actual recreational use include but are not limited to the time of year, weather conditions and river access. It is important to consider non-flow related parameters along with flow in any measurement of floatboating conditions.

Colorado Parks and Wildlife's [Programs]

Colorado's Wildlife Action Plan[17] and the Colorado Recovery and Conservation Plans[18] are designed to take a strategic habitat conservation approach using an adaptive resource management framework composed of five key elements—biological planning, conservation design, conservation delivery, decision-based monitoring, and assumption-driven research. This approach establishes specific, measurable objectives and uses models relating populations to limiting factors to target management and assess its impacts. A "taxonomy of actions" was developed for species and for habitats to summarize this information in a consistent format. Conservation actions for species and key habitats were prioritized on a scale of High, Medium, or Low, based on expert input, existing recovery/ management plans, and staff experience/expertise (CWCS 2006). The process is designed to be iterative and focused on developing and refining a conservation strategy, making efficient management decisions, and using research and monitoring to assess accomplishments and inform future iterations of the conservation strategy. The Action Plan is not an Endangered Species Recovery Plan, nor is it a type of regulatory or "decision" document. Its purpose is to identify the state's wildlife conservation needs in order to foster greater consistency in conservation efforts among all members of Colorado's wildlife conservation community and others with a stake in Colorado wildlife conservation (CPW website[19]).

The CPW's Conservation and Recovery Plans[20] target specific species and includes an extensive list of amphibians, birds, fish, and mammals. One example, the Greenback Cutthroat Trout Recovery Plan, established two central measurable outcomes. The first was to simply maintain existing populations of greenback trout populations. The second was more quantitative, setting out to restore the greenback cutthroat trout to nonthreatened status within its native range and delist the species by the year 2000. These goals can be accomplished by maintaining at least 20 stable greenback populations occupying at least 50 hectares (124 acres) of lakes and ponds and 50 kilometers (31 miles) of stream. These measurable outcomes exemplify the quantitative targets that guide restoration and planning practices in the Conservation and Recovery Plans.

[16] www.americanwhitewater.org/
[17] http://wildlife.state.co.us/WildlifeSpecies/ColoradoWildlifeActionPlan/Pages/ColoradoWildlifeActionPlan.aspx
[18] http://wildlife.state.co.us/WildlifeSpecies/RecoveryConservationPlans/Pages/RecoveryConservationPlans.aspx
[19] http://wildlife.state.co.us/WildlifeSpecies/ColoradoWildlifeActionPlan/Pages/ColoradoWildlifeActionPlan.aspx
[20] http://wildlife.state.co.us/WildlifeSpecies/RecoveryConservationPlans/Pages/RecoveryConservationPlans.aspx

The Range-wide Conservation Agreement and Strategy[21] is a collaborative effort across multiple states signed in 2006 to maintain roundtail chub (*Gila robusta*), bluehead sucker (*Catostomus discobolus*), and flannelmouth sucker (*Catostomus latipinnis*) populations to a degree sufficient to ensure persistence of each species within their ranges. The process established measurable criteria to evaluate the number of populations and individuals within each population required to maintain the three species throughout their respective ranges. These approaches or others can be used by stakeholders to set goals for meeting nonconsumptive needs, and to build long-term implementation plans that identify projects at the local scale while maintaining and integrating those projects into basinwide and statewide objectives.

The following objectives are outlined in the strategy:

- Develop and finalize a conservation and management strategy (strategy) acceptable to all signatories that will provide goals, objectives, and conservation actions to serve as consistent guidelines and direction for the development and implementation of individual state wildlife management plans for these three fish species
- Establish and/or maintain roundtail chub, flannelmouth sucker, and bluehead sucker populations sufficient to ensure persistence of each species within their ranges
- Establish measurable criteria to evaluate the number of populations required to maintain the three species throughout their respective ranges
- Establish measurable criteria to evaluate the number of individuals required within each population to maintain the three species throughout their respective ranges
- Establish and/or maintain sufficient connectivity between populations so that viable metapopulations are established and/or maintained
- As feasible, identify, significantly reduce, and/or eliminate threats to the persistence of roundtail chub, bluehead sucker, and flannelmouth sucker that: 1) may warrant or maintain their listing as a sensitive species by state and federal agencies, and 2) may warrant their listing as a threatened or endangered species under the Endangered Species Act (ESA)

Colorado's Recovery Implementation Programs

The Upper Colorado River Endangered Fish Recovery Implementation Program (UCRRIP)[22] and San Juan River Endangered Fish Recovery Implementation Program (SJRRIP) are unique partnerships of local, state, and federal agencies; water and power interests; and environmental groups working to restore and manage stream flows and habitat, boost wild populations with hatchery-raised endangered fish, and reduce negative interactions with certain nonnative fish species to achieve natural, self-sustaining populations of the endangered fish. The UCRRIP is recovering humpback chub, bonytail, Colorado pikeminnow, and razorback sucker in the Colorado River and its tributaries in Colorado, Utah, and Wyoming. The UCRRIP relies on measurable outcomes to develop and implement management actions and measure success. The recovery goals describe conditions necessary for downlisting the fishes from endangered to threatened and for removing them from ESA protection

[21] http://wildlife.state.co.us/SiteCollectionDocuments/DOW/WildlifeSpecies/SpeciesOfConcern/RecoveryPlans/ChubSuckerRangewideConservationAgreementandStrategy01-04-07.pdf

[22] http://www.coloradoriverrecovery.org/general-information/about.html

(delisting). Recovery goals identify the number and age of fish that comprise a specified number of self-sustaining wild populations. They also identify site-specific management actions that reduce threats to the species. **Table B-5** provides a synthesis of the recovery goals and management actions for each of the four endangered fish species. **Table B-6** quantifies progress on management action and recovery, and specifies opportunities for and constraints on meeting original goals and timelines.

Table B-5. Demographic Criteria for Recovery

*modified from the Upper Colorado River Endangered Fish Recovery Program

Downlisting	Delisting
Colorado pikeminnow	
Over a 5-year monitoring period:	*For 7 years beyond downlisting:*
• Maintain the Upper Basin metapopulation • Maintain populations in the Green River and Upper Colorado River sub-basins ("no net loss") • Green River sub-basin population >2,600 adults • Upper Colorado River sub-basin population >700 adults • Establish 1,000 age 5+ subadults in the San Juan River	• Maintain the Upper Basin metapopulation Maintain populations in the Green River and Upper Colorado River sub-basins ("no net loss") • Green River sub-basin population >2,600 adults • Upper Colorado River sub-basin population >1,000 adults OR Upper Colorado River sub basin population >700 adults and San Juan River population >800 adults
Bonytail chub	
Over a 5-year monitoring period:	*For 3 years beyond downlisting:*
• Maintain reestablished populations in the Green River and Upper Colorado River sub-basins, each >4,400 adults • Maintain established genetic refuge of adults in Lower Basin • Maintain two reestablished populations in the Lower Basin, each >4,400 adults	• Maintain populations in the Green River and Upper Colorado River sub-basins, each >4,400 adults • Maintain genetic refuge of adults in Lower Basin • Maintain two populations in the Lower Basin, each >4,400 adults
Razorback sucker	
Over a 5-year monitoring period:	*For 3 years beyond downlisting:*
• Maintain reestablished populations in Green River sub-basin and EITHER in Upper Colorado River sub-basin or San Juan River, each >5,800 adults • Maintain established genetic refuge of adults in Lake Mohave • Maintain two reestablished populations in Lower Basin, each >5,800 adults	• Maintain established populations in Green River sub-basin and EITHER in Upper Colorado River sub-basin or San Juan River, each >5,800 adults • Maintain genetic refuge of adults in Lake Mohave • Maintain two populations in Lower Basin, each >5,800 adults
Humpback chub	
Over a 5-year monitoring period:	*For 3 years beyond downlisting:*
• Maintain the six populations ("no net loss") • One core population in Upper Basin > 2,100 adults • One core population in Lower Basin > 2,100 adults	• Maintain the six populations ("no net loss") • Two core populations in Upper Basin > 2,100 adults • One core population in Lower Basin > 2,100 adults

Table B-6. Recovery Programs' Progress to Recovery (2011-2012)

Species	Timeline to Downlist/Delist (Years)	Progress Made on Management Actions' to Remove Threats to Recovery and Status of Meeting Demographic Criteria
Colorado Pikeminnow	2013/2020	**Management Actions:** 78% of the actions required by USFWS to downlist have been met or partially met. **Demographics:** IF, Colorado (CO) and Green (GR) river populations do not decline significantly from current levels and 1,000 age-5 fish are present in San Juan River **(moderate to high likelihood) – downlisting could occur in 2013.**
Bonytail	2020/2023	**Management Actions:** 72% of the actions required by USFWS to downlist have been met or partially met. **Demographics:** Stocking programs in the GR and CO rivers have been marginally successful. **There is not enough new information to suggest the 2020 deadline should be revised**.
Razorback Sucker	2020/2023	**Management Actions:** 85% of the actions required by USFWS to downlist have been met or partially met. **Demographics:** Stocking programs in the GR, CO, and San Juan rivers appear to be successful. Although neither Program has initiated population estimation, **current information indicates the 2020 timeline is still achievable.**
Humpback Chub	2016/2019	**Management Actions:** 60% of the actions required by USFWS to downlist have been met or partially met. **Demographics:** IF, over a 5-year period, one of the five Upper Basin populations rebounds to meet the "core criteria" of 2,100 adults, and the other Upper Basin populations increase **(low to moderate likelihood) - downlisting could occur in 2016.**

Upper Colorado River Wild and Scenic Management Plan Alternative

The Upper Colorado River Wild and Scenic Stakeholder Group (SG) represents a diverse range of interests who have worked together since 2008 to develop an Upper Colorado River Wild and Scenic Stakeholder Group Management Plan (SG Plan)[23] to protect the Outstandingly Remarkable Values (ORVs) identified in the U.S. Bureau of Land Management (BLM) and U.S. Forest Service (USFS) Eligibility Reports for Segments 4 through 7 of the Upper Colorado River. The SG Plan aims to protect all ORVs while focusing on recreational fishing (in Segments 4 through 6) and recreational floatboating (in Segments 4 through 7). The SG Plan uses two distinct tools – "ORV Indicators" (characterizing the range and quality of the ORVs) that will be used to gage whether the ORVs are being protected; and "Resource Guides" (reflecting ranges for factors such as flow, temperature, and water quality) that will be used as a source of information among others to inform SG discussions under the Plan.

This Plan adopts a tiered system for implementation of management measures for the protection of the ORVs. Tier 1 Long-Term Protection Measures (e.g., Appropriation of CWCB instream flow rights) are expected to provide significant protection of the ORVs. Tier 2 Cooperative Measures (e.g., acquisition of water rights for ISF purposes) will complement the Tier 1 measures and may serve to maintain or enhance the ORVs. Tier 3 Measures allow a stakeholder to elevate an issue to the Stakeholder Group. The SG Plan's implementation procedures provide a feedback loop to periodically assess and confirm that the management measures under the Plan, in coordination with the BLM and USFS other land management actions, are protective of all ORVs.

[23] http://www.upcowildandscenic.com/resources.html

Routt County Livability Index

The Routt County Livability Index[24] provides an example of efforts to quantify the economics of environmental services and quality of life indicators. The livability index serves as a tool to measure change relating to metrics for four economic/quality of life aspects in Routt County—Economic, Environmental, Social, and Civic. The Index compares Routt County's livability to other mountain communities in Colorado that have social/economic and demographic similarities. The Index is first and foremost a decision support tool. It measures a series of indicators over time to provide quantitative evidence of whether the community is becoming more or less "livable."

References

Groves, C., L. Valutis, D. Vosick, B. Neely, K. Wheaton, J. Touval, and B. Runnels. 2000. Designing a Geography of Hope: A practitioner's handbook to ecoregional conservation planning. The Nature Conservancy, Arlington, VA.

Neely, B., S. Kettler, J. Horsman, C. Pague, R. Rondeau, R. Smith, L. Grunau, P. Comer, G. Belew, F. Pusateri, B. Rosenlund, D. Runner, K. Sochi, J. Sovell, D. Anderson, T. Jackson and M. Klavetter. 2006. Central Shortgrass Prairie Ecoregional Assessment and Partnership Initiative. The Nature Conservancy of Colorado and the Shortgrass Prairie Partnership. 124 pp.

[24] http://www.livabilityindex.com

Appendix C

Tools and Resources for Project Planning

Appendix C

Tools and Resources for Project Planning

The annotated list in this appendix includes scientific, technical, and policy tools and resources used to establish baselines and metrics for nonconsumptive needs. These tools represent a small subset of existing scientific tools and resources that have been narrowed to include those commonly used in, or specifically developed for, Colorado. As the basin roundtables or project proponents consider use of the tools described in this appendix they will need to consider the applicability and limitations of the tool that may apply to the issue they are addressing. The Colorado Water Conservation Board does not promote the application of any specific analysis procedure or tool.

The tools are organized into two main categories—environmental and recreational. The environmental tools focus on physical and biological factors (e.g., how much water is needed in a river system) to meet environmental targets and attributes for nonconsumptive needs. The environmental tools have been further classified by the scales for which they are designed and implemented. "Basin scale" tools operate at the watershed, or basin, level whereas "local scale" tools tend to focus at the river reach level. The recreational tools include resources for conducting usage surveys, quantifying necessary streamflow, and decision support systems for determining baseline conditions for recreational outcomes. Note that the flow-related tools do not necessarily consider the influence of non-flow related variables that may affect the condition of the resource. In addition, it is important to consider site-specific physical and biological measurements and observations during project planning implementation and evaluation. The Toolbox user may also refer to **Appendix G** as a resource for contacting people with knowledge, expertise, and access to additional tools and resources for planning nonconsumptive projects.

Environmental Tools

(*basin scale*) Watershed Flow Evaluation Tool - WFET.[25] The WFET is a new developed approach that is being tested and evaluated. It is a desktop tool that uses existing information to provide a regional framework for examining the risk of ecological change related to stream flow alteration, at a watershed or regional level. The WFET helps basin stakeholders assess nonconsumptive flow needs by associating flow status with ecological response by stream type. The three major steps in the development of the WFET are: 1) use existing data and expert opinion to develop flow-ecology relationships, 2) develop a hydrologic foundation of daily natural and altered flows, and 3) combine flow-ecology relationships and the hydrologic foundation to assign risk status for specific attributes across entire watersheds at a reach or subbasin scale. Thus far, the Colorado and Yampa-White Basin Roundtables have developed the WFET.

It is important to note that in estimating risk to an attribute, WFET does not confirm or measure that an actual resource impact or consequence has occurred. Also, as with other flow-related tools, it does not explicitly consider the influence of non-flow related variables to the condition of a resource.

[25] http://www.engr.colostate.edu/~bbledsoe/pubs/2011/Sanderson_etal_2011_RRA.pdf

(*basin scale*) GeoPDFs.[26] During the SWSI 2010 process, each basin developed a unique map showing focus areas with nonconsumptive environmental and recreational water needs. The basin and statewide maps were created as a Geospatial PDF file, or GeoPDF, to allow the user the ability to "click" areas of the map and view characteristics of that portion of the map, such as what attribute subcategories are present for a given hydrologic unit code or stream segment. In addition, the presence of specific attributes (e.g., razorback sucker, roundtail chub, kayaking, etc.) is summarized as well as information designated by the basin roundtables through creation of tables associated with their maps. To utilize the maps interactively select the tools dropdown list, then select the analysis tools arrow, and then click on the "object data tool." A user must triple click a reach for additional information that will appear on the left side. More detailed instructions for using the nonconsumptive GeoPDFs and for downloading and utilizing Adobe Reader are available in Appendix D of the SWSI 2010 report.

(*local scale*) Physical Habitat Simulation - PHABSIM.[27] PHABSIM is part of a broad conceptual and analytical framework for addressing stream flow management issues called the Instream Flow Incremental Methodology (IFIM) (Stalnaker et al. 1995). PHABSIM predicts physical microhabitat changes associated with flow alterations. It provides a variety of simulation tools, which characterize the physical microhabitat structure of a stream and describe the flow-dependent characteristics of physical habitat in light of selected biological responses of target species and life stages. When interpreting PHABSIM results, an assumption is normally made that flow-dependent physical microhabitats are useful in determining carrying capacity, and therefore are related to the instream flow (ISF) needs or impacts of flow variations on fish or other aquatic organisms in streams.

(*local scale*) River 2D.[28] River2D is a two-dimensional hydrodynamic model that has been customized for fish habitat evaluation studies. The River2D model suite actually consists of four programs—R2D_Bed, R2D_Ice, R2D_Mesh, and River2D. These programs are typically used in succession and then used to solve the water depths and velocities. Ultimately, River2D is used to visualize and interpret the results and perform PHABSIM type fish habitat analyses.

(*local scale*) R2Cross. The R2CROSS tool is one of the standard techniques employed by state and federal agencies to model instream hydraulic parameters and develop ISF recommendations in Colorado. The R2Cross method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge.

(*local and basin scales*) Watershed Assessment of River Stability and Sediment Supply - WARSSS.[29] WARSSS is a three-phase technical framework of methods for assessing suspended and bedload sediment in rivers and streams. Excess sediment has been a leading cause of water quality impairment across the nation for years, but methods to assess sediment problems and plan solutions have been limited. WARSSS is a technical procedure developed by Dr. David L. Rosgen for water quality scientists to use in evaluating streams and rivers impaired by excess sediment.

[26] http://cwcb.state.co.us/water-management/water-supply-planning/pages/swsi2010.aspx
[27] http://www.fort.usgs.gov/Products/Publications/pub_abstract.asp?PubID=22800
[28] http://www.river2d.ualberta.ca/
[29] http://water.epa.gov/scitech/datait/tools/warsss/

(*local and basin scales*) Indicators/Monitoring. Indicators provide an effective tool to measure progress and performance. Generally, an indicator focuses on a small, manageable set of information that gives a sense of the bigger picture, and eliminates the need to measure everything. The choice of an indicator is important as to whether it gives sufficient "sense of the bigger picture." Many different types of indicators have been developed and can be used to reflect a variety of aspects of ecosystems, including biological, chemical, and physical. For example, an **indicator species** is an organism or population whose presence, absence, or abundance reflects a specific environmental condition. Indicator species can signal a change in the biological condition of a particular ecosystem, and thus may be used as a proxy to diagnose the health of an ecosystem.

Recreational Tools

CREEL surveys.[30] There are a number of different methods that can be used to quantify needs for recreational purposes—from desktop methods to resource intensive surveys about user experiences. Similarly, for recreational fishing, CREEL surveys measure angler satisfaction using a variety of different data collection methods. Angler satisfaction is often quantified as Total Fishing Effort (TFE) and Catch/Unit Effort (CPUE). Angler satisfaction is also directly related to biomass and species diversity and indirectly related to river flows, temperature, and water quality. However, these attributes are incorporated into the habitat tools discussed above.

Surveys to assess streamflow needs for whitewater recreation. American Whitewater has developed a survey based approach to assessing the relationship between streamflows and quality of recreational experience. There are two components to this approach. First, an online survey is conducted with commercial and non-commercial paddlers, who evaluate flows for whitewater boating on targeted river segments. Respondent data is collected and organized to identify minimum, acceptable and optimum flows for whitewater boating, summarized in curves that describe the quality of boating opportunities for each measured streamflow. Respondents also report flows that provide certain recreation experiences or "niches". from technical low water to challenging high water trips.

Variables other than streamflow can be the predominant factors that influence actual recreation use. As a result, it is important to consider non-flow related parameters in any measurements of floatboating conditions. Another tool is collection of river usage information by float boaters through vehicle or boat counting, querying commercial boating operations, or obtaining usage information collected by others such as the Bureau of Land Management. As with all survey methods, adequate sample size and verifying results on the ground are necessary to ensure that the results accurately reflect a diverse set of recreational users of a given stream segment.

[30] http://wildlife.state.co.us/Fishing/Reports/ManagementandSurveys/Pages/FisheryWaterSummaries.aspx

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Appendix D

Projects and Methods Mapping

Appendix E

Nonconsumptive Projects and Methods Funding Opportunities

Appendix E

Nonconsumptive Projects and Methods Funding Opportunities

There are several ways that funding can be acquired for environmental and recreational water development. Existing federal and state programs can be drawn on and new programs at the state and local levels can also be created to provide funding. Accessing state funding can be relatively straightforward for certain types of projects. Obtaining federal funding can be considerably more challenging. Other funding entities also exist, ranging from local government through philanthropic foundations. This funding landscape can be challenging to navigate. As part of the nonconsumptive toolbox, this section on funding is intended to provide guidance on those funding sources that are most likely to be accessed by basin roundtable members and other nonconsumptive stakeholders in Colorado. This section should not be viewed as an exhaustive list of possible funding sources.

Several comprehensive lists of funding sources have been compiled. Perhaps the most relevant lists for funding nonconsumptive needs projects and methods in Colorado are Tables 3-7 and 3-8 in Section 3 of the SWSI 2010 report.[31].These tables list, respectively, federal and state funding sources along with descriptions of several aspects of the funding sources (e.g., purpose, eligibility, etc.). The Colorado Watershed Assembly has a list of both private and public funding opportunities[32]. An even more comprehensive national list can be found for free by going to the Red Lodge Clearinghouse funding database[33]. Another useful resource for those seeking information on potential sources of federal funding for conservation is the Catalog of Federal Funding Sources for Watershed Protection[34]. This online database can be queried by type of funding (e.g., grants, loans, cost sharing), eligible organization types, and matching funds requirements. The database recognizes more than 30 different keyword search terms including fisheries, floodplain or riparian zone, invasive species, restoration, source water protection, and wetlands. The Nature Conservancy has compiled a Compendium of Financing Sources and Tools to Fund Freshwater Conservation[35]. This Compendium highlights several innovative and nontraditional funding sources.

Among these large sets of ever-evolving funding sources, there is a relatively small set of sources that are currently and actively being used in Colorado by individuals, landowners, watershed groups, nongovernmental organizations, and others to implement nonconsumptive projects and methods. **Table E-1** lists the most commonly used funding sources, their general purpose, and a link to the funding source website. While CWCB funding sources have been important for many nonconsumptive projects over the past several years, these funds are most easily accessed and best put to use when complemented with other sources of funding.

[31] http://cwcb.state.co.us/water-management/water-supply-planning/Documents/SWSI2010/SWSI2010Section3.pdf
[32] http://www.coloradowater.org/Funding%20Opportunities%20List
[33] http://rlch.org/content/get-funding
[34] http://cfpub.epa.gov/fedfund/
[35]http://dl.dropbox.com/u/77289895/Matheiu%202011%20TNC%20Compendium%20for%20Financing%20Freshwater%20Conservation.pdf

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Table E-1. Most Prominent or Commonly Accessed Funding Sources for Nonconsumptive Projects and Methods in Colorado

Funding Source	Purpose	For further information
CWCB Instream Flow Acquisition Fund	Instream flow acquisitions; also includes more specialized funding from Species Conservation Trust Fund for instream flow acquisitions that benefit threatened, endangered, or candidate species.	http://www.cwcb.state.co.us/NR/rdonlyres/E6DA70D1-1D32-41D2-BF26-67A1BD6092E9/0/19.pdf SWSI 2010, Section 3, Table 3-8.
CWCB Water Supply Reserve Account	Fund water activities approved by the basin roundtables.	http://cwcb.state.co.us/IWMD/WaterSupplyReserve/ SWSI 2010, Section 3, Table 3-8.
CWCB Current Task Order Support for Nonconsumptive Projects	Technical support to basin roundtables.	http://ibcc.state.co.us SWSI 2010, Section 3, Table 3-8.
CWCB Healthy Rivers Fund	Locally based water projects and planning.	http://cwcb.state.co.us/WatershedProtectionFloodMitigation/Watershed/WatershedRestorationProgram.htm SWSI 2010, Section 3, Table 3-8.
CWCB Watershed Restoration Grants	Provides planning, engineering, and construction services for watershed/stream restoration studies and projects.	http://cwcb.state.co.us/WatershedProtectionFloodMitigation/Watershed/WatershedRestorationProgram.htm SWSI 2010, Section 3, Table 3-8.
DOLA Conservation Trust Fund	Implementation of projects that benefit state and local parks, recreation facilities, open space, environmental education, and wildlife habitat.	http://www.dola.state.co.us/dlg/fa/ctf/index.html SWSI 2010, Section 3, Table 3-8.
CDPHE / US EPA – 319 Program	Mitigating nonpoint source pollution to impaired Colorado water bodies.	http://www.epa.gov/OWOW/NPS/cwact.html http://www.cdphe.state.co.us/wq/nps/index.html SWSI 2010, Section 3, Table 3-8.
State of Colorado- Colorado Conservation Easement Tax Credit	Protecting lands through conservation easements.	http://www.revenue.state.co.us/fyi/html/ SWSI 2010, Section 3, Table 3-8.

Table E-1. Most Prominent or Commonly Accessed Funding Sources for Nonconsumptive Projects and Methods in Colorado

Funding Source	Purpose	For further information
CWCB Instream Flow Tax Credit	Provides financial incentive for instream flow donations to the CWCB.	http://www.coloradowatertrust.org/acquisitions/tax-credit/ SWSI 2010, Section 3, Table 3-8.
Species Conservation Trust Fund Grants	Funds projects to protect native species and promote recovery of endangered species.	Colorado Revised Statutes Title 24 Article 33 Section 24-33-111
CPW Habitat Stamp	Acquiring or preserving wildlife habitat.	http://wildlife.state.co.us/ShopDOW/AppsAndLicenses/HabitatStamp/ SWSI 2010, Section 3, Table 3-8.
CPW Fishing is Fun Program	Improve fishing opportunities for anglers.	http://wildlife.state.co.us/Fishing/ResourcesTips/FishingIsFunProgram SWSI 2010, Section 3, Table 3-8.
CPW Colorado Wetland Wildlife Conservation Program	Preserve, restore, enhance, and create wetlands and adjacent habitat.	http://wildlife.state.co.us/LandWater/WetlandsProgram/ SWSI 2010, Section 3, Table 3-8.
GOCO Legacy Initiative	Implement projects of regional or statewide importance that preserve land and water, enhance critical wildlife habitats, create new state and local parks, construct trails, and provide environmental education.	http://www.goco.org/GrantPrograms/Legacy/tabid/ 125/Default.aspx SWSI 2010, Section 3, Table 3-8.
GOCO Open Space Program	Open space protection.	http://www.goco.org/GrantPrograms/OpenSpace/tabid/119/Default.aspx SWSI 2010, Section 3, Table 3-8.
WQCC Watershed Protection Fund	Protect lands and waterways in Colorado's watersheds.	http://www.cdphe.state.co.us/op/wqcc/SpecialTopics/CWPF/colowtshdprot.html SWSI 2010, Section 3, Table 3-8.

Table E-1. Most Prominent or Commonly Accessed Funding Sources for Nonconsumptive Projects and Methods in Colorado

Funding Source	Purpose	For further information
USDA Natural Resource Conservation Service (NRCS) – Wetland Reserve Program (WRP)	Restoring, protecting, and enhancing wetlands and associated uplands on private land.	http://www.nrcs.usda.gov/PROGRAMS/wrp/ SWSI 2010, Section 3, Table 3-7.
USDA NRCS – Wildlife Habitat Improvement Program (WHIP)	Creating high quality wildlife habitats for species of national, state, tribal, or local significance.	http://www.nrcs.usda.gov/programs/whip/ SWSI 2010, Section 3, Table 3-7.
NRCS – Environmental Quality Incentives Program (EQIP)	Soil, air, water, and other natural resource concerns.	http://www.nrcs.usda.gov/PROGRAMS/eqip/ SWSI 2010, Section 3, Table 3-7.
US EPA – Targeted Watershed Grant Program	Water quality improvement along with habitat improvements.	http://www.epa.gov/twg/ SWSI 2010, Section 3, Table 3-7.
WS EPA – Wetland Program Development Grants	Water quality improvement along with habitat improvements.	http://www.epa.gov/owow/wetlands/grantguidelines/ SWSI 2010, Section 3, Table 3-7.
BOR – Water SMART Grants	Projects that reduce conflicts through water conservation, efficiency, and markets.	http://www.usbr.gov/WaterSMART/ SWSI 2010, Section 3, Table 3-7.
US FWS Partners for Fish & Wildlife	Restoring habitat on private lands including wetlands and riparian areas.	http://ecos.fws.gov/partners/viewContent.do?viewPage=home SWSI 2010, Section 3, Table 3-7.
US FWS Sport Fish Restoration Program	Restoring and better managing America's declining fishery resources.	http://wsfrprograms.fws.gov/Subpages/GrantPrograms/SFR/SFR.htm SWSI 2010, Section 3, Table 3-7.

Table E-1. Most Prominent or Commonly Accessed Funding Sources for Nonconsumptive Projects and Methods in Colorado

Funding Source	Purpose	For further information
Colorado River District Grant Program	Development of a new water supply; improvement of an existing water supply system; measures to improve instream water quality; measures that promote water use efficiency; sediment reduction measures; implementation of watershed management actions; tamarisk control measures.	http://www.crwcd.org/page_193
David & Lucile Packard Foundation, Conservation and Science Program	Watershed protection and restoration.	http://www.coloradowater.org/Private%20Funding%20Opportunities/#David
Gates Family Foundation	Promoting long-term stewardship of land, water and other natural resources	http://www.gatesfamilyfoundation.org/
National Fish and Wildlife Foundation: Bring Back the Natives	Restoring, protecting, and enhancing native aquatic species, especially on lands on or adjacent to federal agency lands.	http://www.nfwf.org/AM/Template.cfm?Section=charter_programs_list&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=24293
National Fish and Wildlife Foundation: Upper Colorado Native Fishes Keystone Initiative	Develop a network of watershed- scale areas where entire native fish communities would be restored and protected.	http://www.nfwf.org/AM/Template.cfm?Section=Fish_&CONTENTID=22456&TEMPLATE=/CM/ContentDisplay.cfm
National Fish and Wildlife Foundation Pulling Together Initiative	Support weed partnerships, including those focused on tamarisk and Russian olive eradication.	http://www.nfwf.org/AM/Template.cfm?Section=Home&TEMPLATE=/CM/HTMLDisplay.cfm&CONTENTID=25307
Walton Family Foundation	Creating cleaner, healthier rivers.	http://www.waltonfamilyfoundation.org/
Save the Colorado River Campaign	Protect and restore the health of the Colorado River.	http://www.savethecolorado.org/grants.php

Appendix F

Case Studies

Appendix F

Case Studies

The following section provides a series of case studies to offer real world examples of nonconsumptive projects and methods planned and implemented throughout Colorado. Using the template and challenge statements from Section IV, these projects illustrate how problems were identified, which tools were used to analyze conditions for attributes, how projects and methods were developed, and which implementation solutions were employed. The goal of these case studies is to demonstrate how basin roundtables should identify attributes and set targets at the basin-scale first, categorize important projects and reaches for implementation, and follow the template to define measurable outcomes.

Case Study: Lower Blanco River Restoration Project

The San Juan-Chama Diversion project came online in 1971, and since that time the Lower Blanco River has been reduced to small flows in an over-wide stream bed. The river no longer has the seasonal flows to shape the channel bed, create scour pools, and maintain spawning gravel beds. In many locations the mature riparian vegetation is not next to the flowing water. Wetland features at the margins of the channel are infrequent. Water temperatures are elevated in the summer months because of shallow and wide flow conditions. There is only limited habitat available for salmonids and other aquatic species.

STEP 1: Challenge/Problem Statement

The Lower Blanco River Restoration Project seeks to restore some of the aquatic life functions that were lost when a major portion of the river's historic flow was diverted to New Mexico to meet Colorado River Water Compact obligations. Attributes protected = Trout

STEP 2: Decision Making Process

The condition of the Lower Blanco River after the San Juan-Chama Diversion was of great concern to property owners along the river. The Lower Blanco Property Owners Association (LBPOA) was formed in 1985, and one of its early initiatives was to start looking for help to fix the river. There was little help offered by the federal agencies administering the Diversion project, but the state of Colorado through the Colorado Water Conservation Board (CWCB) was forthcoming with assistance. The science of river restoration was still in its infancy; however, the CWCB saw the need and provided grant funding to plan for and implement a river restoration Demonstration Project on the Lower Blanco River. A "Restoration and Fish Habitat Enhancement Plan" was prepared by Dave Rosgen in 1992, which provided a detailed analysis of the changed hydrologic and aquatic conditions in the river, and made specific recommendations on how to rehabilitate stream and aquatic functions within the limitations of a reduced hydrologic regime. Implementation of the restoration work began in 1993, and after monitoring the work for several years, a second phase of implementation was undertaken in 1996. Phase 1, 2, and 3 were complete by 2002 and had completed work on approximately 2.75 miles of the river. After a several-year hiatus where the POA continued to seek funding for the project, implementation work began again in 2007. In the fall of 2007, a single private landowner near the bottom of the Lower Blanco valley funded restoration work on his 1.0-mile stretch of the river. Then in 2008-2009 the LBPOA completed another 3.25 miles of river restoration (Phases 4 and 5) with funding assistance from the NRCS, the Southwestern Conservation District, and the San Juan Water

Conservancy District. The final 2 miles of restoration were completed in the early fall of 2010 with funding provided from these same entities. With the completion of this final section (Phase 6), the Lower Blanco River, totaling nearly 10 miles, has been restored from the Highway 84 intersection to the confluence with the San Juan River.

What Can We Do?

STEP 3: Identify Measureable Outcomes

Due to flow alteration from upstream conversion, channel reconstruction and aquatic and riparian restoration are necessary.

Channel Reconfiguration was chosen as the right tool to restore poor aquatic habitat. The reconfigured channel maintains channel capacity for a 100-year flood event. It also helps maintain or improve domestic well levels.

Are The Attributes Secure?

Habitat, Water Quality, Flows

STEP 4: Categorize Scientific Needs

Habitat: Reconfiguration improved the natural stability of the channel, fish habitat, fish spawning locations, water quality, riparian/floodplain functions, and aesthetics.

STEP 5: Implementation Process

Planning/Assessment: A "Restoration and Fish Habitat Enhancement Plan" was prepared by Dave Rosgen in 1992, which provided a detailed analysis of the changed hydrologic and aquatic conditions in the river, and made specific recommendations on how to rehabilitate stream and aquatic functions within the limitations of a reduced hydrologic regime.

Design: Each phase of the project was designed as funding became available. Reconfigured channel length (Project Phase) was determined by the available funds. A detailed hydraulic water surface profile computer model (HEC-RAS 4.0) was developed for a representative reach of the project area. The model demonstrated that the reconfigured design would convey and contain the 100-year flood with no appreciable rise in flood elevation.

Permitting: A series of Nationwide #27 permits issued by U.S. Army Corps of Engineers (likely this would require an individual 404 permit today)

- Floodplain Development Permit required by Archuleta County
- 401 Water Quality Permit required by Colorado Dept. of Public Health and Safety – Water Quality Control Division

Construction:
Phase I: Fall 1999, 1.1 miles, $227,500 Rock cost - $37 each
Funding sources = EPA 319 $96,000, CWCB $80,000, Southwestern Water Conservation District (SWCD) $10,000, San Juan Water Conservancy District (SJWCD) $10,000, Lower Blanco Property Owners Association (LBPOA) $30,000, Archuleta County $1,500
Phase II: Spring 2004, 2.2 miles, $387,000 3,900 rocks installed = 22 Cross Vanes, 29 J hooks, 41 Deflectors, 91 Habitat Rocks.
Funding sources = EPA 319 $250,000 CWCB $80,000, SWCD $25,000, SJWCD $20,000, LBPOA $12,000
Phase III: Summer 2008, 1.14 miles, $183,500 2,500 CY rock installed = 15 Cross Vanes, 17 J hooks, 6

Deflectors, 71 Habitat Rocks, 30 Sill Rocks.
Funding Sources = NRCS EQIP $95,000, CWCB $30,000, SWCD $25,000, SJWCD $20,000, LBPOA $12,000, Archuleta County $1,500
Phase IV: Fall 2009 – Spring 2010, 2.02 miles, $348,463 2,450 CY Rock Installed = 28 Cross Vanes, 3 J hooks, 11 Short Vanes, 34 Deflectors, 105 Habitat Rocks, 185 Sill Rocks
Funding Sources = NRCS EQIP $91,463, CWCB $132,000 Fish and Wildlife Resources Fund & $100,000 SW Basin Roundtable, LBPOA $25,000
Phase V: Fall 2010, 1.93 miles, $255,000 2420 CY Rock Installed = 20 Cross Vanes, 5 J hooks, 10 Short Vanes, 35 Deflectors, 90 Habitat Rocks, 80 Sill Rocks
Funding Sources = NRCS EQIP $95,000, CWCB $150,000 Water Supply Reserve Account Statewide Funds, SJWCD $10,000

Monitoring: Annual macro-invertebrate monitoring for 3 years as specified by USACE permit.

Typical Restored Section. Photo of newly constructed point bar with dense bank vegetation. Note the rock structure and deeper water river-left, creating good fish holding potential beneath the overhanging riparian vegetation.

Case Study: Parks and Wildlife Instream Flow Recommendation for an Increase in Flow for East Elk Creek

The state of Colorado's Instream Flow Program (ISFP) was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (See §37-92-102 (3) C.R.S.). The statute vests the CWCB with the exclusive authority to appropriate and acquire instream flow (ISF) and natural lake level water rights. In order to encourage other entities to participate in Colorado's ISF program, the statute directs the CWCB to request ISF recommendations from other state and federal agencies.

Colorado Parks and Wildlife (CPW) has historically been one of the primary entities that submit ISF recommendations to the CWCB. CPW actively participates in the ISF program in order to meet Colorado's policy "… that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such a program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.).

In keeping with this statutory mandate, CPW will frequently review past appropriations to determine their efficacy to preserve the natural environment to a reasonable degree. The science of determining ISFs is continuing to evolve. Current ISF science is indicating that older single flow year-round ISF recommendations are often inadequate to fully provide such preservation. In some cases, it has been determined that past recommendations are inadequate to fully provide such preservation. In such cases, CPW may recommend an increase in the previously decreed ISF amounts. If appropriated, these increases are decreed with a new junior appropriation date. The previous decree remains, and the increase is administered under its own priority.

STEP 1: Challenge/Problem Statement:

In 2008-2009, CPW recommended an increase on East Elk Creek due to the fact that it supports a naturally reproducing brook trout fishery, experiences heavy recreation use due to its proximity to Blue Mesa Reservoir, and because it runs through the Sapinero State Wildlife Area. Additional cross-section modeling and application of current guidelines indicated that the decreed summer flow amounts between April 1 and October 31 should be increased by 0.7 cubic feet per second (cfs).

STEP 2: Decision-Making Process

The decision-making process began with the recommending entity. In this case, CPW became concerned with the adequacy of the existing ISF when biologists noted that during the last drought cycle, flow rates on East Elk Creek became almost too low to support fish life. Without an increase in the existing appropriation, it was feared that new junior appropriators could divert water during drought periods for extended periods of time, which would leave the brook trout population susceptible to thermal stress. It was feared that inadequate protection could lead to the complete loss of the fishery on the stream over time. In addition, CPW noted that this area had been affected by overgrazing, which resulted in a Bureau of Land Management (BLM) action to remove grazing on these lands so that the stream could meet riparian and fish management objectives. CPW believed that an ISF increase was justified because the stream provides a high recreational value to sportsman due to its proximity to Blue Mesa Reservoir and the Sapinero State Wildlife Area.

What Can We Do?

STEP 3: Identify Measureable Outcomes:

The objective was to ensure that East Elk Creek had sufficient flows appropriated under the state's Instream Flow and Natural Lake Level Program that would result in reasonable preservation of the natural environment. CPW worked through the ISF program to appropriate the required water rights because by statute only the CWCB can hold such water rights.

Attributes and Tools. To determine the adequacy of the existing decreed flow amounts, CPW and BLM biologists reviewed past R2Cross Modeling results and modeled two new cross-sections on East Elk Creek. After reviewing the results, it was determined that the decreed 1.5 cfs flow amount only met two of the three required hydraulic model criteria. Although average depth and wetted perimeter criteria were met in most riffle locations, average velocity through the riffle was inadequate. BLM and CPW biologists believe that the velocity criteria are critical for maintaining suitable stream temperatures and dissolved oxygen concentrations for salmonids.

Are The Attributes Secure?

Once CPW determined that an increase of the ISF on East Elk Creek was necessary, the Agency's ISF coordinator formally brought the recommendation to the CWCB Stream and Lake Protection Staff at the CWCB's February 2008 ISF workshop.

Habitat, Water Quality, Flows

STEP 4: Categorize Scientific Needs.

CWCB Staff reviewed the findings and associated scientific data to assure that the recommendation met the CWCB's statutory requirement to 1) Determine whether there is a natural environment that can be preserved to a reasonable degree if the CWCB's water right is granted; 2) whether a natural environment will be preserved to a reasonable degree by the water available for the appropriation; and 3) whether such environment can exist without material injury to water rights. Once staff completed its review, it made its recommendation that the CWCB form its intent to appropriate an increase in ISF rights on East Elk Creek.

STEP 5: Implementation Process:

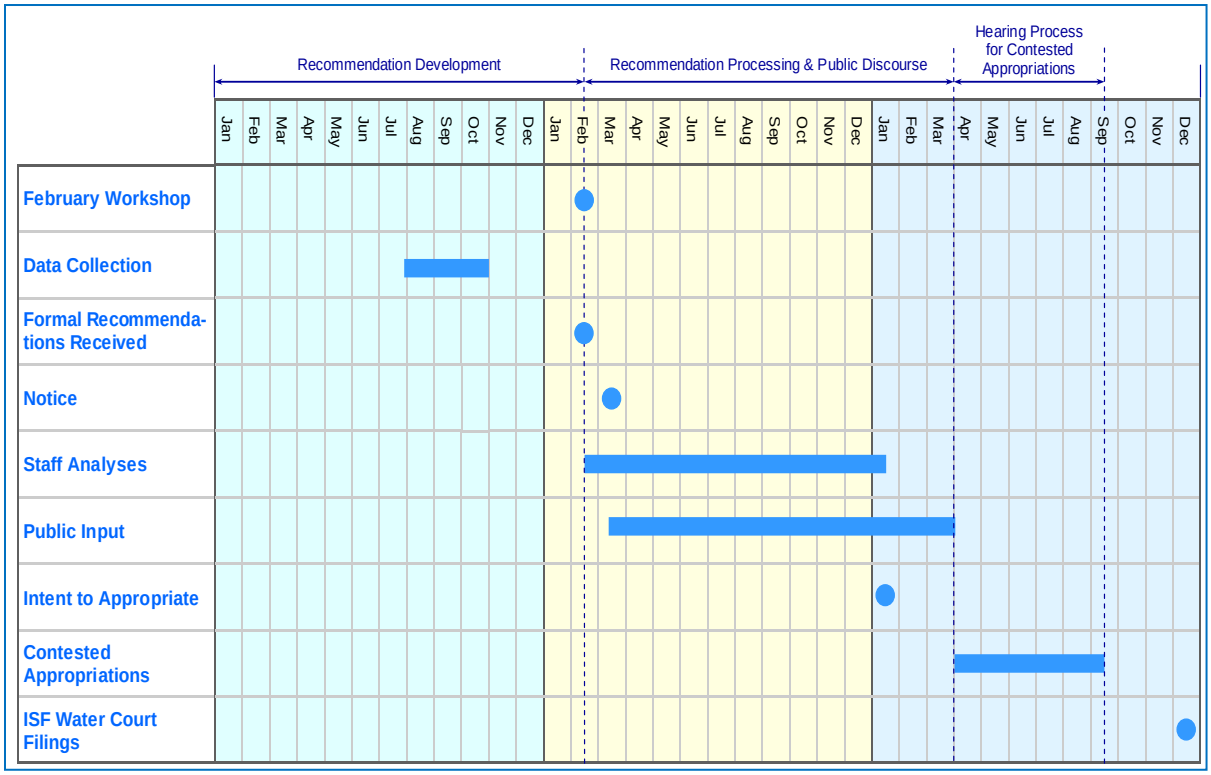
Implementation Plans

This process was initiated by CPW as part of their mandate to protect, preserve, enhance, and manage the state's wildlife resources. However, any person or entity may make an ISF recommendation to the CWCB. Such recommendations must be with specificity and in writing. Please refer to CWCB's Rules [36] Concerning the Colorado Instream Flow and Natural Lake Level Program.

*Note that at times state and federal agencies may cooperate with one another and/or other stakeholders in making an ISF recommendation.

The timeline below provides an overview of how the appropriation process unfolds from data collection through water court filing.

[36] http://cwcb.state.co.us/legal/Documents/Rules/Final%20Adopted%20ISF%20Rules%201-27-2009.pdf



Operations. Once appropriated, CWCB will legally protect its decreed water rights in water court by thoroughly reviewing the monthly water court resumes and filing statements of opposition to applications that have the potential to injure its rights. In addition, CWCB will monitor and place calls for its water rights as against out-of-priority diversions. However, in many cases there are no gaging stations on an ISF reach that can be used for administrative purposes. In these cases CWCB relies on the recommending entities, DWR water commissioners, and other stakeholders to alert CWCB staff to low flow concerns. If it is determined that a gage would result in administration of the CWCB's rights, staff will consider installing an appropriated measuring device depending on funding availability and other factors.

Case Study: Upper Gunnison River Water Conservancy District Recreational In-Channel Diversion and the Gunnison Whitewater Park

STEP 1: Challenge/Problem Statement

"...to protect [Gunnison's recreational] water resource that is so valuable to [the Gunnison] community, both as a recreational amenity and an important source of revenue" - Robert Drexel, president of the Upper Gunnison River Water Conservancy District (UGRWCD), UGRWCD press release dated December 22, 2005.

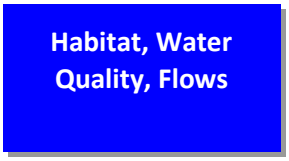
STEP 2: Decision-Making Process

The decision-making process created to obtain a recreational in-channel diversion (RICD) water right for the Gunnison Whitewater Park was undertaken by UGRWCD and included discussions and authorization in public meetings and also negotiation and execution of an Intergovernmental Agreement between Gunnison County and UGRWCD. Other stakeholders that participated in the creation of the Gunnison Whitewater Park included the City of Gunnison, Western State College's Todd Crane Center for Outdoor Leadership, Colorado Division of Wildlife, El Pomar Foundation, Gunnison County Metropolitan Recreation District, local boaters, outfitters, and engineers. Also, the CWCB, the State and Division Engineers for Water Division No. 4, and the UGRWCD entered into an agreement resolving their opposition to UGRWCD's RICD water right for the whitewater park.

It is important to note that the decision-making environment is slightly different today than it was when the UGRWCD obtained a RICD for its whitewater park. The RICD statute was amended in 2006 to provide additional guidance to the CWCB and the water courts when they are conducting their reviews of RICD applications and proposed decrees.

*Note that only a county, municipality, city and county water district, water and sanitation district, water conservation district, or water conservancy district may file a water right application for a RICD.

STEP 3: Identify Measureable Outcomes



The purposes of the UGRWCD RICD was to protect water supplies for recreational purposes, improve the recreational experience that existed within a certain reach by modifying the river channel, to ensure protection of Gunnison County's investments in the course, and to ensure that the purpose and function of the Gunnison Whitewater Park can be maintained in the future, notwithstanding development of other water rights on the Gunnison River.

STEP 4: Categorize Scientific Needs

The primary goals for the whitewater park are to provide beginners and novices a course to practice their skills on moving water, during low flows; and at higher flows, a course that may be used for slalom events, play boating, cart wheeling, whitewater rodeos, etc.

STEP 5: Implementation Process

Implementation Plans

Fundraising for the project included t-shirt sales and contributions from the following entities:

- Gunnison County
- City of Gunnison
- Todd Crane Center for Outdoor Leadership
- Colorado Division of Wildlife Education
- The Gunnison County Metropolitan Recreation District Grant
- The City of Gunnison Challenge Grant
- Western State College's Gunnison Whitewater Park Development Class
- El Pomar Grant/GHS
- Upper Gunnison River Water Conservancy District

Additionally, Western State College's Recreation Department and the Todd Crane Center for Outdoor Leadership both played a major role in the design and development of the park by hosting a special topics class in spring 2003. The class oversaw the planning and development of many of the park's amenities such as the bathrooms, changing rooms, rules and regulations, nature trails, and message board.

Although the Gunnison Whitewater Park stakeholders did not seek funds from the CWCB, current CWCB funding sources that may be available for the design and construction of a whitewater park include:

- Construction Fund Non-Reimbursable Project Investment Grant Program
- Severance Tax Trust Fund Operational Account Grant Program
- Water Supply Reserve Account (WSRA) Grant Program

The design of the whitewater course was performed by Recreational Engineering and Planning through Gunnison County. Construction was completed in 2002 and the final course contains six water features including river-wide U structures and offset double deflectors. The primary materials used in construction were grouted boulders. Construction costs were approximately $200,000. U.S. Army Corps of Engineers' regional general and nationwide permits were obtained for construction and subsequent maintenance activities.

Also in 2002, the UGRWCD filed for the RICD water right in water court and participated in a hearing before the CWCB. Note that since that time, the CWCB's process has changed and RICD applicants now participate in a public deliberation in front of the board. Cost for the RICD water right and legal fees were approximately $475,000. The decree for the RICD was issued in 2006.

Operations. The Gunnison Whitewater Park has provided recreation boating experiences for many boating enthusiasts since 2002 and has been host to the Annual Gunnison River Festival and the 2010 USA Freestyle Kayaking Point Series.

The RICD court decree requires that the RICD be able to be adequately measured and administered by using the USGS Gunnison River gage at Gunnison and account for intervening diversions between that gage and the whitewater course.

Maintenance is performed by the county and operation of the RICD water right is performed by UGRWCD.

The UGRWCD RICD is a tool than can be utilized to protect the nonconsumptive needs of this major recreational segment of the Gunnison River. Currently the UCRWCD is perfecting the right.

Construction photos


Photos of completed project


References:

1) McLaughlin Whitewater Design Group (July 2010). *Whitewater Course Evaluation, Selected Venues in the State of Colorado*.

2) http://www.ugrwcd.org (December 19, 2011).

3) http://gunnisoncounty.org/whitewaterpark (December 19, 2011).

4) Decree and Findings of Fact for Division 5 Case No. 02CW038 (dated January 12, 2006).

Case Study: Upper Colorado River Wild and Scenic Stakeholder Group's Management Plan Alternative

STEP 1: Challenge/Problem Statement

As part of their resource management plan revision process, the BLM and U.S. Forest Service (USFS) identified four reaches of the Colorado River as potentially suitable for Wild & Scenic River designation. Numerous stakeholders did not want these reaches deemed suitable and wanted to find an alternative way to protect the Outstandingly Remarkable Values (ORVs) identified by the federal agencies such as recreational fishing and wildlife. Other stakeholders were in favor of deeming the reaches suitable, but were willing to work to find a way to provide the same or a greater level of protection for the ORVs using a different approach. The agreed upon goal was to develop a management plan alternative that the BLM and USFS could adopt in lieu of a finding of suitability.

STEP 2: Decision Making Process

The stakeholders formed the Upper Colorado River Wild and Scenic Stakeholder Group (SG), comprised of representatives of East and West Slope local governments and water providers, recreational interests, conservation groups, water users, and landowners. Representatives of state and federal agencies participated in SG discussions and helped develop the Upper Colorado River Wild & Scenic Stakeholder Group Management Plan (SG Plan). The plan's primary focus is on stream-influenced ORVs, including wildlife, botanical, scenic, recreational float boating, and recreational fishing. The timing for submittal of the plan was dictated by the BLM/USFS NEPA process for the resource management plan revisions.

Assembling Stakeholder Group: Participation in the SG was open to all stakeholders, with the main constraint being the ability to spend the time required to work on the Plan. Because of the complexity and number of issues that needed to be addressed, the SG contracted with a facilitator to assist the SG with reaching consensus and producing the necessary documents.

Issue Clarification / Contributing Factors: The SG members spent a significant amount of time working through their divergent interests to formulate a mutually acceptable goal for the SG Plan, which is "to balance permanent protection of the ORVs, certainty for the stakeholders, water project yield, and flexibility for water users." The SG Plan aims to protect all ORVs with a focus on recreational fishing and recreational floatboating.

STEP 3: Identify Measureable Outcomes

To develop a SG Plan that would: 1) be acceptable to the BLM/USFS and the public (via the NEPA process) as an alternative to a finding of suitability for the subject reaches of the Colorado River; and 2) result in a neutral deferral of a finding of suitability for those reaches. The intent of the SG Plan is to balance permanent protection of the ORVs, certainty for the stakeholders, water project yield, and flexibility for water users.

Choosing the right tool(s) to address the challenge: The SG Plan uses two distinct tools – "ORV Indicators" (characterizing the range and quality of the ORVs), which will be used to gage whether the ORVs are being protected; and "Resource Guides" (reflecting ranges for factors such as flow, temperature and water quality).

Long-Term Protection Measures and Voluntary Cooperative Measures in the SG Plan – cooperative voluntary efforts of interested water users, local governments, and other entities to protect (and perhaps enhance) the ORVs in ways that coordinate with federal agency management. Such measures may include, but are not limited to:

- ISF water rights on the subject reaches of the Colorado River. Appropriation of new ISF water rights will protect base flows and preserve the natural environment on the Colorado River to a reasonable degree. This measure was chosen because it provides permanent protection under decreed water rights.
- Delivery of water to senior water demands downstream of the subject Colorado River reaches, and water deliveries to the 15-Mile Reach in the Grand Valley pursuant to the Upper Colorado River Endangered Fish Recovery Program. These measures were chosen because, while they do not guarantee permanent protection, they are expected to result in ongoing protection of the ORVs, absent a material change in circumstances.
- Acquisitions of water for ISF use to preserve or improve the natural environment (potentially protect higher flows than the appropriated base flows).
- Coordinated timing/scheduling of late summer and early fall reservoir releases to meet annual reservoir target elevations that can help satisfy late season flow demands.
- Storage and subsequent release of historical consumptive use and return flows.
- Use of Windy Gap System: Depending on the hydrology, operations, agreements, and other circumstances, Northern's Municipal Subdistrict may be able to allow the use of excess capacity in the Windy Gap system for the diversion and storage of water for the benefit of the ORVs.
- Spring peak enhancement: Spring flushing flows could be enhanced through the coordinated bypass of reservoir inflow during the spring runoff.
- Cooperative flow management: Voluntary flow management programs can be used as a water management tool.

Habitat, Water Quality, Flows

STEP 4: Categorize Scientific Needs

To protect the ORVs, the SG Plan will use identified Long-Term Protection Measures and voluntary Cooperative Measures of the Stakeholder Group. Examples of the protective measures include the appropriation of CWCB ISF water rights, delivery of water to senior water demands downstream of the subject Colorado River reaches, and water deliveries to the 15-Mile Reach in the Grand Valley pursuant to the Upper Colorado River Endangered Fish Recovery Program. These measures will be used for maintaining and enhancing flow-related values within a given stream reach, while meeting downstream demands such as those for the endangered fish species, through the collaborative operation of water facilities and other cooperative efforts. The appropriation of ISF water rights is a

measure that specifically addresses the recreational fishing and wildlife ORVs. The attributes addressed by the ISF water rights are brown trout, rainbow trout and mountain whitefish, which constitute the basis for the recreational fishing ORV, and flannelmouth sucker, bluehead sucker, roundtail chub, and river otter and bald eagle habitat.

STEP 5: Implementation Process

Implementation Plans

With exception of the ISF water rights appropriation, the SG Plan's long-term protection measures are already in place. Implementation of the SG Plan's cooperative measures will be done under the relevant entity's specific authority and will be addressed on a case by case basis. Using the ISF water rights appropriation as an example, the following illustrates implementation of the SG Plan. As indicated by the plan, the SG provided a written recommendation to the CWCB for the appropriations under the CWCB's Instream Flow Rules.

Planning/Assessment: As part of developing the ISF recommendation, the SG retained Miller Ecological Consultants to provide additional biological information to the SG regarding the habitat needs of certain fish species within the proposed ISF reaches on the Colorado River. The resulting report, dated February 18, 2011, is titled "Instream Flow Report for the Colorado River from Kremmling downstream to Dotsero, Colorado." Colorado Parks and Wildlife performed an independent analysis and submitted its own ISF recommendation to the CWCB on June 30, 2011. The SG also conducted a water availability analysis with guidance from CWCB staff. The CWCB applied to water court for these ISF water rights on November 30, 2011.

Design: N/A

Permitting: No permitting process required for the SG Plan.

Construction: N/A

Monitoring: The SG Plan includes a Monitoring Plan as well as requirements for periodic reporting to BLM and the USFS. The SG Plan also includes provisions addressing governance, representation, decision-making, funding, and agency coordination.

NOTE: This summary only touches upon the basic elements of the SG Plan. For more details, go to http://www.upcowildandscenic.com/

Case Study: Donation by Colorado Water Trust of Peabody Ditch Water Rights to Colorado Water Conservation Board for Instream Flow Use

STEP 1: Challenge/Problem Statement:

The Colorado Water Trust (CWT) entered into an option agreement to purchase the Peabody Ditch water rights (Peabody rights), with the intent of donating the water rights to the CWCB for ISF use to preserve and improve the natural environment on Boulder Creek and the Blue River in Summit County. Adding the Peabody rights to the CWCB's ISF water rights portfolio would benefit the trout fishery on Boulder Creek and the Gold Medal rainbow and brown trout fishery on the subject reach of the Blue River, making those environmental attributes more secure.

STEP 2: Decision-Making Process:

The CWT began working with the CWCB staff to develop the information needed to bring the proposed water right donation to the CWCB. The CWCB's process for evaluating and accepting offers of water for ISF use is governed by Rule 6 of the Rules Concerning the Colorado Instream Flow and Natural Lake Level Program (ISF Rules), which can be found at http://cwcb.state.co.us/legal/Documents/Rules/Final%20Adopted%20ISF%20Rules%201-27-2009.pdf . While the example addressed in this document was a donation of a water right to the CWCB, the CWCB also can acquire water rights by purchase, lease or other contractual arrangement. This document uses the term "acquisition" to refer generally to all of these mechanisms. After the CWCB accepts a water right for inclusion in the ISF Program, the CWCB must apply to water court to obtain a decreed right to use the water for ISF purposes.

CWCB Process: Under ISF Rule 6, the CWCB must consider the following factors when considering a proposed water acquisition:

- Reach of stream where acquired water will be used
- Historical use and return flows
- Location of other water rights on reach
- Potential for material injury to existing decreed water rights
- Natural environment that may be preserved or improved by proposed acquisition
- Effect of proposed acquisition on:
  - Interstate compact issues
  - Maximum utilization of waters of state
- Whether the water will be available for subsequent use downstream
- Water administration issues, if any
- Cost to complete the transaction or other associated costs

Acquisition Agreement: Every water acquisition requires a written agreement between the CWCB and the donor, seller, or lessor of the water right. The agreement:

- Is developed cooperatively with water right owner
- Outlines the terms and conditions of the conveyance; and
- Can address:
  - Water court responsibilities
  - Stream flow monitoring
  - Protection and enforcement of the conveyed right

- Special terms requested by the owner, such as drought reservations

Water Court Process: The water court process for changing the use of a donated water right to ISF use is the standard process used for other types of water rights changes. The applicant must provide information on historical consumptive use and return flows and the proposed new use of the water right. Also, terms and conditions to prevent injury to other water rights on the subject stream must be included in the resulting water court decree.

Studies/Reliance on Expert Opinion: To evaluate a water right offered to it for ISF use, CWCB reviews technical and legal analyses, including a historical consumptive use analysis, and for water rights purchases or leases, research into the validity of title to the water right and an appraisal of the water right. These analyses must be performed by professionals in the field of analysis.

What Can We Do?

STEP 3: Identify Measureable Outcomes:

Because the CWCB is the only entity in the state that can hold ISF water rights, the CWT chose the ISF Program as the tool best suited to protecting water under the Peabody rights throughout the ISF reaches on Boulder Creek and the Blue River, and thereby protecting the environmental attributes present in those reaches. Merely leaving that water in the stream most likely would result in it being diverted by the next water user on the stream and would fail to achieve the desired protection of the natural environment and environmental attributes on Boulder Creek and the Blue River.

Are The Attributes Secure?

Habitat, Water Quality, Flows

STEP 4: Categorize Scientific Needs:

Environmental Flows

STEP 5: Implementation Process:

In preparation for submitting the proposed donation of the Peabody rights to the CWCB, the CWT had a preliminary historic consumptive use analysis of the Peabody rights performed. That analysis was necessary to inform the CWCB of the projected yield of the Peabody rights that would be available for ISF use.

Implementation Plans

Monitoring: The final result of this project is a water court decree authorizing the CWCB to use the changed Peabody rights to preserve and improve the natural environment to a reasonable degree. Project monitoring consists of monitoring existing stream gages to ensure protection and enforcement of the changed rights.

Photo: Boulder Creek above confluence with Blue River

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Appendix G

Existing Programs

Appendix G

Existing Programs

The following table highlights several existing programs and policies that can serve as resources for stakeholders planning a nonconsumptive project. Examples in the table are divided into three main categories:

- Instream flows for environmental and recreational purposes
- Habitat protection, restoration, and enhancement
- Planning, administrative, and regulatory programs

These projects and methods can serve as a useful resource and provide precedent for practitioners designing a project or developing an implementation plan.

Table G-1. Possible Projects and Methods for Meeting Nonconsumptive Needs in Colorado

Method	Cost	Process/Contact	Examples of Implementation
INSTREAM FLOWS			
New ISF and Natural Lake Level Appropriations: CWCB authorized by §37-92-102 (3) to appropriate ISF water rights for in-channel use and natural lake level water rights to preserve the natural environment to a reasonable degree.	• Site-specific data collection by scientists required for identification of natural environment and quantification of flows. • Coordination with CWCB and CPW staff may reduce costs. • $5000 for R2Cross in small streams; $50,000 to $75,000 for River2D in rivers.	• Anyone can recommend ISF appropriation. • One-year notice and comment process after supporting scientific data is compiled. • See CWCB Rules Concerning the Colorado Instream Flow and Natural Lake Level Program (ISF Rules).	• Since 1973, 1,500+ water rights appropriated covering over 9,000 miles of stream and 400+ lakes. • 15 Mile Reach of Colorado River. • Dominguez Canyon Wilderness Area ISFs (pending). • Colorado River ISFs as alternative to Wild and Scenic (pending).
ISF Acquisitions: CWCB authorized by §37-92-102 (3) to acquire existing water rights for ISF use to preserve or improve the natural environment to a reasonable degree.	• Historic consumptive use analysis of senior water rights can be expensive. • Limited funding available for purchases and leases of water. • Usually involves water court process.	• Proposed ISF acquisitions evaluated by CWCB staff to determine potential to benefit environmental attributes. • Two-meeting Board approval process. • See ISF Rule 6. • Water court process.	• Donation by City of Boulder of water rights on Boulder Creek. • Colorado Water Trust donation of water rights on Boulder Creek/Blue River. • Purchase of irrigation right to re-water Washington Gulch and supplement Slate River flows.
Temporary transfer of water rights to instream flows: Under certain circumstances, a water user can temporarily loan an agricultural water right to the Board without the need for water court approval (see 37-83-105(2) C.R.S.)	• $35-$500 or more per acre-foot leased, depending on source and location.	• Contact Colorado Water Trust or CWCB ISF Program.	• Colorado Water Trust ISF lease on the Yampa River. • Colorado Parks and Wildlife loan of released water from Lake Avery.
Alternative Agricultural Water Transfer Mechanism: CWCB is funding projects that explore untested mechanisms for environmental interests to work with irrigators.	• $100,000 or more, depending on the complexity of the legal and technical analyses.	• Contact CWCB.	• Lake Canal / ReGenesis / The Nature Conservancy pilot on the Cache la Poudre.

Table G-1. Possible Projects and Methods for Meeting Nonconsumptive Needs in Colorado

Method	Cost	Process/Contact	Examples of Implementation
Transfer or maintenance of consumptive water rights for wetland and ISF purposes: Transfer or maintenance of senior consumptive water rights can contribute to maintenance of wetland and instream habitats.	• Costs range broadly depending on mechanism for protection.	• Work with private water rights holders as appropriate.	• Most conservation easements in Colorado perpetually tie water rights to the eased property.
RICDs: Local governmental entities can appropriate water associated with in-channel structures to protect it in the channel for the minimum stream flow needed for a reasonable recreation experience.	• Costs for building a structure can be $100,000 or more. Appropriating the water right requires staff and attorney fees.	• For more information see http://cwcb.state.co.us/environment/recreational-in-channel-diversions/Pages/main.aspx.	• Salida – Arkansas River. • Town of Avon. • City of Longmont. • City of Steamboat Springs.
Re-timing of flows through wetland recharge projects	• Low $10s of thousands for wetland enhancement or creation without property acquisition; up to $1M or more if properties must be eased or acquired.	• Contact Ducks Unlimited.	• Tamarack Project. • Ovid Project.
Infrastructure improvements as a means to improved flows	• Small diversions: $10s of thousands. • Medium diversions: $100-$200k. • Large diversions $500k-$1M+.		
Reservoir Reoperation	• $50M/dam >20MAF. • $20M/dam 3-5MAF. • $10/AF for <2MAF.	• Depends heavily on who owns and operates reservoir.	• Flaming Gorge (through Recovery Program). • Arkansas River.
Voluntary Flow Agreements & Policy Mechanisms for Long-term Security	• Costs are largely staff resources.	• Depends heavily on who owns and operates water rights.	• East Slope and West Slope interests' agreement to maintain senior rights associated with the Shoshone Power Plant, even if plant is not calling for all of its water right.

Table G-1. Possible Projects and Methods for Meeting Nonconsumptive Needs in Colorado

Method	Cost	Process/Contact	Examples of Implementation
PROTECTION, RESTORATION, ENHANCEMENT			
Channel Restoration & Instream Habitat Improvements: Used to restore aquatic habitat such as pools for trout.	• $100,000 to $1,000,000+, depending on length of stream or river being worked on.	• Contact CWCB Watershed Restoration Program or Colorado Watershed Assembly.	• Cache Creek – Arkansas River. • Rio Blanco.
Conservation Easement: Voluntary agreements that preclude certain uses of land such as subdivision for development.	• Often $150-$500 per acre, but highly dependent on locations. Can be partially or fully donated with state and federal tax benefits.	• Contact local land trust, statewide land trust (The Nature Conservancy, Colorado Open Lands, Trust for Public Land), or Land Trust Alliance.	• Rio Oxbow, and multiple other examples on the Rio Grande.
Fencing of riparian areas or for grazing management: A tool for enhancing riparian habitat.	• $1.20 per foot for permanent fencing. $2500 for stock tank.	• Contact Colorado Parks and Wildlife Wetlands Program.	• Brett Grey Ranch (Steele's Fork).
Culvert replacement: Re-establishes connectivity of fish habitat.	• $10k to $100s of thousands, depending on the fix and the road; typically $60,000 or more.	• Contact Colorado Parks and Wildlife or Trout Unlimited.	• Culvert replacement /retrofit for cutthroat connectivity on the Routt NF.
Building barriers to fish passage: inhibits movement of undesirable species into high-priority habitats, especially for cutthroat trout.	• $5,000 to $100s of thousands or more, depending on stream size, materials, and accessibility.	• Contact Colorado Parks and Wildlife or Trout Unlimited.	• Barriers constructed on and adjacent to the Routt NF.
Diversion structure reconstruction or enhancements: Improves fish passage, boater safety, and diversion efficiency.	• $20,000 for small structures; $250,000 for medium and large structures (CCC Ditch); $750,000 to $2M for very large structures (Relief Ditch; Hartland Dam).	• Contact structure owner.	• Hartland Dam. • CCC Ditch. • Relief Ditch.
Riparian Habitat Restoration: Improves streamside habitat.	• $500-$1500 per acre (average of approximately $1200 per acre in tamarisk/Russian olive projects.	• This work is typically done through partnership with watershed group, federal agency, or weed association.	• San Miguel River.

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Method	Cost	Process/Contact	Examples of Implementation
Wetland restoration: Provides habitat to waterfowl, shorebirds, and amphibians.	• $50,000 per site, including contractors and materials.	• CPW Wetlands Program or local Wetland Focus Areas committee are good first points of contact.	• Multiple projects in North Park, lower South Platte, and San Luis Valley led by Ducks Unlimited and/or Colorado Parks and Wildlife.
Watershed Restoration Planning: Typically a comprehensive plan for restoration across an entire watershed.	• Costs are staff. An initial plan can be done for $50-100,000, but costs can reach $250,000 or higher.	• Colorado Watershed Assembly. http://www.coloradowater.org/Watershed%20Planning.	• Roaring Fork Conservancy.
PLANNING, ADMINISTRATIVE, REGULATORY			
Local Land Use Regulations: Riparian /wetland setbacks.	• Costs are mostly staff of regulating entity, but could include consulting costs of $10,000-$50,000.	• Contact city or county land use planning office.	• San Miguel County. • Boulder City. • Larimer County.
Range Management of riparian areas, or upland habitat for bank stability, habitat, and water quality on both private and public land.	• Costs are usually staff for planning process, but may include fencing and watering locations.	• For federal lands, check planning processes and ways to engage.	• BLM grazing management plans on the Dolores River.
National Environmental Policy Act reviews. Includes Environmental Assessments or Environmental Impact Statements.	• Engagement is often volunteer, but also includes staff time for nonprofits.	• Contact lead agency overseeing the NEPA process (e.g., US Army Corps of Engineers; Bureau of Reclamation).	• All major proposals: Moffat firming, NISP, Halligan-Seaman, Windy Gap.
Wild and Scenic processes provide protections for environmental, recreational, and scenic values on rivers.	• Costs are almost entirely staff, but developing "alternatives" to Wild & Scenic may cost $100,000 or more for supporting studies and up to $100,000 for facilitation.	• Contact appropriate federal planning agency (i.e. BLM, USFS, etc.) or create an alternative public planning processes.	• River Protection Workgroup. • Cache la Poudre is only river designated Wild & Scenic in Colorado. • Upper Colorado River Wild and Scenic Stakeholder Group Management Plan Alternative.

Table G-1. Possible Projects and Methods for Meeting Nonconsumptive Needs in Colorado

Method	Cost	Process/Contact	Examples of Implementation
Salinity Control Program improves irrigation infrastructure to maintain crop production while reducing total diversions and salt-laden return flows.	• Variable depending on type and size of project. For guidance, contact: Steve Miller Colorado Water Conservation Board steve.miller@state.co.us	• Contact US Bureau of Reclamation. http://www.usbr.gov/uc/progact/salinity/index.html.	• Uncompahgre Valley.
CPW Management Plan Implementation	• Costs vary depending on action being taken. Implementation of plans can employ a variety of other mechanisms listed in this table.	• Wildlife.state.co.us.	• Arkansas darter.
Endangered Species Recovery Programs	• Costs and funding (~$15M per year in Upper Colorado River Basin) are appropriated through Congress.	These programs have established composition, structure, work plans, etc. See websites for more info: http://www.coloradoriverrecovery.org http://www.fws.gov/southwest/sjrip/ https://www.platteriverprogram.org/Pages/Default.aspx	• Upper Colorado River Endangered Fish Recovery Program. • San Juan River Basin Recovery Implementation Program. • Platte River Recovery Implementation Program.