Colorado Water Conservation Board

Colorado's Water Supply Future
Statewide Water Supply Initiative - Phase 2

CDM

November 2007

Technical Roundtable Report Sections:

- Conservation and Efficiency
- Alternative Agricultural Water Transfer Methods to Traditional Purchase and Transfer
- Delineating and Prioritizing Colorado's Environmental and Recreational Resources and Needs
- Addressing the Water Supply Gap

STATE OF COLORADO

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FOREWORD

November 14, 2007

Fellow Coloradans:

Addressing Colorado's Future Water Needs

As we move forward over the next decade we will have important decisions to make which will have a tremendous impact on the vision for Colorado's future. At the center of these decisions will be one of our most precious natural resources-- water. As we chart our path and explore how we use and develop water it is essential that we make informed decisions. To assist in that effort the Colorado Water Conservation Board, in collaboration with water interests throughout the state, has produced this important report.

Building on the initial findings and recommendations of the 2003 Statewide Water Supply Initiative, this report summarizes the work of Technical Roundtables that were formed to conduct detailed analysis of four key topics. It is hoped that this information can help form the basis for Colorado to begin to identify and implement solutions for our water supply future in a manner that will benefit all water user interests. The four areas of investigation included:

- Water Conservation and Efficiency (Agricultural and Municipal and Industrial)
- Alternative Agricultural Water Transfer Methods to Traditional Purchase and Transfer
- Delineating and Prioritizing Colorado's Environmental and Recreational Resources and Needs
- Addressing the Water Supply Gap (between Current Supply and Current and Future Water Needs)

The overall goal of this effort was to develop a range of solutions that will sustainably meet our future water needs. Developing a range of potential solutions will help water providers, policymakers, and stakeholders gain a deeper understanding of the relative role that water efficiency, agricultural transfers, and new water development can play in meeting future needs and the trade-offs associated with these solutions. These solutions can then be considered in the context of meeting human needs for water and providing for the needs of Colorado's natural environment and recreation.

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Acronyms

AF	acre-feet
AFY	acre-feet per year
AHRA	Arkansas Headwaters Recreation Area
ARSG	Animas River Stakeholders Group
ASLA	American Society of Landscape Architects
AWWA	American Water Works Association
BLM	Bureau of Land Management
BMPs	Best Management Practices
BOR	U.S. Bureau of Reclamation
BRT	Basin Roundtables
CBT	Colorado-Big Thompson
CDOW	Colorado Department of Wildlife
CDPHE	Colorado Department of Public Health and Environment
cfs	cubic feet per second
CNHP	Colorado Natural Heritage Program
COASLA	Colorado American Society of Landscape Architects
CROs	Coordinated Reservoir Operations
CRRP	Colorado River Return Project
CU	consumptive use
CUWCC	California Urban Water Conservation Council
CVWD	Coachella Valley Water District
CWA	Clean Water Act
CWCB	Colorado Water Conservation Board
DOI	Department of Interior
DRCOG	Denver Regional Council of Governments
DSS	Decision Support System
DWB	Denver Water Board
ECCV	East Cherry Creek Valley Water and Sanitation District
EIS	environmental impact statement
ESA	Endangered Species Act
ET	evapotranspiration
FERC	Federal Energy Regulatory Commission
FRICO	Farmers Reservoir and Irrigation Company
FS	feasibility study
FY	fiscal year
GDP	gross domestic product
GIS	geographic information system
GOCO	Great Outdoors Colorado
GSP	gross state product
HB	House Bill
HBA	Home Builders Association
HCP	Habitat Conservation Plan
HUC	Hydrologic Unit Code
HUP	Historic User Pool
IBCC	Interbasin Compact Committee
IID	Imperial Irrigation District
ISAs	Interruptible Supply Agreements
ISF	instream flow program
M&I	municipal and industrial
MF	multi-family

mg/L	milligrams per liter
mgd	million gallons per day
MMC	Metro Mayors Caucus
MOU	Memorandum of Understanding
MU	municipal user
MWD	Metropolitan Water District
NAWQA	National Water Quality Assessment Program
NCWCD	Northern Colorado Water Conservancy District
NEPA	National Environmental Policy Act
NGOs	Non-government Organizations
NHD	National Hydrography Dataset
NISP	National Streamflow Information Program
NOAA	National Oceanic and Atmospheric Administration
NPS	nonpoint source
NRCS	Natural Resources Conservation Service
NWCOG	Northwest Council of Governments
O&M	operations and maintenance
OM&R	operations, maintenance and replacement
OWC	Office of Water Conservation
OWCD	Office of Water Conservation and Drought Planning
PAWSD	Parker Water and Sanitation District
PVID	Palo Verde Irrigation District
QSA	Quantification Settlement Agreement
RCAC	
RFID	Rotational Fallowing Irrigation District
RICD	Recreational In-channel Diversions
ROFR	right of first refusal
SAWS	San Antonio Water Supply
SB	Senate Bill
SDCWA	San Diego County Water Authority
SECWCD	Southeastern Colorado Water Conservancy District
SEO	State Engineer's Office
SF	single-family
SSI	self-supplied industrial
SWCD	Southwestern Water Conservation District
SWSI	Statewide Water Supply Initiative
TABOR	Taxpayor Bill of Rights
TDS	total dissolved solids
TDS	total dissolved solids
TMDL	total maximum daily load
TNC	The Nature Conservancy
TRT	Technical Roundtables
UPCO	Upper Colorado
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
WGF	Windy Gap Firming
WSR	Wild and Scenic River

Introduction

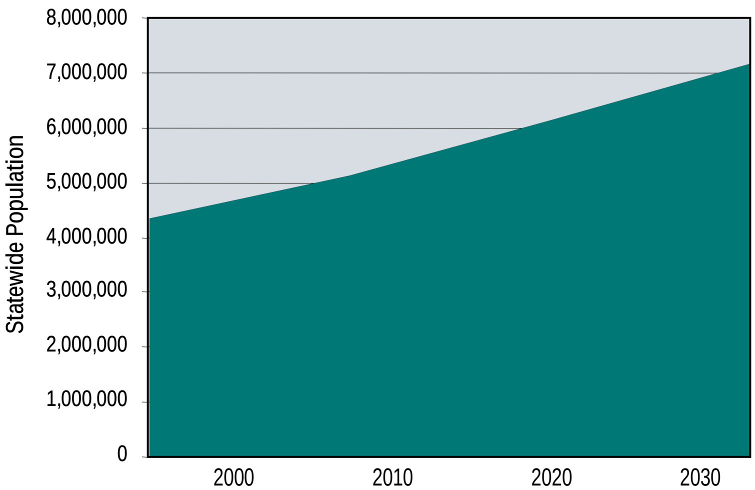
The Colorado Water Conservation Board is responsible for:

1. Aiding in the protection and development of the state's water resources for present and future generations
2. Gathering data and information to achieve greater utilization of the waters of the state
3. Identifying and recommending water development projects to the General Assembly

1.1 Background

As the population of Colorado grows (Figure 1-1), the Colorado Water Conservation Board (CWCB or Board) is faced with challenges related to the conservation, protection, and development of Colorado's water. The CWCB must help ensure that water is utilized to meet the needs of Colorado's citizens while protecting the environment.

In the last few years, state leaders and state resource management agencies have been increasingly interested in helping ensure that Colorado has an adequate water supply for its citizens and the environment. In 2003, the Colorado General Assembly authorized the CWCB to implement the Statewide Water Supply Initiative (SWSI). SWSI is a comprehensive identification of Colorado's current and future water needs and it examines a variety of approaches Colorado could take to meet those needs. SWSI implemented a collaborative approach to water resource issues by establishing SWSI roundtables. Membership in these roundtables represented a broad range of water user interests. SWSI focused on using a common technical basis for identifying and quantifying water needs and issues (the report can be viewed at http://www.cwcb.state.co.us/IWMD/pdfDocs/Report/SWSI_Report_11-15-04.pdf.



Basin	2000	2030	Increase in Population	Percent Change 2000 to 2030	Percent Annual Growth Rate
Arkansas	835,100	1,293,000	457,900	55	1.5
Colorado	248,000	492,600	244,600	99	2.3
Dolores/San Juan/San Miguel	90,900	171,600	80,700	89	2.1
Gunnison	88,600	161,500	72,900	82	2.0
North Platte	1,600	2,000	400	25	0.7
Rio Grande	46,400	62,700	16,300	35	1.0
South Platte	2,985,600	4,911,600	1,926,000	65	1.7
Yampa/White/ Green	39,300	61,400	22,100	56	1.5
Total	4,335,500	7,156,400	2,820,900	65	1.7

Source: Colorado Department of Local Affairs Demography Section

Figure 1-1
Population Projections by Basin

1.2 The Path Forward

While the CWCB was directed to complete SWSI and deliver its findings and recommendations to the General Assembly in 18 months, implementing SWSI will take years and decades. Helping ensure Colorado's water future is a complex and difficult challenge. Addressing Colorado's water supply future means that the social, economic, and cultural health and integrity of all of its river basins must be protected. This is a daunting challenge and it will require creative solutions, dedication, and persistence.

Following completion of the first phase of SWSI, the CWCB adopted several goals and objectives that can be accomplished with the help of Colorado's water providers, water users, elected officials, and citizens. These goals will be met by developing sound implementable objectives that can be met over a longer term. Based on information obtained during SWSI, it is now known that—Colorado can potentially meet 80 percent of its municipal and industrial water needs by 2030; however, some water suppliers may need help building infrastructure, mitigating and permitting projects, enhancing and improving the environment, and conserving water.

1.3 Meeting 80 Percent of the Municipal & Industrial (M&I) Need

SWSI has catalogued the specific projects, plans, and processes that local water suppliers have identified and are undertaking as components of their own water supply planning efforts to meet the needs they themselves have identified. As a whole, if these projects are implemented, 80 percent of the state's 2030 M&I water needs can be met. This is the most optimistic scenario. But there is uncertainty and hurdles to overcome.

Consequently, the mission of the state with respect to meeting 80 percent of Colorado's M&I water needs by 2030 should be:

Following the lead of local water suppliers, the state will monitor long-term water needs, provide technical and financial assistance to put the necessary plans, projects, and programs in place to meet those needs, and foster cooperation to avoid being forced to make trade-offs that would otherwise harm Colorado's environment, lifestyle, culture, and economy.

The goals associated with this mission are to:

1. Follow the lead of local water suppliers. In order for the CWCB to follow, local water suppliers must not only lead, but also must share information and be inclusive so that state leaders can confidently make decisions and provide the support required to ensure the fourth goal can be met.

2. Monitor long-term water needs. One of the major hurdles faced was the difficulty in collecting water use and water planning data. Information about agricultural water use comes from statistics, water commissioner records, and aerial and satellite imagery that demonstrate that over time growing patterns and crops change over geographic areas. The state has even less information to share that is provided on a regular basis about M&I water use and demand. A better system that still protects water rights holders must be developed.

3. Provide technical and financial assistance to put the necessary plans, projects, and programs in place to meet those needs. The CWCB Drought Assessment highlights that most water suppliers want technical and financial assistance from the state. SWSI provided for some categorization among water users so that the type of help and assistance needed can be pinpointed.

4. Foster cooperation to avoid being forced to make trade-offs that would otherwise harm Colorado's environment, lifestyle, culture, and economy. SWSI makes it clear that future plans include drying up farmland to provide water for cities, towns, communities, and industries. While there will be the inevitable reductions of irrigated acres as development occurs on these lands, some of the additional projected losses of irrigated lands can be reduced if viable alternatives are available to M&I providers (Figure 1-2). Options exist that could reduce the need to dry up additional irrigated agricultural lands, but

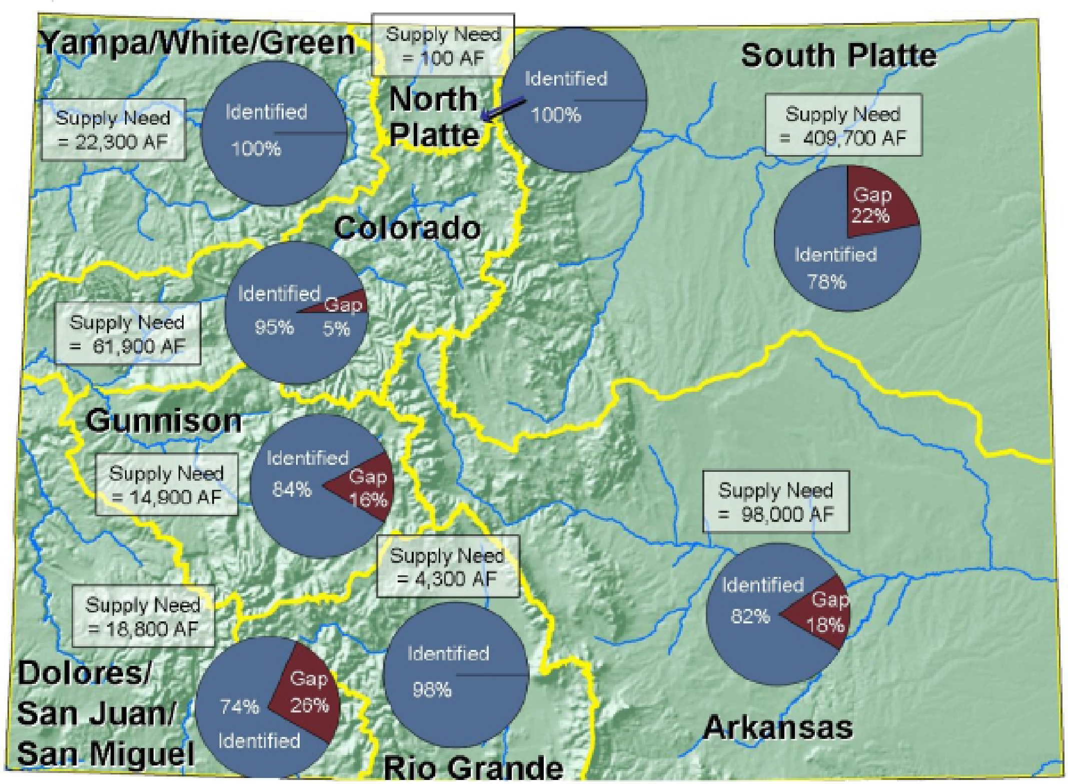


Figure 1-2
Effectiveness of Identified Projects and Processes in Meeting 2030 M&I and SSI Demands

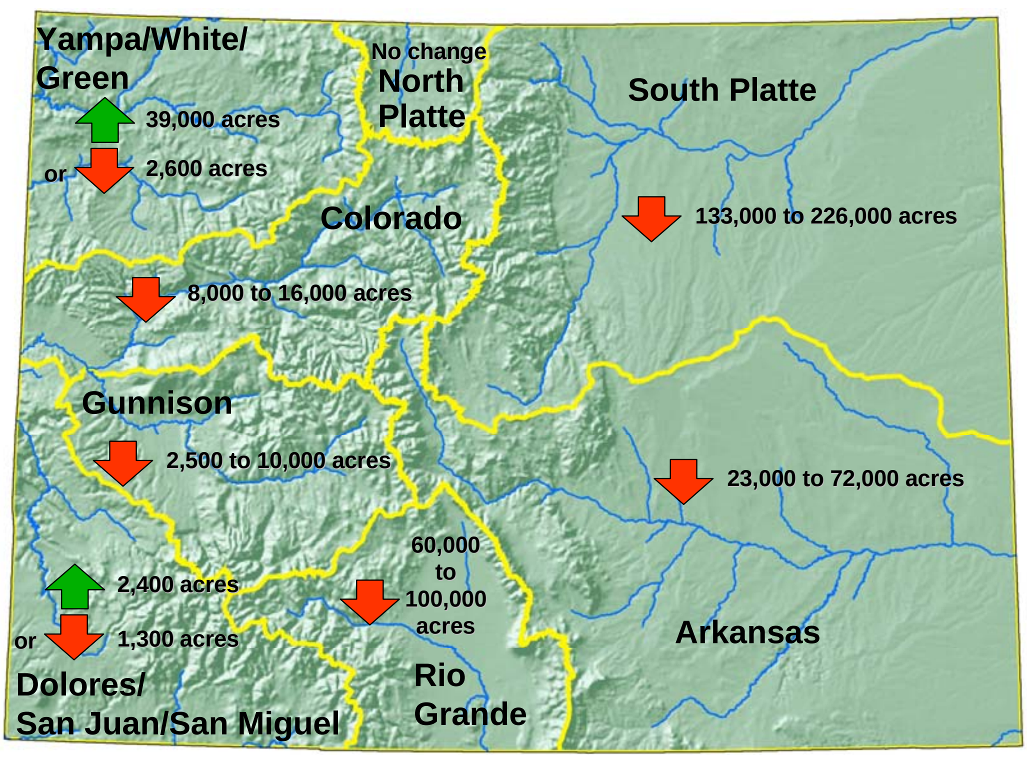
cooperation is essential. The state may be able to help level the field so that "win-win" options can be chosen. This must be done in a way that enhances Colorado's environment and protects recreational resources.

There are numerous issues that should be explored in this dialogue:

- Competition among water providers for the same sources of water.
- The trade-offs between in-basin agricultural transfers and new water supply development.
- How to create win-win scenarios where the basin or area of origin and the area of beneficial use both derive sufficient benefits from a proposed water development project.
- How to collaborate on the implementation of the Identified Projects and Processes, and further development of the options for meeting future needs.
- Identification of options to allow for more use of non-permanent transfers of water from agriculture.

1.4 The 20 Percent M&I Water Shortage, Agricultural Shortages, and Environmental and Recreational Enhancements

Another major achievement of SWSI was the identification of an inevitable gap in water supply that exists between current M&I water supply planning and the projected need for water (Figure 1-3). In addition, localized agricultural shortages have been identified in all basins and significant environmental and recreational needs were identified. Articulating the CWCB's role in helping to narrow and eventually eliminate this gap is much trickier—both institutionally and politically. This challenge is a major focus of this report.



Source: Colorado's Decision Support Systems and Basin Roundtable/ Basin Advisor input.

Figure 1-3
Projected Change in Irrigated Acreage by 2030

It is this gap that must be filled with "new" water. If water suppliers had the water to meet the demand represented by this gap, there would be no gap.

The mission for the state in filling this gap should be:

Foster cooperation among water suppliers and citizens in every water basin to examine and implement options to fill the gap between ongoing water planning and future water needs.

The goals of this mission are to:

1. Foster cooperation among water suppliers and citizens in every water basin. Because SWSI was an *initiative*, the work must be carried forward. The CWCB has continued the discussions that began at the Basin Roundtable (BRT) meetings about in-basin projects and needs through the Interbasin Compact Process BRTs.

2. Examine and implement options to fill the gap between ongoing water planning and future water needs. SWSI did not produce a list of specific projects to fill the 20 percent M&I gap, or provide for environmental and recreational needs. SWSI did identify the options, both at the conceptual and project specific level, that would most likely be pursued to meet the gap between supply and demand. The examination and implementation of these options should be placed in the context of goal number one.

3. Examine and implement options to fill the gap associated with local agricultural shortages and environmental and recreational enhancements. As the state moves forward in addressing statewide needs, it should look to foster multipurpose projects that could also satisfy M&I, environmental, and recreational needs. These multipurpose projects will enhance project feasibility. In addition, opportunities for nonpermanent agricultural transfers warrant further consideration.

1.5 SWSI Key Findings

SWSI put forth a "picture" of where Colorado may be by the year 2030 and identified a number of important issues and questions regarding how that "picture" of Colorado fits with the values, objectives, and future goals identified for Colorado. SWSI articulated 10 major findings, which are summarized below.

1. Significant increases in Colorado's population—together with agricultural water needs and an increased focus on recreation and environmental issues—will intensify competition for water. By 2030, 2.8 million more people are expected to call Colorado home. Water demands will increase by 53 percent during this time.

2. Projects and water management processes that local M&I providers are implementing or planning to implement have the ability to meet about 80 percent of Colorado's M&I water needs through 2030.

3. To the extent that these identified M&I projects are not successfully implemented, Colorado will see a significantly greater reduction in irrigated agricultural lands as M&I water providers seek additional permanent transfers of agricultural water rights.

4. Supplies are not necessarily where demands are; localized shortages exist, especially in headwater areas, and compact entitlements in some basins are not fully utilized.

5. Increased reliance on non-renewable, non-tributary groundwater for permanent water supply warrants serious reliability and sustainability concerns in some areas, particularly along the Front Range.

6. In-basin solutions can help resolve the remaining 20 percent gap between M&I water supply and demand, but there will be tradeoffs and impacts on other users—especially agriculture and the environment.

7. Water conservation will be relied upon as a major tool for meeting future M&I demands, but conservation alone cannot meet all of Colorado's future M&I needs. Significant water conservation has already occurred in many areas.

8. Environmental and recreational uses of water are expected to increase with population growth. Without a mechanism to fund environmental and recreational enhancement beyond the project mitigation measures required by law, conflicts among M&I, agricultural, recreational, and environmental users could intensify.

9. The ability of smaller, rural water providers and agricultural water users to adequately address their existing and future water needs is significantly affected by their financial abilities.

10. While SWSI evaluated water needs and solutions through 2030, very few M&I providers have identified supplies beyond 2030. Beyond 2030, growing demands may require more aggressive solutions.

1.6 Addressing Colorado's Future Water Needs

Based on the SWSI findings and stakeholder input, the CWCB identified several recommendations to address Colorado's future water needs, issues, and opportunities. To move forward on these recommendations, the CWCB established the Intrastate Water Management and Development Section to further analyze, evaluate, and develop deeper consensus on key issues and needs. This work forms the basis for Colorado to begin to implement solutions to its water needs in a manner that will benefit all water interests. The first step in this process was the formation of Technical Roundtables (TRTs) to continue work in a facilitated meeting forum and conduct technical analysis around four key areas:

- Water Conservation and Efficiency (Agricultural and Municipal and Industrial)
- Alternative Agricultural Water Transfer Methods to Traditional Purchase and Transfer
- Delineating and Prioritizing Colorado's Environmental and Recreational Resources and Needs
- Addressing the Water Supply Gap (between Current Supply and Current and Future Water Needs)

The overall goal of this effort is to develop reconnaissance level concepts to address the 20 percent M&I gap, agricultural shortages, and environmental and recreational enhancements. To the extent possible, multi-objective concepts are being considered. Developing a range of potential solutions will help water providers, policymakers, and stakeholders gain a deeper understanding of the relative role that water efficiency, agricultural transfers, and new water development can play in meeting future needs and the trade-offs associated with these concepts. These concepts can then be considered in the context of meeting human needs for water and providing for the needs of Colorado's natural environment and recreation.

1.6.1 Technical Roundtable Formation

Each of the TRTs met several times over the past 2 years. The mission statements of each TRT, as well as a brief summary of the major questions each TRT is addressing, are provided in Table 1-1.

It is important to emphasize that the potential findings and conclusions of this report represent an initial starting point to begin discussing the benefits and limitations of various water supply concepts. Over the next year this information will be further refined with input from the TRTs, CWCB, the Water for the 21st Century Roundtables, the Interbasin Compact Committee (IBCC), and other interested stakeholders.

Table 1-1 TRT Focus and Mission Statement

Technical Roundtable	TRT Focus	Mission Statement
Water Conservation and Efficiency	To identify the potential long-term savings from conservation measures, water system reliability concerns, and the public, political, and institutional challenges with implementing conservation measures.	*Develop a deeper understanding and greater consensus on conservation and efficiency measures for Municipal & Industrial and Agriculture*
Alternative Agricultural Transfers to Permanent Dry-up	To address the technical, institutional, financial, and legal aspects of alternative agricultural transfers to permanent dry-up, such as interruptible supply agreements, long-term rotational fallowing, water banks, reduced crop consumptive use, and purchase and leaseback.	*Examine and illustrate if or to what extent Municipal & Industrial and other water uses can be met with agricultural rights on a reliable basis without the permanent dry-up of irrigated agricultural land or impairing property rights*
Prioritize and Quantify Recreation and Environmental Needs	To develop mapping of important environmental and recreation resource areas throughout the state. In addition, the group has developed a list of multi-purpose projects incorporating environment and recreation values. The TRT has also addressed legal and institutional issues.	• *Sustain and optimize water-related recreational and environmental components of Colorado's economy and values* • *Identify generally accepted approaches to quantify environmental and recreational water needs* • *Identify and utilize existing and newly created physical, institutional, legal, and financial mechanisms designed to serve those needs and values*
Addressing the Gap	To address the major water supply gaps that were identified in SWSI. Information from each of the other TRTs will be combined with several water storage and management concepts. Both in-basin and cross-basin concepts will be developed. These concepts will represent a range of solutions that can be used to address Colorado's future water needs.	*Foster cooperation among water suppliers and citizens in every water basin to examine and implement options to fill in the gap between ongoing water planning and future water needs*

1.7 Report Organization

This report summarizes the findings of the TRTs, and is organized as follows:

- Section 1—Introduction
- Section 2—Water Conservation and Efficiency (Agricultural and Municipal and Industrial)
- Section 3—Alternative Agricultural Water Transfer Methods to Traditional Purchase and Transfer
- Section 4—Delineating and Prioritizing Colorado's Environmental and Recreational Resources and Needs
- Section 5—Addressing the Water Supply Gap (between Current Supply and Current and Future Water Needs)
- Section 6—Recommendations
- Section 7—References
- Appendix A—Response to Comments on Conservation and Efficiency Draft White Paper
- Appendix B—Response to Comments on Alternatives to Permanent Agricultural Transfers Draft White Paper
- Appendix C—Response to Comments on Environment and Recreation Needs Draft White Paper
- Appendix D—SWSI Phase 2 ArcReader Application—Environmental and Recreational GIS Coverages
- Appendix E—CWCB Instream Flow Filing Tabulations

Conservation and Efficiency Technical Roundtable

2.1 Overview of Water Conservation and Efficiency Technical Roundtable

The November 2004 Statewide Water Supply Initiative (SWSI) Report identified two important findings regarding water conservation and efficiency. First, conservation is an important component to most municipal water providers' future plans to meet the water supply needs of their customers. Second, while conservation will be an important solution for meeting some of the future water needs, conservation alone cannot meet all future water needs. Recognizing the importance of water conservation and wise water use, the Colorado Water Conservation Board (CWCB) formed a Technical Roundtable (TRT) to further explore the opportunities, challenges, and limitations associated with the implementation of water conservation measures at the local and regional level. The membership of the TRT can be found in Section 2.6.

The CWCB's intent throughout SWSI and the TRT process is to support the Identified Projects and Planning Processes that are part of the local providers' plans for meeting future water needs. The potential for future water conservation and efficiency savings outlined in this section in many cases are already an integral part of meeting future water demands, and are part of water provider's future plans. This section is intended to provide information and resources to support water providers as they pursue both meaningful water conservation and efficiency measures as well as traditional water storage and development projects. This section explores the role that conservation and efficiency can play in meeting future water needs and provides recommendations that encourage Colorado to move to more effective conservation and efficiency programs, while at the same time respecting local planning and protection of water rights and private property.

During SWSI and the TRT process, some providers expressed concern that the work described in this section could be used to interfere with or be used as justification to put at risk or eliminate structural solutions that water providers are pursuing to meet current and future water demand and provide drought protection. It is not the intent of CWCB to interfere with local decisionmaking or endanger projects and processes that were identified by local water providers in the 2004 SWSI Report as necessary to meeting long-term water needs.

The primary policy debate that emerged from this TRT can generally be characterized in the following manner:

- On the one hand, water providers recognize the important role that conservation plays in reducing future demands. At the same time, since conservation measures take decades to fully implement, and given the fact that there is uncertainty in the total amount of water saving that can be achieved, water providers also believe they must concurrently pursue structural water storage and management projects to ensure that future water needs are met.
- On the other hand, some conservation and environmental interests believe that conservation can be cost-effective and should be pursued first; before storage and other structural projects are constructed.

These two schools of thought clearly have validity and additional agreement and consensus building should be pursued to allow more timely and effective implementation of both structural water projects and conservation measures. The following realities should be considered in bringing water providers and conservation and environmental interests together.

- Some conservation measures take decades to fully implement
- Each water provider's system and water rights are different and local planners are in the best position to make decisions on the timing and the nature of the water needs of their communities
- Water projects take almost a decade and in some cases much longer to design, permit, and implement
- Water demand beyond the year 2030 will continue to grow; both conservation and storage are needed to address timeline and future needs beyond 2030

This section describes the activities and products from the TRT that was formed to address Water Conservation and Efficiency (Agricultural and Municipal and Industrial) issues. Subsequent to the formation of this TRT, it was determined that the discussion of agricultural efficiency issues was better suited for discussion by the Alternative Agricultural Transfer Methods TRT. Information on agricultural efficiency can be found in Section 3.

A high efficiency clothes washer can save over 20 gallons per load, reducing water used for clothes washing by over 50 percent

2.2 Technical Roundtable Mission and Objectives

The following mission statement was adopted at the first TRT meeting:

Develop a deeper understanding and greater consensus on conservation and efficiency measures for Municipal & Industrial and Agriculture

In addition, objectives and specific technical questions were identified. The objectives were never formally adopted, but were incorporated into the final technical analysis and were addressed to varying degrees by the TRT as described later in this document.

Municipal and Industrial (M&I) objectives identified were:

- Promote public education and information sharing on M&I programs that have been successful.
- Gain a greater understanding of the interplay between conservation and system reliability.
- Gain a greater understanding of the role conservation may play as a drought reserve.
- Gain a greater understanding of the economics of conservation.
- Gain a greater understanding of current conservation levels and practices.
- Identify the role conservation might play in addressing the water supply gap between current supplies and future demand.
- Identify the role conservation might play in creating water for the environment.
- Identify (quality of life) impacts with and without expanded levels of conservation.
- Evaluate effects of conservation on the urban landscape.

The following comments were made by TRT members on the draft mission statement and objectives:

- Local providers (both for agriculture and M&I) are the ultimate decisionmakers on water supply needs—SWSI can suggest or recommend measures that these groups can consider but it is not the ultimate decisionmaking authority.
- During this TRT the consequences and benefits of using conservation alternatives need to be identified.
- Deeper understanding of the issues can lead to greater insight.
- How is SWSI interacting with other statewide planning efforts such as population and land use issues?
  - SWSI is not formally linked to demographic projections, land use decisions, open space issues, etc. It was recognized during the first phase of SWSI that the water planning agencies represented on the roundtables were reactive entities and do not set policy on growth issues. It is hoped that the information developed during SWSI will be a

Road Median Before and After Landscape Retrofit

source of information to help local and county land use planning agencies make informed decisions.

- A question that should be considered by the group is whether conserved water can be used to address Colorado's future water supply gap versus use of conserved water in areas without gaps.

Agricultural efficiency objectives were also identified, but the evaluation of agricultural efficiency was moved to the Alternatives to Permanent Agricultural Dry-up TRT. Please refer to Section 3 for information on this topic.

2.3 Summary of Major Discussions during Technical Roundtable Meetings

Three Conservation and Efficiency TRT meetings and several subcommittee meetings were held. The discussion items for each of the full TRT meetings are as follows:

TRT 1

- **Presentation of an initial white paper that summarized information from SWSI and other relevant sources**
- **Development of the TRT Mission Statement**
- **Discussion of objectives**
- **Discussion of key issues raised in initial white paper and selection of questions to be addressed by TRT**
- **Establishment of subcommittees to address final questions**

TRT 2

- **Presentation of an overview to the approach of addressing questions**
- **Discussion of approaches to questions and TRT schedule**

TRT 3

- **Review and discussion of Question 1 memorandum on reliability and conservation impacts**
- **Review and discussion of Question 2 matrix on potential savings from various conservation measures**
- **Presentations on Colorado Springs Utilities customer survey on willingness to pay for conservation measures, City of Westminster case study, and CWCB Water Conservation Plan process**
- **Review of matrix on willingness to pay and implementation issues**
- **Review of white paper report schedule and interaction with Water Supply Gap TRT**
- **Discussion of final work products and schedule**

At the first TRT meeting, the following questions were determined as priorities for the TRT to address during the TRT process. Subcommittees were formed to help answer each question.

Municipal & Industrial

1. If we use conserved water for the following purposes, how does it affect water supply system reliability?
   - To improve reliability for existing customers
   - For new growth
   - Other uses
     i. Enhance streamflows
     ii. Sale to other users outside the service area

2. What are the projected long-term savings from conservation alternatives?
   - What conservation measures have been most effective in terms of amount and cost per acre-foot (AF) saved?
   - What are the implementation costs and "avoided" costs when implementing water conservation and efficiency measures?

3. What are the issues with ability to pay for M&I users, both at the provider and customer level?

4. What are the public, political, and institutional challenges to successfully implementing the various levels of M&I conservation?

In addition, the following question was developed for both M&I and Agriculture conservation and efficiency.

5. What are the legal and water rights constraints on ability to use water that is saved as the result of implementation of conservation and efficiency measures?

This was identified as an important issue; however, this question was not addressed in detail by the TRT.

2.3.1 M&I Water Conservation and Efficiency Measures

(Results from the Subcommittees)

In order to address the questions in a logical sequence, the subcommittees chose to first focus on the projected savings opportunities from various water conservation strategies/measures. Utilizing many recent studies, papers, and real-life water utility experiences, the Question 2 subcommittee compiled a set of water savings and costs that can be expected from a specific suite of conservation measures, if successfully implemented. These were presented to and reviewed by the full TRT.

Conservation Measures Identified

The TRT developed a list of M&I conservation measures. The list below does not represent an all-inclusive list, but provides examples of potential conservation measures.

- Sub-metering in multi-family housing
- Improved cooling tower efficiency
- Utility water loss reduction programs
- Commercial landscape audits
- Conservation-oriented water rate structures
- Rebates for indoor appliances (e.g., toilets and clothes washing machines)
- Residential and commercial indoor audits
- Turf replacement/landscape adjustment

Projected Long-Term Savings from Conservation and Efficiency Measures

A matrix of potential conservation water savings from the implementation of various measures was developed. Conservation savings as used in this report is defined as the quantity of water that can be achieved by reducing existing and/or future water demand. The TRT conservation savings matrix (Table 2-1) reveals there is significant potential for additional water use reduction by Colorado M&I water providers through the implementation of many measures. Some of these measures are programs, while others represent policies that would be implemented by the water provider or land use governing authority.

Based on this summary table, the various conservation measures, if fully and successfully implemented, represent a range of potential demand reduction from 287,000 AF to 459,000 AF per year (AFY) by 2030 with a mid-point estimate of these potential statewide savings of 372,000 AF. The average cost to achieve these water conservation measures is estimated to be $10,600/AF. The more inexpensive measures cost as little as $1,000 to $2,000/AF. This makes conservation a cost-effective option for most providers.

The level of penetration, which can be defined as the extent to which the conservation measure is implemented or adopted, is the most sensitive variable that affects the amount of reduction in water demand (conservation) that may be achieved. For example, low flow toilets can be an effective conservation method, but if no resident installs the fixture (0 percent penetration) then no savings will be realized. Similarly, if more customers than anticipated adopt conservation measures, then greater water savings may be achieved. This point is central to the debate over how far conservation measures can go in reducing current and future water demand.

The greatest single potential for water savings is turf replacement. This measure alone accounts for approximately 40 percent of the total potential savings. For example, in evaluating turf replacement, a statewide savings of 125,000 to 210,000 AFY was based on 25 percent of single family residences having no more than 60 percent turf in their landscape by 2030. In highly urbanized areas, such as the Denver metro area, new residential development by 2030 may have both smaller lot sizes and significantly less bluegrass in the overall landscape mix. Rural and suburban residential development and higher income areas, as seen on the West Slope and Douglas, El Paso, Larimer, and Weld counties on the Front Range may, however, continue to have larger lots and extensive bluegrass landscaping. Residential lot sizes are generally a function of the housing market and usually cannot be controlled to a meaningful level by local water providers.

Table 2-1 What are the Projected Potential Long-term Savings from Conservation Alternatives?

Measure	Estimated Implementation or Penetration Level by 2030	Potential Water Savings Range - Per Customer (thousand gals/year)	Potential Water Savings Range - Entire Program (thousand gals/year)	Potential Water Savings Range - Entire Program (AFY)	Estimated Cost Range of Program per AF of Savings ($/AF)	Expected Durability of Savings	Sources/Documentation
Turf replacement	25 percent of single family (SF) residents with no more than 60 percent turf	30 to 60	41,000,000 to 69,000,000	125,800 to 211,700	$7,000 to $25,000 depending on level of rebates offered	Limited deterioration anticipated.	2005. Xeriscape Conversion Study results; Southern Nevada Water Authority (SNWA) 2004 "Cash for Grass - A Cost Effective Method to Conserve Landscape Water"; UC-Riverside; Sylvan Addink, Ph.D. 1996. Watering Established Lawns in Western Colorado: Cool-season Grasses (Kentucky bluegrass, turf-type dwarf tall fescue and perennial ryegrass); Colorado State University Cooperative Extension; Curtis E. Swift, Ph.D.
Utility water loss reduction programs	90 percent of public water suppliers	3 to 5 percent of total system demand	16,952,000 to 28,264,200	52,000 to 86,700	$2,000 to $7,000	Relies on continued utility leak detection program.	Harold Evans, City of Greeley, American Water Works Assoc. (AWWA) Water Loss Control Committee
Toilet rebates	80 percent by 2030	14.6 per household based on 2.6 SF residents	18,192,000	55,800 in 2030	$7,230 @ $150 rebate per toilet (avg 2 per unit)	Deteriorization as flappers wear. Requires ongoing education or flapperless toilets	Amy Vickers and Associates, Pacific Institute, California Urban Water Conservation Council (CUWCC), Westminster
Conservation oriented water rates - increasing block rates, water budgets, excess use surcharges, information oriented billing	100 percent of municipal customers	Varies by customer class, current rate structure, and other variables	10,000,000	30,675	$6,000 (assuming an implementation cost of $180 per customer)	Dependent on Utility/Governing Board Decisions.	Experience of various TRT members
Washer rebates	80 percent by 2030	3.6 to 8.5 per household based on age of unit and density	5,550,150 to 13,104,500	17,000 to 40,200 by 2030	$4,000 to $28,000; rebate range $100-$300	No deteriorization if new appliance standards implemented and old units disposed	Amy Vickers and Associates, Pacific Institute, CUWCC
Cooling Towers increased cycle concentration	50 percent by 2030	Not Applicable	1,000,000 to 8,000,000	3,100 to 24,500	$1,000 to $5,000	10 percent deterioration possible	1995 U.S. Geological Survey (USGS) Com./Ind. Use & Denver Water internal estimates

Table 2-1 What are the Projected Potential Long-term Savings from Conservation Alternatives?

Measure	Estimated Implementation or Penetration Level by 2030	Potential Water Savings Range - Per Customer (thousand gals/year)	Potential Water Savings Range - Entire Program (thousand gals/year)	Potential Water Savings Range - Entire Program (AFY)	Estimated Cost Range of Program per AF of Savings ($/AF)	Expected Durability of Savings	Sources/Documentation
Rebates for landscape retrofits other than turf replacement	2.0 to 2.5 percent of residential customers	15 to 20 percent of irrigation or 11 to 36	1,000,000 to 6,000,000	3,100 to 18,400	$2,439 to $10,678	Permanent	Evaluation of Water Conservation Program, Maddaus Water Management, July 2003 coupled with Customer Information System (CIS) Data and Internal Analysis and Assumptions
Residential landscape audits (includes irrigation system upgrades, shutoff devices, weather-based controllers, other new technology)	25 percent of all residential customers - targeted at high users	5 to 15	1,250,000 to 3,750,000 by 2030	3,800 to 11,500 by 2030	$2,000 to $7,000 (assuming utility pays $100 per audit and customer pays system repair costs)	Same as if no audits are conducted -i.e., standard irrigation system on-going maintenance issues.	1999. Residential End Uses of Water. AWWA, Amy Vickers, Aquacraft landscape irrigation studies, engineering estimates.
Residential Indoor Audits	25 percent of all residential customers - targeted at high users	3 to 9	750,000 to 2,250,000	2,300 to 6,900	$3,600 to $11,000 (assuming utility pays $100 per audit and customer pays any repair costs)	Limited deterioration anticipated.	1999. Residential End Uses of Water. AWWA, Amy Vickers, Aquacraft landscape engineering estimates.
Submetering in multi-family housing	20 percent of multi-family (MF) housing by 2030	6 to 17/apartment unit/year	600,000 to 1,700,000 by 2030	1,800 to 5,200 by 2030	Variable ($0 to $4,000) depending upon who pays for the metering.	No deterioration.	2004. National Submetering and Allocation Billing Program Study
Commercial landscape audits (includes irrigation system upgrades, shutoff devices, weather-based controllers, other new technology)	25 percent of all commercial irrigators - targeted at high users	20 to 75	500,000 to 1,875,000 by 2030	1,500 to 5,800 by 2030	$2,000 to $8,000 (assuming utility pays $500 per audit and customer pays system repair costs)	Same as if no audits are conducted -i.e. standard irrigation system on-going maintenance issues.	2000. Commercial and Institutional End Uses of Water. AWWA, Aquacraft landscape irrigation studies, Amy Vickers, engineering estimates.
Commercial Indoor Audits	25 percent of commercial customers - targeted at high users	10 to 50	250,000 to 1,250,000	800 to 3,800	$3,300 to $16,300 (assuming utility pays $500 per audit and customer pays any repair costs)	Limited deterioration anticipated.	2000. Commercial and Institutional End Uses of Water. AWWA, Amy Vickers, engineering estimates.

Table 2-1 What are the Projected Potential Long-term Savings from Conservation Alternatives?

Measure	Estimated Implementation or Penetration Level by 2030	Potential Water Savings Range - Per Customer (thousand gals/year)	Potential Water Savings Range - Entire Program (thousand gals/year)	Potential Water Savings Range - Entire Program (AFY)	Estimated Cost Range of Program per AF of Savings ($/AF)	Expected Durability of Savings	Sources/Documentation
Metering of all utility customers	Very few customers in Colorado were not metered as of 2005						
TOTAL (not including duplicates)			93,543,300 to 149,509,600	286,900 to 458,600	$10,600 (weighted avg/AF)		

FOOTNOTES

- Penetration rates and potential water savings are designed to be realistic, but conservative estimates are based on implementation across the entire state over the next 25 years. These estimates do not take into consideration new products and technologies that are entering the market even today such as high efficiency toilets and super high efficiency clothes washers. Substantial changes in irrigation practices are also expected in the next quarter century. It is quite possible that actual savings will be higher than projected.
- Conservation savings, unlike traditional supply options, must be rigorously verified and maintained through ongoing public education and social marketing efforts. For conservation programs to be successful, citizens and businesses alike must understand that water is valuable and should not be wasted.
- The above measures may go after some of the same savings.

Other measures not listed above

<u>Municipal ordinances</u>

- Municipal codes and ordinances can be used as a tool to increase implementation of cost effective conservation savings. These tools can be effective and encourage conservation in several areas.

<u>Landscape ordinance</u>

- Landscape ordinances can reduce outdoor demands in new construction by establishing guidelines and requirements for landscape and irrigation system installations as currently exist for other building trades.

<u>Retrofit on sale/resale ordinance</u>

- Retrofit on sale or resale requirements often includes a rebate to help fund the requirement. Local building officials can require more efficient fixtures than the national or state codes mandate. In this manner, a community may choose to require 1.1 gallon per flush toilets be installed rather than the standard 1.6 gallon per flush toilets and use the savings to extend water supply.
- Providers can limit lost opportunities by establishing standards since incremental costs for proven methods and technology are often minimal in a new installation. Retrofit on sale ordinances requires properties that sell to retrofit fixtures to current standards. For example, this method of increasing participation is already used in many regions to ensure that properties comply with smoke alarm requirements.

However, lot sizes can be influenced by the local land use governments, particularly in the planning and zoning process. Water utilities can also exert influence in this area by developing a water tap fee (also termed system development charge or water resources and plant investment fee) structure that takes into consideration lot size and the projected demands that each new customer will place on the system.

There was general consensus that the implementation of reduced turf areas would be much easier to achieve with new development rather than retrofitting existing developed areas. There was not consensus, however, among the TRT members on the actual savings that may in fact be experienced by 2030 as a result of turf replacement. The primary area where there were differences of opinion was not in the savings if successfully implemented, but in the success of achieving and maintaining the turf replacement goals. Some TRT members suggested that if one factors in a reasonably slow but steady landscape conversion for existing residents along with the potential of reduced bluegrass landscape of new residences on a statewide basis, by 2030 it may be that closer to 50 percent of single family residences will have at most 60 percent turf in their landscapes, resulting in somewhere between 250,000 and 423,000 AF of savings statewide. Others stated that the desire to have residential bluegrass landscaping for aesthetic preferences, play areas for children and pets, plus the perceived ease of maintenance and ability to control dust and weeds, and reduce temperatures will result in the continued prevalence of bluegrass or similar turf landscaping in residential development.

Many water providers in Colorado can claim water rights credit for lawn watering return flows

Successful implementation of water conservation measures may represent other benefits to water providers in addition to the value to the utility of the water saved. These include:

- Water loss reduction decreases water treatment costs and water plant capacity needs.
- Landscape changes may lower owner's maintenance costs, such as mowing and fertilizer applications and sprinkler maintenance in addition to lower water bills.
- Irrigation system efficiency improvements can reduce damage to streets and parking lots from saturation of subsurface under pavement.
- Energy cost reductions by diminishing the volume of heated water used indoors and potential greenhouse gas emissions, depending upon the source of energy (i.e., coal-fired power plants).
- Potential cost savings to customers if reduced demand can reduce overall water system costs or conserved water can be used for other revenue-generating activities, such as new customers.
- The potential savings developed by the TRT are dependent upon the successful and long-term implementation of the various potential measures. Implementation of some of these measures will be dependent upon the enactment of ordinances or regulations of the local land use authority. Other water efficiency measures are within the purview and control of the water utility. Implementation issues are discussed later in this section.

In the case of water districts and entities such as Denver Water that serve areas outside of the City and County of Denver, regulations on plumbing codes and landscaping standards are not within the authority of the water provider. Other measures, such as water conservation water rates with steep rate increases for higher levels of water use, are within the authority of water utilities such as Denver Water, but depend upon the willingness of the utility rate setting authority to implement these measures. Many providers experience support and opposition for new rates and rate structures that reward conserving customers and discourage high water use, but some level of opposition from certain customers is to be expected.

Another area where consensus was not reached was on the continued level of effort and cost to maintain conservation savings once successfully implemented. For example, savings from an incentive program for turf replacement may require continued incentives to avoid replacement of low water using plant materials by new property owners who wish to revert their landscaping back to irrigated turf.

Example of High Water Use (Bluegrass Dominant) Residential Landscaping

Example of No Water Use Landscaping (Use of Rock vs. Xeriscape Landscaping)

The 2004 SWSI Report estimated a total statewide M&I demand of 1,824,000 AFY in 2030 and an increase from the year 2000 demand of 630,000 AF after a 101,000 AF reduction for water conservation savings expected from natural retrofit of older plumbing fixtures. The estimated potential additional conservation savings range presented in this section includes this estimated 101,000 AF demand reduction identified in SWSI. The range of savings developed by the Water Conservation and Efficiency TRT represents a significant potential water savings that could be realized. The SWSI also estimated additional conservation savings that could be realized by the complete penetration of existing conservation measures and the implementation of additional conservation measures. The extent of potential savings developed by the TRT is in the range of the estimated potential savings listed in the SWSI report of 272,000 AFY (Level 3 conservation) to 443,000 AFY (Level 4.) More information on the projected savings in SWSI can be found in Appendix E of the SWSI Report.

2.3.2 Examining the Relationship Between Water Conservation and Water Supply Reliability

The goal of the Question 1 subcommittee was to determine what effect water conservation might have on water supply reliability. In an effort to increase understanding of these issues and move toward consensus, the following points were developed based on a review of the available literature and knowledge of demand management, drought response, and water system planning. David Little, Peter Mayer, and Alan Ward developed the following points, which were subsequently presented and confirmed by the Question 2 subcommittee and the TRT.

1. Water Planning and System Reliability
   - Every water system in Colorado is unique; hence, water system planning and modeling for each system should take into consideration the unique interplay of demands, supply, and storage.
   - Useful concepts for understanding and modeling system reliability are:
     i. Reliability simply defined is a water supply system's ability to meet the needs of its customers during times of stress.
     ii. Safe yield (also called firm yield, although the definitions may vary) is defined here as the maximum volume of water that can be delivered by an entire system over a realistic hydrologic period that includes the drought of record.
     iii. Reliability criteria are the allowable shortages and their respective frequencies that a water provider is willing to tolerate without failing in its service commitment to customers. For example, the City of Boulder's water supply planners have planned their water system to meet the following reliability (assurance) criteria: (a) meet essential water needs against droughts of 1,000-year recurrence interval; (b) meet needs to sustain landscaping against droughts of 100-year recurrence levels; and (c) meet total demand against droughts of 20-year recurrence levels.
   - Some water providers evaluate the "absolute reliability" of their water supply system from a mass balance standpoint by testing how well it performs during a critical drought, based upon historic hydrology data. This concept is similar to safe yield (described above). Some providers prefer the concept of "design reliability," which takes the absolute reliability and applies a "factor of safety" such as assuming there is less storage in their system than actually exists or by using hypothetical hydrology that includes more severe droughts.
   - Providing for growth in a system and/or increased reliability can be accomplished by (a) adding new supply to increase the safe yield of the raw water system; (b) decreasing the demands of existing customers; or (c) a combination of the two.
2. Water Conservation and Drought Response
   - There are important differences between long-term water conservation programs and drought response programs.
   - Long-term water conservation programs typically seek to achieve permanent reductions in demand through technical and structural improvements and behavioral changes.
   - Drought response programs typically seek immediate and often temporary reductions in demand primarily through behavioral changes.
   - Technical savings (through fixture retrofits and technological efficiency improvements, leak management, etc.) can usually best be achieved through a long-term conservation program. While some technical savings may be achieved as part of drought response, these programs often take time to successfully implement and are often not conducive to the immediacy of drought response.
3. Water Conservation, Drought Response, Water Supply Reliability, and Demand Hardening
   - The concept of demand hardening is defined as follows: "By saving water, long-term conservation can also reduce the water savings potential for short-term demand management strategies during water shortages" (Flory, J. E., and T. Panella 1994).
   - Demand hardening is a consideration during a water shortage if conserved water is used to serve new customers.
   - Customers who have reduced their demand through technological changes or who join a system as efficient users (such as new

customers) can still achieve behavioral reductions during a shortage.

- By modeling the demand impacts of long-term conservation programs on current customers, and the potential for drought curtailment in new and existing customers, it is possible for water providers to determine what portion of achieved conservation savings should be held to maintain (or improve) system reliability and what portion can be used to serve new customers.
- Since conservation savings are achieved by existing customers it is important that the supply reliability for these customers not be negatively impacted as new customers are added to a system.

Retrofit Before

Retrofit After

4. Matrix by Water Source and Water Right
   - Table 2-2 presents a simple analysis of the impact of conserved water uses on systems with various water sources and rights. Under this simplified analysis, it is assumed that no new supply is added in any scenario and it is assumed that "Demand" refers to the constrained drought year demands (i.e., the demands the system experiences under a drought with mandatory restrictions in place). Reliability is defined using the basic definition from the beginning of this memo.
   - In this analysis, some portion of conserved water can be used to serve new customers without negatively impacting reliability as long as the constrained drought demand does not increase. While this is a greatly simplified analysis with significant caveats, it suggests that conserved water is a resource that can be used to serve new customers under the right set of circumstances. This simplified analysis also highlights the importance of considering the unique interplay of demands, supply, and storage on case-by-case bases for each water supply system.

Table 2-2 Matrix of Conservation Impacts by Source and Right

	Total System Demand is Reduced – Conserved Water Not Sold to New Customers	Total System Demand Stays Constant – Some Conserved Water Serves New Customers	Total System Demand is Increased – All Conserved Water Serves New Customers
Tributary groundwater (senior rights)	=	=	?
Tributary groundwater (junior rights)	+	=	-
Non-tributary groundwater (not mined)	=	=	?
Non-tributary groundwater (mined)	+	=	-
Direct flow surface rights, no storage (senior rights)	=	=	-
Direct flow surface rights, no storage (junior rights)	+	=	-
Surface rights, with storage (senior rights)	=/+[1]	=	-
Surface rights, with storage (junior rights)	+	=	-

+ Reliability increased
- Reliability decreased
= Reliability unchanged
? Depends upon the specific aquifer
[1] Some water providers can't tell that their water system is experiencing drought conditions until a significant portion of the first year of the drought has past. This lack of forecasting ability hinders the capability to reduce demand through drought restrictions in the first year of a drought. It is significant to note that demand reductions from conservation measures would be present in the first year of a drought, increasing system reliability.

2.3.3 Financial Considerations

(Question 3 Subcommittee)

Fundamentals associated with the water providers' and customers' ability and willingness to pay for conservation measures were reviewed by the TRT. These included principles that Colorado water users have adopted such as the wise and efficient use of water, intolerance of water waste, and goals that should be adopted by water providers. It was agreed that, in most cases, the issue is not ability to pay, but rather the willingness of providers to charge customers. However, the ability of lower income customers to pay higher conservation-oriented water rates was not fully explored. In addition, some TRT members indicated that if the cost of water exceeds an acceptable level, lower income customers may not water and let lawns and landscaping deteriorate and become unattractive.

Overall, the TRT was not able to find definitive information on ability and willingness to pay. However, the TRT did identify a few case studies that provide information on both financial and institutional issues that effect the implementation of water conservation measures. These case studies are presented below and in the following section.

Colorado Springs Utilities Case Study

Colorado Spring Utilities conducted customer surveys in 2004 and 2005 on the customer's willingness to pay. Both residential and business customers were included in the survey.

Customers were asked a number of questions regarding willingness to pay for conservation measures. When asked about reasons why they might conserve water, the response was as follows:

- Reducing the monthly bill - 40 percent
- Ensure resources for future generations - 33 percent
- Concern for the environment - 23 percent
- Not sure - 3 percent

Responses to "How much do you think Colorado Springs Utilities should spend to promote water conservation?" are shown in Table 2-3. Approximately 70 percent of the respondents (shaded rows) thought that Colorado Springs Utilities should charge between $0.50 and $1.50 per month for promoting water conservation.

Table 2-3 "How Much Do You Think Colorado Springs Utilities Should Spend to Promote Water Conservation?"

	Frequency	Percent
More than $2 per customer/mo.	26	9%
Between $1.50 and $2 per customer/mo.	20	7%
Between $1 and $1.50 per customer/mo.	52	17%
Between $0.50 and $1 per customer/mo.	80	27%
No more than $0.50 per customer/mo.	79	26%
Should not spend anything at all	43	14%

Figure 2-1 shows responses to the question: "How important should each of the following be to Colorado Springs Utilities in influencing how customers use water?" Both mandatory and voluntary programs were equally supported by 60 percent of residential users, while commercial users were slightly less supportive of mandatory programs. Promoting conservation through conservation oriented rate structures had less support by both residential and commercial customers when compared to mandatory and voluntary conservation programs.

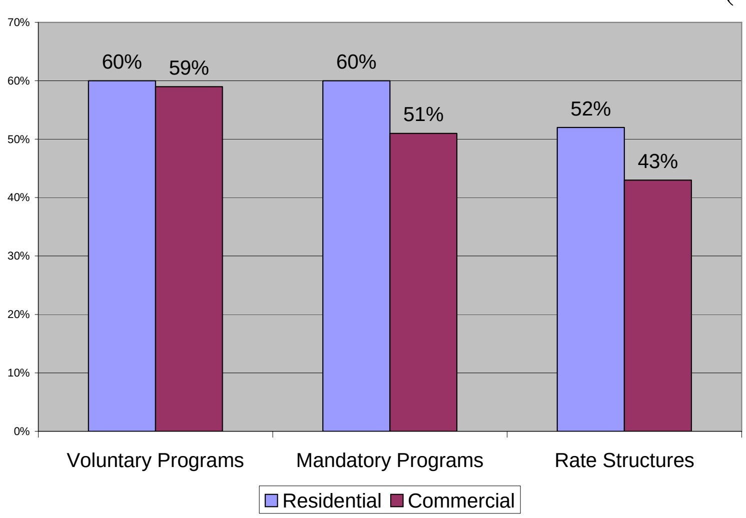


Figure 2-1
"How Important Should Each of the Following Be to Colorado Springs Utilities in Influencing How Customers Use Water?"

The following comments were made by TRT members on Questions 3 & 4:

- Municipalities' willingness to charge higher prices for water to promote conservation must also be considered. For Glenwood Springs, there is a difference between citizen's ideas and where the City Council is going with certain programs. There is also a minority of opponents to conservation who are very vocal.
- Lifeline services similar to ones implemented in the energy crisis during the 1970s could be used to increase the implementation of conservation through pricing. Under this philosophy, the amount of water needed for basic indoor water user would be priced to be affordable by all customers, regardless of income, and higher conservation water rates would only be implemented on water use above this basic "lifeline" water use.
- The Ad Council may be willing to provide pro-bono support for public education on water conservation and this should be investigated.

2.3.4 Institutional and Legal Considerations *(Question 4 Subcommittee)*

In April of 2004, the Metro Mayors Caucus (MMC) began drafting a Memorandum of Understanding (MOU) on Water Conservation and Stewardship. Signed by 28 jurisdictions and endorsed by 16 organizations, the MOU establishes a common understanding among mayors of the importance of water to all aspects of life and commerce in Colorado and expresses the intent of the signing jurisdictions to enhance the stewardship of the water resource within their jurisdictions in a number of specific ways.

After the signing of the MOU on January 22, 2005, the Caucus teamed with the Colorado WaterWise Council to draft best management practices (BMPs) for Water Conservation. The BMPs were a direct outgrowth of the commitment within the

MOU to "...use our best efforts to continue to identify and adopt, or urge the water utilities that serve us to adopt BMPs that achieve efficient water use through conservation, reuse, and/or new technologies." As stated in the MMC cover letter to the mayors, the BMPs are specifically intended to serve as a menu of options to water providers that want to enhance water conservation by reducing demand among their customers. In June of 2005, these BMPs were adopted as Appendix C to the Colorado Model Water Conservation Plan by the CWCB. http://cwcb.state.co.us/ conservation/ conservation/hbl365/pdf/appendixc.pdf

Table 2-4 discusses the implementation of the various conservation measures identified in this report and the corresponding BMP developed through the MMC.

Table 2-4 Implementation of Conservation Measures

Conservation Measure	Implementation Comments	Metro Mayors Caucus BMP
Metering of all Utility Customers	The majority of Colorado water utilities are metered. This is a base assumption that all utilities should meter.	BMP2, BMP7, BMP11
Submetering in Multi-family Homes	Relatively easy to implement on new properties. Retrofit cost is dependent upon existing plumbing configuration. Billing should be conducted by utility and not property owner to ensure implementation.	BMP5
Cooling Towers Increased Cycle Concentration	Increased cycles and resulting increase in concentrations must be monitored carefully for potential impacts to equipment.	BMP5
Residential Landscape Audits	Convincing utility management of the benefit and to fund the program. Implementation of the audit findings by the property owner.	BMP1
Utility Water Loss Reduction Programs	Water loss reduction decreases treatment costs and plant capacity needs.	BMP11
Commercial Landscape Audits	Implementation of the audit findings by the property owner.	BMP3
Conservation Oriented Water Rates	Potential need for new utility billing program and monthly meter reading.	BMP7
Rebates for Landscape Retrofits	Relatively high cost and level of effort to retrofit. Market penetration will be a challenge. Landscape changes may lower owner's maintenance costs.	BMP1 (discusses replacement not rebates)
Toilet Rebates	Market penetration will be a challenge. Rebates should target for 1.0 gallon per flush (gpf) vs. 1.6 gpf toilets to maximize savings. May be best targeted on commercial users.	BMP1 (discusses replacement not rebates)
Residential Indoor Audits	Convincing utility management of the benefit and to fund the program. Implementation of the audit findings by the property owner.	BMP1
Commercial Indoor Audits	Convincing utility management of the benefit and to fund the program.	BMP5
Washer Rebates	Some utilities trying to phase out washer rebate program since high efficiency washers are becoming more popular and may not require rebates. Can the water utility rebate be combined with energy utility rebate?	BMP1 (discusses replacement not rebates)
Turf Replacement	Customer willingness to participate. Avoid double-counting of savings with landscape rebates and landscape audits that may lead to turf replacement. Landscape changes may lower owner's maintenance costs. Reduction in turf easier to implement for new construction.	BMP1 and BMP3

The BMPs for Water Conservation identified by the MMC include:

1. Residential Indoor and Outdoor Water Use Conservation Programs
2. Commodity Rate Metering for New Connections and Existing Connection Retrofit
3. Landscape Water Conservation Policies and Programs for Commercial, Industrial, Institutional Properties and Public and Private Common Area Landscapes
4. School Education Program
5. Conservation Program for Commercial-Industrial-Institutional and Multi-Family Residential Accounts (Indoor)
6. Wholesale/Contract/Allotted Assistance Programs
7. Conservation Pricing Via Water Rate and Fee Structures
8. Water Waste Prohibitions and Enforcement Program
9. Water Conservation Coordination
10. Demand Reduction During a Water Crisis
11. Water Loss – System Audits and Leak Detection Programs

City of Westminster Case Study

The successes and challenges of implementing a water conservation program are partially illustrated in Tables 2-5 through 2-9, which provide a history of the implementation efforts related to the City of Westminster, Colorado's water conservation programs. The City of Westminster implemented a growth management program and conservation oriented water rates, tap fees, and landscape regulations in order to address water supply planning and water conservation issues. This history illustrates that implementation takes not only years, but decades and the coordination with and cooperation of policy makers, managers, developers, and multiple city departments. An important component to the success of the Westminster program is the cross departmental communication and coordination between the land use planners (Community Development Department) and the water utility planners (Public Works and Utilities Department).

Table 2-5 City of Westminster Growth Management Program – Implementation History

Year	Description	Implementation Challenges
1977	City implemented a growth management plan which does not allow utility taps (service commitments) to be allocated without adequate water and wastewater capacities identified.	Lawsuit filed by the Home Builders Association of Metro Denver (HBA) claiming that the City did not have the authority to limit utility taps. Colorado Supreme Court confirmed the City's authority to regulate growth.
1978 - 2002	Given the limited number of taps available there was an annual competition for service commitments (tap credits) which included points for water conservation features.	A higher priority was placed on bluegrass landscape than xeriscape design by the Community Development Department. The perception was that xeriscape was not as attractive and thus low water use landscaping was not heavily weighted in competition.
1996	A moratorium was placed on new service commitments until additional water supplies and treatment capacity was added. Residential growth was exceeding the capacity of the City to develop and implement sustainable and reliable water supplies at a rate to keep up with growth.	Moratorium was strongly opposed by the development community. Developers claimed the city water allocation per service commitment was too high. The allocation was 0.43 AFY/ single family residential unit. The HBA claimed they could construct homes using 0.33 AFY.
1996	A joint study of residential water use by City and HBA was conducted. A geographic information system (GIS) database linking billing, parcel, tax assessor, and building permits was developed. Data-logging of residential uses was conducted. Prototype low water-using homes were constructed.	HBA agreed to fund 50% of the cost of the study through residential tap fee surcharge.

Table 2-6 City of Westminster – Water Conservation Rate Structure Implementation History

Year	Description	Implementation Challenges
1977	Implemented residential increasing block rate structure with higher per 1,000 gallons rates during the winter than summer. Toilet dams and faucet aerators offered for free to customers.	Growth rate was exceeding City's ability to provide for water supply, so conservation oriented rates had City Council support.
1980 - 1984	City manager wants to implement toilet replacement rebate program.	Utility staff does not believe that rebate program will result in substantial increase to water supply, since city uses wastewater effluent to make required returns on transferred agricultural water.
1991	Water rate study conducted and higher winter rates were eliminated. As a result, summer rates increased.	In order to ensure revenue requirements without impacting low income and low water using customers, city management added a 4th block to the water rate structure aimed at discouraging high residential water use.
1992	Water rate structure was realigned to 3 residential blocks.	A warm, dry summer resulted in higher than average water use, resulting in strong customer reaction to high water bills as a result of the conservation oriented rates. Over 2,000 customer complaints were received and the 4th block was eliminated.
1995 - 2006	Finance Department, responsible for utility billing, periodically floats proposal to reduce utility costs by reducing meter reading frequency to every 2 months.	City management initially supports measure to cut meter reading costs without understanding impacts on customer response to conservation water rate structure. Water resources staff must provide justification for continuation of monthly meter reading. Utility billing staff does not actively follow up on high water use report program that is generated that allows high water users to be identified.
2000	City council approves adding 2nd commercial block based on meter size.	No opposition from commercial users. Second block did not include irrigation accounts due to improper meter sizing of these accounts.
2005	New utility billing program is implemented.	New utility billing system has limited data analysis capabilities. The linkage with the GIS database program that links water billing data to building department, tax assessor and GIS parcels is no longer supported by city's information technology department. Historical customer water billing data is also no longer available
2006	Discussions between utility and information technology departments on restoring water use analysis capabilities of billing program, including historical customer water use data and GIS capabilities.	Discussions in progress. Outcome unknown.

Table 2-7 City of Westminster – Water Tap Fee Implementation History

Year	Description	Implementation Challenges
1977-2002	Water and Sewer tap fees based solely on meter size	Developers lobby against most tap fee increases
1996-2001	Analysis of peak and annual water use by customer type and meter size is conducted in order to better understand and characterize residential and commercial demand patterns	Datalogging of accounts was not considered until residential water use study jointly funded by HBA shows the efficacy of the approach.
2002	Water tap fee structure modified to charge water resources fee based on estimated annual water use. Data from HBA study and data logging used to support this approach. Treated Water Investment fee continues to be based on meter size, but datalogging allows better sizing of meters, especially for commercial and irrigation accounts.	Extensive outreach to the development community (HBA, residential and commercial builders) and city's community development and economic development staff is conducted for buy-in. No strong opposition is experienced.
2002	Irrigation water tap fee is changed and based on landscape area and type, rather than meter size.	Conflicting messages are received from the city. Community development department encouraged bluegrass landscaping for esthetic reasons while tap fee structure penalized developers installing bluegrass landscape.

Table 2-8 City of Westminster – Formal Water Conservation Program Implementation History

Year	Description	Implementation Challenges
1995-2000	Periodic attempts by water resources division to hire dedicated water conservation staff.	Management did not view this position as a priority compared to other "bricks and mortar" projects. Existing staff can continue modest conservation efforts as time permits.
2001	Management approved a temporary, full time conservation/tap fee staff position.	Water resources staff presented novel funding approach for approval of water conservation staff position. The position is not permanent and is tied to demonstrating cost effectiveness through additional water conservation savings and increased tap fee revenue.
2006	Evolution of water conservation position to include other areas such as water resources planning, utility related code analysis and reclaimed system operations.	Staff person has been assigned additional priorities and cannot devote as much time to water conservation activities.

Table 2-9 City of Westminster – Water Conservation Landscape Regulations Implementation History

Year	Description	Implementation Challenges
1977	Soil amendment for residential front lawns is required by ordinance.	Soil amendment requirement is not enforced by community development department.
1997	Soil amendment requirement added for all types of development.	Soil amendment requirement is not enforced by community development department. There is no inspection by city staff.
1997-2002	Lobbying by City water resources staff for changes to commercial landscape regulations – e.g., no high water use in medians, rights-of-way (ROW) strips, and other difficult to irrigate areas.	Community Development expresses concern over aesthetic appearance of parking areas and streetscapes.
2002	Drought - recognition of poorly designed landscapes and irrigation systems.	Strong support internally in the city for conservation.
2004	Comprehensive adjustment of landscape regulations to include changes in irrigation technology and establish water budget for landscape design. Added review and enforcement positions.	Approval for 2 new staff. Working with development community to design and install per regulations.

The CWCB would like to express our deep gratitude to the entire TRT, especially the following subcommittee members who help produce the information presented in this section.

M&I Question 1 Subcommittee

If we use conserved water for the following purposes, how does it affect water supply system reliability?

- Dave Little, Denver Water - chair
- Stu Feinglas, City of Westminster
- Doug Kemper, Aurora Water (during process changed jobs to become Executive Director of Colorado Water Congress)
- Peter Mayer, Aquacraft Water Engineering
- Bart Miller, Western Resource Advocates
- Alan Ward, Pueblo Board of Water Works

M&I Question 2 Subcommittee

What are the projected long-term savings from conservation alternatives?

- Peter Mayer, Aquacraft Water Engineering - chair
- Harold Evans, City of Greeley Water Board
- Stu Feinglas, City of Westminster
- Greg Fisher, Denver Water
- Kenny Romero, Colorado Springs Utilities
- Ann Seymour, Colorado Springs Utilities
- Taryn Hutchins-Cabibi, Western Resource Advocates
- Doug Short, City of Lafayette
- Paul Lander, City of Boulder

M&I Question 3 Subcommittee

What are the issues with ability to pay for M&I users, both at the provider and customer level?

- Rocky Wiley, Rothberg, Tamburini and Winsor - chair
- Greg Fisher, Denver Water
- Dave Merritt, Colorado River Water Conservation District and City of Glenwood Springs (Mayor Pro-Tem)
- Kenny Romero, Colorado Springs Utilities
- Ann Seymour, Colorado Springs Utilities

M&I Question 4 Subcommittee

What are the public, political, and institutional challenges to successfully implementing the various levels of M&I conservation?

- Doug Short, City of Lafayette - Chair
- Doug Kemper - Mr. Kemper was initially chair but moved from his position at City of Aurora to the Director of Colorado Water Congress
- Dave Little, Denver Water
- Chuck Wanner, San Juan Citizens Alliance
- Todd Williams, Williams and Weiss Consulting

2.4 CWCB's Water Conservation and Drought Planning

2.4.1 Office of Water Conservation & Drought Planning

The CWCB's Office of Water Conservation and Drought Planning (OWCD) promotes water use efficiency while providing public information and technical and financial assistance for water conservation planning. The Office was created in 1991 with the passage of the Water Conservation Act of 1991. This legislation established the Office of Water Conservation (OWC) and gave general statutory authority to the Board to provide water conservation support to the State and its citizen under § 30-60-124 and § 30-60-126 C.R.S., respectively. In 2004, the General Assembly passed House Bill (HB) 1365, which expanded the duties and responsibilities of the office to include drought mitigation planning, changing the name to the "Office of Water Conservation and Drought Planning," and provided a funding source for water conservation and drought mitigation planning. In 2005, under HB 1254, the Colorado General Assembly created a three-year grant program to provide covered entities (water providers with annual demand at or exceeding 2,000 acre-feet) with financial assistance to implement water conservation plan measures and promote water conservation education and public outreach around the State. In 2007, the General Assembly passed Senate Bill (SB) 08, which (1) broadened the use of the Water Efficiency Grant Program Fund to include water conservation planning and implementation, education and public outreach, and drought mitigation planning and implementation, (2) expanded the types of entities eligible for grant monies to develop and implement water conservation plans, (3) extended the grant program until June 2012, (4) appropriated an additional $800,000 in both Fiscal Year (FY) 2007-2008 and FY 2008-2009, for a total of $1.6 million in the Grant Program over 2 years, and (5) broadened the eligibility requirements for agencies seeking grant funds to promote water resource conservation education and outreach.

At a fundamental level, water conservation involves managing existing water supplies to reduce demand and increase efficiency of use. Accomplishing this mission includes serving as a repository for water conservation planning and water efficiency measures information. The OWCD disseminates this information to water providers and the general public around the state via its website and its participation in workshops, seminars, conferences, and water festivals. However, as water conservation planning becomes a more prominent component of the state's water supply portfolio necessary to meet future water supply shortages statewide, the OWCD will initiate efforts to develop more comprehensive and socially penetrating strategies for educating all sectors of the public on the importance of water and the need to use it efficiently and wisely.

The OWCD will work to identify opportunities to, either solely or in partnership with water providers and other water interests, develop educational and technical resources to effectively educate the public. Through these collaborations, it is CWCB's intent to facilitate water providers' efforts to incorporate and accomplish the statutory water conservation planning elements and improve dissemination of information regarding water use efficiency measures including public education.

All water conservation plans submitted to the CWCB for approval must include a public education and outreach element. This component is a critical piece of each plan since it is the impetus for achieving high market penetration rates for other water conservation plan elements as well as success in achieving the overall water conservation goals. Through the efforts of the state to collect and develop well researched methods and strategies for engaging the public in efforts to promote efficient water use, water providers are able to capitalize on this work and incorporate water conservation education measures that have been successful in other utility service areas or other regions of the state or the west. This has the potential to free up valuable staff and fiscal resources necessary to successfully implement other components of a water conservation plan.

In an effort to accomplish its mission to coordinate with multiple state and local agencies to provide public information, the OWCD will seek opportunities to work closely with these groups to utilize their constituent base as a vehicle to promote water use efficiency around the state. Table 2-10 is a preliminary list of key groups and organizations. As CWCB develops its outreach plan, additional groups and organizations will be identified and contacted.

Table 2-10 List of Potential Coordinating Organizations for Conservation Public Information

Areas of Interest	Organizations
Local government	Municipalities and water districts, Colorado Municipal League, International City Managers Association (Colorado), Colorado Counties, MMC, local and regional councils of government (Northwest Council of Governments [NWCOG], Denver Regional Council of Governments [DRCOG], etc.), water conservancy and conservation districts
Chambers of commerce, business organizations, economic development and business/governmental organizations	Local and regional chambers of commerce and other business groups such as Colorado Association of Commerce and Industry, Southeast Business Partnership, consulting firms involved with water conservation and water demand planning, Local, county and regional economic development organizations, Club 20, Action 22, Progressive 15
Professional organizations involved in water conservation	Colorado WaterWise Council, Rocky Mountain American Water Works Association
Construction and development industry	Home Builders Association of Colorado, Home Builders Association of Metropolitan Denver
Landscape design organizations	American Society of Landscape Architects, ASLA (national), COASLA (state)
Irrigation industry	Irrigation Association (national), GreenCO (state)
Federal government	National Oceanic & Atmospheric Administration (NOAA), U.S. Environmental Protection Agency (EPA), Natural Resources Conservation Service (NRCS), and USGS
State universities and research organizations	Colorado State University, University of Colorado, Western Water Assessment, and local colleges and universities
Media	Environmental and water reporters for local print, radio and television media

2.4.2 Financial Assistance to Facilitate Conservation Planning

The Water Conservation Act of 2004, adopted by the 2004 Colorado General Assembly under HB 04-1365, not only expanded the responsibilities of the OWCD to include providing technical assistance for drought planning, but it also added additional plan elements required of all water conservation plans submitted to the state for approval. Following on the heels of the 2002 drought, the legislature recognized the need to provide a strong incentive for water conservation and drought planning. Thus they created a funding mechanism for the CWCB, through the OWCD, to provide grant monies for water conservation and drought planning.

The Water Efficiency Grant Program Fund offers financial assistance, in the form of grants, to covered entities that are preparing to develop or update their water conservation plans, ultimately resulting in more meaningful water conservation statewide. A covered entity is any municipality, agency, utility, public or private, with a legal obligation to supply, distribute, or otherwise provide water at retail to domestic, commercial, industrial, or public facility customers with a total annual demand of 2,000 AF or more. Please visit http://www.cwcb.state.co.us/conservation/ for more information about the grant program.

2.4.3 Financial Assistance for Implementation of Conservation Plans

In 2005, the Colorado General Assembly continued in their efforts to promote the importance of water conservation in Colorado by passing the Water Efficiency Act of 2005, under HB 05-1254. The Water Efficiency Grant Program provides financial assistance to covered entities and qualifying agencies. A covered entity may use grant monies to aid in achieving the water conservation goals outlined in their locally adopted water conservation plan, whereas an agency may use grant monies to fund outreach and/or education aimed at demonstrating the benefits of water efficiency.

In order for the state to realize some of the projected water savings expected from implementation of water conservation measures identified in the Question 2 matrix, water providers will need to implement their water conservation plans. Funding for the Water Efficiency Grant Program will facilitate the implementation and penetration of these measures, thereby aiding those entities in their efforts to achieve their estimated water saving goals, but more importantly to reduce the projected statewide water supply shortages. Comprehensive and well targeted public education and outreach programs will be critical in penetrating consumer markets and achieving maximum savings. Please visit http://www.cwcb.state.co.us/conservation/ for more information about the grant program.

2.4.4 Regional Messaging and Public Outreach

The OWCD already plays a vital role in supporting the effectiveness of local and regional public outreach and involvement efforts by providing technical support to water providers as they implement water conservation programs. However, the state's increased role in improving the public's understanding of state water and water resource issues will be the cornerstone of future efforts. As a complement to the state's regulatory and information intensive campaigns, a community based social marketing approach will be implemented to help water providers identify customer barriers and benefits to being successful at meeting their water conservation goals.

Through a comprehensive water conservation survey of Colorado citizens scheduled to be conducted in 2007-2008, the state hopes to gain a better understanding of Colorado citizen perceptions of water, its availability/scarcity, and its value. These findings will provide the state guidance in its development of a regional and statewide messaging campaign. Efforts to create and promulgate a consistent regional message of the value of Colorado's water resources will go a long way to creating a water conservation savvy citizenry, supporting their water providers efforts to utilize water conservation strategies to maximize their system water supplies. Helping to create customer and political support for water conservation at the customer level will enable water providers, who are currently struggling to implement more advanced levels of conservation, to succeed in doing so.

The OWCD will also continue its efforts to meet the need for improved water conservation measures and programs, as well as measurement techniques to determine the social and cost-effectiveness of these tools. Projects aimed at measuring the effects of various conservation measures or suites of measures will be accomplished in order to meet the critical water provider need for sound technical information to develop and set realistic goals for water consumption reductions resulting from the implementation of a water conservation plan.

2.4.5 Bringing Together Supply Planning and Conservation Elements (Integrated Water Resources Planning)

Water conservation should be considered in the larger context of sound water management. Also, water conservation planning should be integrated into as many aspects of local water resource planning as possible to achieve overall water resource management goals. Water conservation planning can help water providers identify where future planning efforts need to be focused. The planning process helps the provider look at the effect of water conservation on future water supply and demands, and how water conservation may affect timing and cost of new water supplies and other investments. Integrated water resources planning is designed to put water conservation on an equal basis with water supply development when analyzing options for meeting future water needs.

In an effort to approach water conservation planning in an integrated manner, the CWCB has developed a Model Water Conservation Plan Development Guidance Document (http://www.cwcb.state.co.us/conservation/pubs.html), which provides a process and template with instructions for use to support meaningful water conservation planning through the integration of water conservation planning with water supply planning. The nine planning steps outlined in the guidance document encourage water providers to comprehensively analyze and evaluate their water supply systems in the context of supply and demand, and calculate the impacts resulting from various conservation measures and penetration rates. Coupled with a complete implementation and monitoring strategy, as well as mechanisms for adapting to changing public response to the proposed conservation measures, a water conservation plan can be a powerful tool and water supply management strategy for water providers as they develop their water resource plans for meeting water demands in the future.

2.5 Conclusions and Recommendations

As its mission, the M&I Water Conservation TRT set out to "develop a deeper understanding and greater consensus on conservation and efficiency for municipal, industrial, and agricultural water uses." In the category of urban water demand, the TRT made significant advances that forward our understanding of the important role of water conservation and efficiency in municipal water planning. Successes include:

- Reaching consensus on how conservation may affect system reliability under various scenarios
- Quantification of potential long-term savings available from conservation measures
- Development of a range of potential water conservation savings from select measures that were in a comparable range to potential water conservation savings identified in the SWSI report
- Common understanding on reaching some issues

Limited progress was made on agricultural water efficiency and this remains a significant challenge. Based on initial work, there appears to be some opportunities to achieve additional efficiencies in agricultural water use. However, since agricultural return flows are used by downstream water users, at a watershed level there are significant limitations in the overall net potential savings that can be realized. Nevertheless, since agricultural water use accounts for over 85 percent of total water use in the state, follow-up efforts should include this group of water users. This issue is discussed in Section 3 of this report.

In addition the impacts of climate variability on water conservation and system reliability have not been addressed by this TRT.

The following conclusions and recommendations are made by CWCB staff after a review of the Water Conservation and Efficiency TRT efforts. The primary areas where there is a lack of consensus among TRT members is on the successful implementation of some of the conservation measures, especially turf replacement and the role of water conservation in eliminating the need for structural projects and processes that water providers have planned to meet future water demands.

Example of Low Water Use (25% Bluegrass) Residential Landscaping
WaterWise Landscaping Trees, Shrubs & Vines
Jim Knopf, Chamisa Books

Example of Moderate Water Use (50% Bluegrass) Residential Landscaping
WaterWise Landscaping Trees, Shrubs & Vines
Jim Knopf, Chamisa Books

Potential Impacts of Water Conservation on Supply Reliability and Potential Uses of Conserved Water

1. Issues related to conservation and reliability are specific to each utility and dependent upon the portfolio of water rights (type and priority).

2. Water planners are strongly encouraged to analyze safe yield and develop reliability criteria for their systems.

3. Water providers should evaluate the actual impacts of conservation on system yields and reliability through model runs and reasonable assumptions about technological and behavior savings that may be expected from customers during droughts before and after the implementation of conservation measures.

4. The impacts of the implementation of water conservation measures on the reliability of water systems should be examined based on the potential uses of the conserved water, such as new growth, instream flows, drought reserve, or lease or sale to other entities.

5. The use of a portion of conserved water for new growth or drought reserve by the conserving utility appears possible under most circumstances without impacting reliability.

6. The use of a portion of conserved water for environmental flows also is feasible, especially if the water is subject to a pull back by the utility during drought or other water shortages. Some conserved water, such as from in-basin direct flow rights, may have limitations if transferred to an environmental flow.

7. At this time, based on extensive utility feedback, it is very unlikely that any utility would permanently sell conserved water to another utility.

8. When evaluating demand reduction, it appears that some additional water savings can still be

achieved through temporary drought measures and behavioral changes, even after the implementation of technological water conservation measures. Future efforts should attempt to quantify savings that could be achieved through temporary behavioral changes once technological water conservation measures have been successfully implemented.

Potential Savings from Water Conservation Measures

1. While most water providers have implemented significant conservation, there are opportunities to achieve even greater conservation savings. In the first phase of SWSI, it was estimated that providers across the state have implemented permanent conservation measures that will ultimately reduce future demand in excess of 12 percent, which would be included in the projected overall savings presented below. Based on information gathered by this TRT, it appears that additional demand reduction can be accomplished by a variety of measures. These measures, if fully and successfully implemented, represent a range of demand reduction from 287,000 AF to 459,000 AFY by 2030. As with all options, there are significant technical, engineering, legal, and institutional challenges associated with how much demand reduction can occur and how much this demand reduction can be used to address Colorado's future water supply need (see Section 5).

2. The average cost to achieve these water conservation savings is estimated to be $10,600/AF. The more inexpensive measures, i.e., the "low-hanging fruit" cost as little as $1,000 to $2,000/AF. This makes it a cost-effective option for most providers.

3. Some water conservation measures, such as sub-metering of multi-family housing and reduction of irrigated turf areas, will be much easier to implement with new development than through the retrofit of existing development.

4. Water conservation in most cases can reduce or delay the need for additional water supply development projects, reduce or delay the need for water treatment plant expansions and other utility infrastructure, and reduce financing, operations, and maintenance costs.

5. Water conservation can potentially reduce costs to the water user through reduced water bills, energy savings, and reduced landscape maintenance costs. However, the unit cost for water may have to increase to recover lost revenues in response to overall reduction in water sales if additional customers are not added or utility operating costs reduced.

6. The impacts of water conservation must be factored in utility financial planning as it can result in net revenue losses to the utility if operating costs are not reduced, water rates increased, or revenues maintained through new sales to other users.

7. Many water conservation implementation concerns are related to cost. As the potential water savings matrix indicates, certain water conservation measures are cost-effective when compared against other options.

8. Utility managers and decisionmakers should analyze the overall net financial impact of water conservation on their utility operations.

9. Utility managers and decisionmakers should analyze the potential benefits of implementing water conservation measures that may allow for the delay of water acquisitions or infrastructure capital improvements against the risks of delay of implementation of water acquisitions or structural projects.

10. Another major implementation issue surrounds citizens' and utilities' willingness to develop and participate in conservation programs. As noted in the Colorado Springs Utilities' water customer survey, the past few years have seen an increase in awareness of the benefits of conservation and, as a result, an

increased willingness to engage in conservation. The dialogue has shifted from whether to conserve to how much conservation is appropriate for a particular community.

11. If conservation is to be used successfully to meet growing demands in Colorado, it must be fully integrated into the water resources planning process. The CWCB-recommended conservation planning process is an excellent example of how to accomplish this. Few utilities in Colorado have successfully completed this type of integrated resources planning to date, but are strongly encouraged to use this process.

12. Conservation takes time to implement and verify. It is, this way, different than traditional supply development in that it is truly an incremental process.

13. Conservation would benefit from greater coordination inside water utilities' departments and between utilities and city and county governments, as sound decisions involve building and landscape codes and input from the development community, policy makers, and citizens.

14. A statewide social marketing campaign to promote the value and importance of sustainable water resources in Colorado for our people, land, environment, and economy will greatly assist conservation efforts and will help implement the conservation levels established in this document. Water is often a divisive issue in Colorado and such a campaign is a way to bring Coloradoans together to achieve common ground on the value of water and the importance of wise stewardship of our precious resources.

The Role of Water Conservation in Water Supply Planning and Meeting the Gap

By the year 2030, Colorado's population is expected to grow 65 percent, adding about 2.6 million more residents for a total population of 7.1 million people. This represents an increase in M&I demand of approximately 630,000 AF of water. SWSI identified that about 80 percent of this need could be met if M&I providers projects and plans are successfully implemented.

SWSI has catalogued the specific projects, plans, and processes that local water suppliers have identified and are undertaking as components of their own water supply planning efforts to meet the needs they themselves have identified. As a whole, if these projects are implemented, 80 percent of the state's long-term M&I needs will be met. This is the most optimistic scenario. But there is uncertainty and hurdles to overcome.

The mission of the state with respect to meeting 80 percent of our M&I water needs by 2030 should be:

Following the lead of local water suppliers, the state will monitor long-term water needs, provide technical and financial assistance to put the necessary plans, projects, and programs in place to meet those needs, and foster cooperation to avoid being forced to make trade-offs that would otherwise harm Colorado's environment, lifestyle, culture, and economy.

As previously stated, water conservation will be an important element of these plans, the state must also address the remaining 20 percent gap between supply and need. In addition, localized agricultural shortages have been identified in all basins along with significant environmental and recreational needs. Articulating the CWCB's role in helping to narrow and eventually eliminate this gap is much trickier – both institutionally and politically.

It is this gap that must be filled with "new" water. If water suppliers had the water to meet the demand represented by this gap, there would be no gap.

The mission for the state in filling this gap should be:

Foster cooperation among water suppliers and citizens in every water basin to examine and implement options to fill the gap between ongoing water planning and future water needs

The role that water conservation could play in helping address the future water supply needs and the gap identified in SWSI is discussed in general terms below. Additional detail can be found in Section 5 of this report that discusses alternatives for meeting the gap.

1. Implementing additional conservation measures in some of the major gap areas (Northern El Paso, Arapahoe, and Douglas Counties) where water demand is primarily supplied by non-renewable groundwater can reduce the rate of mining of groundwater and extend the useful life of aquifers. However, this does not provide a renewable water supply for these water providers. It would be inaccurate and misleading to look at statewide conservation savings and arithmetically apply it to the gap areas. This would assume that saved water in other basins or other geographic areas can or would be delivered to gap areas. There has not been any indication that water providers who achieved future water conservation savings would be willing to perpetually allocate saved water to other water providers. In the event that water providers would agree to permanently sell conserved water to the gap areas, significant infrastructure costs would need to be added to the costs in the Table 2-1 matrix. However, the successful implementation of conservation in the gap areas would reduce, but not eliminate the need for renewable water sources.

2. A portion of conserved water can be used for new growth, improving system reliability and environmental flows but it is unlikely that it will be used to provide water to other entities. There has not been any indication that water providers who achieved future water conservation savings would be willing to perpetually allocate saved water to other water providers. Rather, it is more likely that conserved water would be used first to increase system reliability and then any additional savings might be allocated to year to year M&I or agricultural leases or to enhancing environmental or recreational flows.

3. There is a need for the successful implementation of water conservation measures. However, successful implementation will not eliminate the need for additional water supply acquisition and development of structural projects to meet growing water demands that will continue beyond 2030.

   - The recent drought exposed the vulnerability of many providers' systems.

   - Water providers have identified shortfalls in existing system reliability and meeting future demands.

   - Coupled with the potential impacts of climate variability and the fact that growth will continue past 2030, it is clear that both water conservation and structural water projects will be needed to meet future M&I demands.

   - Storage will be needed to carry over conserved water for droughts.

It would be inaccurate and misleading to look at statewide conservation savings and arithmetically apply it to the gap areas. This would assume that saved water in other basins or other geographic areas can or would be delivered to gap areas.

4. A concern expressed by many water providers to the implementation of water conservation measures is that water conservation may be used as a justification to delay the implementation of structural projects that will ultimately be needed.

5. Though not discussed by the TRT, CWCB believes that there may be a significant risk to water providers in delaying the implementation of identified projects and processes and other water supply development that will be ultimately needed even with successful implementation of water conservation. Competition for scarce supplies, cost escalation of water supply development, and the increasing difficulty in permitting projects suggest that delays in implementation may result in the inability to develop the project at a later date.

6. Water conservation implementation should be implemented concurrently with structural water supply development. Effective conservation programs make other supply alternatives, such as agricultural transfers and new reservoirs, more palatable to all parties, including utility customers, agricultural water users, environmental and recreational interests and citizens, businesses, and local government in neighboring river basins.

7. The "Gap" TRT should formulate alternatives, including a "conservation-oriented alternative" for addressing needs in specific "gap" areas, i.e., where there is a well-defined likely shortfall by 2030. Future efforts could involve formation of a sub-committee, made up of some members of both the Conservation and the Gap TRTs and perhaps some members of the inter-basin compact roundtables. These members could work together to clarify how "current" (2000), more recent (2006), and expected levels of water use will be factored into the "gap" analysis, especially for areas of the state expected to experience rapid growth or to face difficulty in meeting demand. This information should also be provided to the interbasin compact basin roundtables.

8. Both water conservation and structural projects need to be implemented now, since both take time to implement and produce the desired reduction in demand or increase in yield. Structural projects take time to permit and construct and conservation takes time for market penetration.

9. An issue not discussed by the TRT, but identified in the SWSI Report is that the implementation of M&I conservation will result in some reduction in wastewater and lawn irrigation return flows. It is likely that even without additional conservation, M&I water providers will continue to increase their use of legally consumable return flows, whether from lawn irrigation or wastewater effluent. This will inevitably result in reduced supplies to downstream agricultural users who have benefited from these increased flows over the past 40 years.

The Role of the Colorado Water Conservation Board and other Stakeholders

1. It is not the intent of the CWCB that the implementation of water conservation measures should interfere with the justification or permitting of needed structural water supply projects. As part of the adoption of the SWSI, the CWCB adopted the following mission statement:

Following the lead of local water suppliers, the state will monitor long-term water needs, provide technical and financial assistance to put the necessary plans, projects, and programs in place to meet those needs, and foster cooperation to avoid being forced to make trade-offs that would otherwise harm Colorado's environment, lifestyle, and economy.

2. The CWCB, through its OWCD, should continue to take a statewide role in promoting water conservation and drought planning. CWCB intends to continue to be proactive in drought planning by implementing an update to the drought and water supply assessment survey and studying the impacts of climate variability on water supply.

3. The CWCB should continue to provide grants to water providers for the development of water

conservation plans and to assist in the implementation of the conservation measure outlined in the conservation plans. The CWCB should work with other key stakeholders to develop and implement requirements for standardized annual M&I water use data reporting to facilitate the collection of water use data and to track the implementation and effectiveness of water conservation measures.

4. The CWCB should continue the SWSI Water Conservation and Efficiency TRT as a multi-stakeholder resource, drawing on the expertise of the Colorado WaterWise Council, environmental interests, and M&I water planners.

5. The Water Conservation and Efficiency TRT should be used as a statewide technical resource to the interbasin compact basin roundtables and IBCC.

6. The CWCB, working with the Water Conservation and Efficiency TRT, the interbasin compact basin roundtables, Colorado WaterWise Council, MMC, and other interested stakeholders, should develop consensus statewide water conservation goals and BMPs. These might include the following goals:
   - Pursue agreement between interest groups to help ensure that both conservation and water infrastructure projects are implemented in a timely fashion. Water conservation should be pursued as an important component to water supply planning but not in lieu of critical infrastructure needs.
   - Metering is required by law for all water providers, regardless of utility size. Very small water systems of less than 600 water taps are presently exempt from this requirement. Financial assistance from state or federal agencies should be considered for small water providers, if necessary.
   - Development of moderate and advanced levels of water conservation BMPs, with the goal that the moderate level of water conservation should be implemented by all providers, regardless of size, geographic location, or water supply situation by 2030.
   - Development of average residential per capita water use goals for new development, taking into account local climatic differences impacting irrigation water requirements.
   - Development of a statewide social marketing campaign on the value and importance of sustainable water resources in Colorado for our people, land, environment, and economy. The goal of this campaign should be to promote the value of water in and for Colorado and the importance of using it wisely. This effort will help providers to achieve the conservation savings projected in this analysis and will demonstrate the commitment of the entire state to sustainable water resources. Water is often a divisive issue in Colorado and this campaign is a way to bring Coloradoans together to achieve common ground on the value of water and the importance of wise stewardship of our precious resources.

2.6 Water Conservation and Efficiency Roundtable Membership

The membership of the Conservation and Efficiency TRT was based on an e-mail request to the original SWSI BRT members for volunteers and recommendations on other people that were interested in this issue and/or had professional expertise in the area of water conservation and efficiency. Additional members were included in order to provide for broad river basin and interest group representation. Table 2-11 lists the names of members that participated or volunteered to serve on the TRT. Due to travel and other commitments, some TRT members were unable to attend some or all of the meetings.

Table 2-11 Water Conservation and Efficiency TRT Membership

Member	Organization	Interest Category
Ken Beegles	Colorado Division of Water Resources Dolores/San Juan/San Miguel River Basin	Technical Advisor
Mike Berry	Tri-County Water Conservancy District Gunnison River Basin	Water Conservancy and Conservation Districts
Jim Broderick	Southeastern Colorado Water Conservancy District Arkansas River Basin	Water Conservancy and Conservation Districts
Carrie Campbell	Pagosa Area Water & Sanitation District Dolores/San Juan/San Miguel River Basin	Municipal Water Providers
Christine Canaly	San Luis Valley Ecosystem Council Rio Grande River Basin	Environmentalists and Related Organizations
Marc Catlin	Uncompahgre Valley Water Users Association Gunnison River Basin	Water Conservancy and Conservation Districts
Larry Clever	Ute WCD South Platte River Basin	Water Conservancy and Conservation Districts
Carlyle Currier	Rancher Colorado River Basin	Agricultural, Ranching, Ditch, and Reservoir Companies
Reed Dils	Former Rafting Company Owner, Co-founder of Arkansas River Outfitters Assoc. Arkansas River Basin	Recreation and Related Organizations
Harold Evans	City of Greeley Water & Sewer Board South Platte River Basin	Local Government
Stu Feinglas	City of Westminster South Platte River Basin	Municipal Water Providers
Greg Fisher	Denver Water South Platte River Basin	Municipal Water Providers
Joe Frank	Lower South Platte Water Conservancy District South Platte River Basin	Water Conservancy and Conservation Districts
Jim Hall	Colorado Division of Water Resources South Platte River Basin	Technical Advisor
Taryn Hutchins	Western Resource Advocates Statewide	Environmentalists and Related Organizations
Lynda James	Park County Land & Water Trust Fund South Platte River Basin	Environmentalists and Related Organizations
Dave Kanzer	Colorado River Water Conservation District Colorado River Basin	Water Conservancy and Conservation Districts
Doug Kemper	Formerly City of Aurora, currently Colorado Water Congress South Platte River Basin	Municipal Water Providers
Frank Kugel	Colorado Division of Water Resources Gunnison River Basin	Technical Advisor
Paul Lander	City of Boulder, Colorado WaterWise Council South Platte River Basin	Municipal Water Providers
Dave Little	Denver Water South Platte River Basin	Municipal Water Providers
Peter Mayer	Aquacraft Water Engineering Statewide	Technical Advisor
Veva McCaig	CWCB Statewide	Technical Advisor
Dave Merritt	Colorado River Water Conservation District Colorado River Basin	Water Conservancy and Conservation Districts

Table 2-11 Water Conservation and Efficiency TRT Membership

Member	Organization	Interest Category
Bart Miller	Western Resource Advocates Statewide	Environmentalists and Related Organizations
Steve Miller	CWCB Arkansas River Basin	Technical Advisor
Dave Nickum	Colorado Trout Unlimited South Platte River Basin	Environmentalists and Related Organizations
Bob Norman	U.S. Bureau of Reclamation (BOR) Statewide	Technical Advisor
Bob Plaska	Colorado Division of Water Resources North Platte River Basin	Technical Advisor
John Porter	Independent Water Consultant and Southwest WCD Dolores/San Juan/San Miguel River Basin	Technical Advisor
Dick Proctor	Grand Valley Water Users Association Colorado River Basin	Agricultural, Ranching, Ditch, and Reservoir Companies
John Redifer	CWCB Board Member Colorado River Basin	Technical Advisor
Kevin Reidy	City of Aurora South Platte River Basin	Municipal Water Providers
Kenny Romero	Colorado Springs Utilities Arkansas River Basin	Municipal Water Providers
Anna Seder	Colorado Springs Utilities Arkansas River Basin	Municipal Water Providers
Ann Seymour	Colorado Springs Utilities Arkansas River Basin	Municipal Water Providers
Doug Short	City of Lafayette South Platte River Basin	Municipal Water Providers
Gregg Strong	Redlands Water & Power Co. Colorado River Basin	Municipal Water Providers
Greg Trainor	City of Grand Junction Colorado River Basin	Municipal Water Providers
Chuck Wanner	San Juan Citizens Alliance Dolores/San Juan/San Miguel River Basin	Environmentalists and Related Organizations
Alan Ward	Pueblo Board of Water Works Arkansas River Basin	Municipal Water Providers
John Wiener	University of Colorado South Platte River Basin	Technical Advisor
Bob Wiley	Farm Bureau Arkansas River Basin	Agricultural, Ranching, Ditch, and Reservoir Companies
Rocky Wiley	Rothberg, Tamburini, Winsor Statewide	Technical Advisor
Eric Wilkinson	CWCB Board Member South Platte River Basin	Technical Advisor
Todd Williams	Independent Water Consultant South Platte River Basin	Technical Advisor
Scott Winter	Colorado Springs Utilities Arkansas River Basin	Municipal Water Providers
Steve Witte	Division 2 Engineer Statewide	Technical Advisor
Dick Wolfe	Division of Water Resources Statewide	Technical Advisor

Alternative Agricultural Water Transfer Methods to Traditional Purchase and Transfer

3.1 Overview of Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

This section describes the activities and products from the Technical Roundtable (TRT) that was formed to address agricultural water transfer issues. The 2004 Statewide Water Supply Initiative (SWSI) Report found that as population grows there will be increased competition for new water supplies. In addition, because agricultural water use is still the dominant use of water in Colorado (85 to 89 percent) and the fact that agriculture tends to have fairly senior water rights, it is likely that entities seeking new water supplies will increasingly look to agriculture to acquire new supplies.

The Colorado Water Conservation Board (CWCB) recognizes the importance and supports the ability of water users to transfer water rights under free market conditions (willing seller/lessor and willing buyer/leasee). SWSI found that transfer of agricultural water is an important component of many water providers plans to meet future water needs. This section of the SWSI Phase 2 Report summarizes the TRT's efforts to examine how additional/alternative water transfer methods can or could also be used to help meet Colorado's future water needs.

SWSI concluded that within the foreseeable future significant water supplies would likely shift from present-day agricultural use to uses linked to both municipal and industrial (M&I) demands and possibly environmental and recreational needs. In the South Platte, Arkansas, and Rio Grande Basins, there are also projected to be substantial reductions in irrigated acreage due to insufficient supplies for augmentation of agricultural irrigation well pumping. The 2004 SWSI Report identified that numerous M&I providers and self-supplied industrial (SSI) users currently include agricultural transfers as a key component to their future water supply needs. In some basins the largest agricultural transfers may occur as a result of satisfying the estimated 2030 M&I demands. It is apparent that substantial future M&I supplies will come from current agricultural uses (i.e., irrigation) to the extent we are unable or unwilling to develop our remaining supplies of unappropriated water.

Traditional agricultural water transfers have historically been and continue to be an important component of most M&I water providers' supplies as a means for meeting growing water demands. In geographic areas where development is occurring on or near irrigated lands, these agricultural water transfers are a potential outcome since these rights can likely be used for M&I purposes for potable use or nonpotable irrigation of the developed lands. Where these transfers occur as a result of development, it is likely that the economic drivers associated with irrigated agriculture will be supplanted by economies that may be more diverse and yield greater gross state product (GSP).

There may be circumstances where alternatives to traditional agricultural water transfers may be advantageous to all parties to the transfer and provide community or other third party benefits. Such alternatives to traditional water purchases may allow more rural areas that are heavily reliant on an agricultural economy to remain economically viable while providing water in some or all years for other uses. Alternatives to traditional agricultural transfers may also present opportunities for local governments desiring to increase the reliability of their water supply system as well as establishing areas for open space, trails, parks, wildlife habitat, or other uses within and between communities. These alternatives may facilitate the ability for some irrigated agriculture to remain active among and between existing and future municipal boundaries.

It is recognized that exploring "transfer" alternatives that are not entirely market driven raises questions not easily answered. Such questions run the spectrum from quantifying the 'quality of life' some equate to having local irrigated agriculture to the concerns for interfering with property rights, the market price of water, and the future plans of local water providers for meeting their future water needs. It is further recognized that alternatives that deviate from traditional approaches may likely be more costly and have a broader array of beneficiaries. As a result a conventional cost-benefit analysis is difficult.

It is not the intent to interfere with or criticize traditional transfers of agricultural waters since these are a property right and, as outlined in the SWSI Report, are needed to meet the 2030 M&I water needs. It is the intent, however, to illustrate how and when alternatives to traditional agricultural transfers may present benefits to not only the parties to the transfer, but other third party beneficiaries.

While any transfer method is likely to reduce agricultural production (yield or number of irrigated acres), exploration, and implementation of alternative transfer methods may lessen the effect of the transfer within a defined geographic location and may help sustain agriculture by providing additional revenue sources to the agricultural user.

The alternatives defined by the TRT include:

1. Interruptible supply agreements.
2. Long-term rotational fallowing.
3. Water banks.
4. Reduced agricultural consumptive use through efficiency or cropping while maintaining historic return flows.
5. Purchase by end user with leaseback under defined conditions.

It is important to establish up front the key difference between what some have called "inefficiencies in agriculture" and reduced consumptive use (CU). Water that is applied to a crop has three major components:

1. The quantity of water that is utilized by the crop, which is termed crop CU and is viewed as a beneficial consumptive use of water.

2. The amount of water that is diverted to be delivered to the crop. If this amount of water is greater then the crop CU, there may be opportunities to reduce the gross diversions (total water diverted from the stream or pumped from the ground) and resulting return flows. These reduced return flows could in some cases improve water availability for other uses and/or improve water quality; but, in other cases could cause injury to downstream water rights that rely on the return flow.

3. Nonbeneficial CU is the quantity of water that is not used by the crop and does return to surface or groundwater systems where it is available for other uses. Examples of nonbeneficial CU include:

   - Evaporation not associated with crop CU;
   - Deep percolation of water diverted from the source or applied to the lands via irrigation methods that does not eventually return to the stream system as return flows; and,
   - Water that is consumed by other vegetation including non-native plants (high water use plants known as phreatophytes are of particular interest).

The first part of this section focuses on methods that reduce CU by reducing the amount or yield of crops planted and irrigated. It is this reduced crop CU, not the reduction in gross diversions (e.g., changes from flood irrigation to sprinkler irrigation, etc.) that can potentially be transferred to a new use. When considering alternative methods for transferring agricultural water to a new use, one must understand that some amount of land is taken out of production and/or the amount and type of crop is reduced or changed. The goal of the alternative transfer is to minimize the impact on the local economy, provide other funding sources to the agricultural user, and optimize both the agricultural and nonagricultural benefits of the remaining lands.

Several types of agricultural transfers have been examined as potential alternatives to the traditional agricultural transfers that result in permanent dry-up of an entire system's irrigated agricultural lands as a means to obtain additional water supplies for emerging M&I, environmental, and recreational needs. The purpose of this section is to generally describe and/or define such alternatives and summarize some of the perceived advantages and disadvantages of each alternative. By no means is the listing exhaustive nor should it be considered advocacy for one or more alternatives. It is hoped that the definitions will form the initial basis for discussion and evaluation of alternatives to traditional agricultural water transfers. Following the description of the alternatives, this section concludes with highlights of some financial benefits, to both the farmer and end user that may accompany many of the alternatives. Section 3.13 of this section discusses the opportunities for improving irrigation efficiencies without injuring downstream water rights.

3.2 Background

Agricultural uses currently account for more than 85 percent of the water diverted and consumed in Colorado. Additionally, agricultural users often hold most of the senior water rights in most basins. Water rights in Colorado are a property right and, in most instances, can be legally transferred via a water court action and severed from the land moving the historical CU to a different location. As a result, agricultural water rights in most basins are increasingly sought after by many M&I water providers and SSI water users and transferred to M&I use. In typical, traditional agricultural transfers, farm land is usually "dried up" or no longer irrigated and the water historically consumed during irrigation of this land is used for meeting M&I needs. Generally only the portion of the water historically consumptively used can be transferred in order to protect other appropriators who rely on return flows from injury. Transferred agricultural rights can also be used for other purposes such as dedication to the CWCB for instream flow purposes. In certain change decrees, transferred water can at the election of a new user be leased back on an interim basis for agricultural use.

In some areas of the state, particularly the Front Range, agricultural transfers are commonly used to develop supplies to meet M&I needs, and are important water supply options. As development of new water supplies becomes more difficult due to permitting and the limited availability of unappropriated water, M&I water providers are predicted to increase their acquisition of senior agricultural water rights as a means to meet future demands and provide better system reliability during droughts.

3.3 Potential Statewide Changes in Irrigated Acres

A reduction in statewide irrigated acreage is expected to occur in the future as a result of: 1) urbanization of irrigated lands; 2) lack of available water supply; and, 3) purchase of water rights and transfer to M&I use. Agricultural transfers to M&I use are part of many water providers' plans for meeting future water demands. As outlined in Section 5 of the SWSI Report, there may be a significant amount of AF from irrigation uses transferred to M&I use.

By 2030, reductions in irrigated acres are expected to occur in most basins as agricultural lands are urbanized or changed to domestic use and/or water is transferred from agriculture to M&I use to provide for M&I water needs. Additional reductions in irrigated acreage in the South Platte and Arkansas Basins may occur if adequate augmentation sources are not developed for the farms using alluvial groundwater as their primary source of water supply. In the Rio Grande Basin, groundwater pumping has resulted in major declines in groundwater levels. Analysis by water users in the Rio Grande Basin suggest that a reduction of up to 100,000 irrigated acres may be required to restore groundwater levels in the basin and achieve long-term sustainability of this resource.

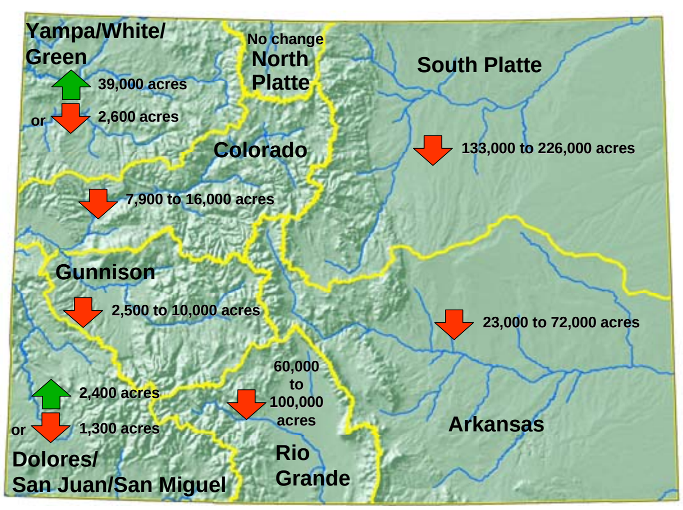
In other areas of the state, localized decreases and increases in agricultural water use are also expected. During the initial SWSI process, participants provided input on potential changes in irrigated acres, including the following examples. Several agricultural participants of the Yampa/White/Green BRT indicated the desire to irrigate an additional 20,000 to 39,000 acres, if storage could be developed to provide a firm supply of water and funding sources provided. The additional irrigation could occur in Moffat County in Water Districts 44, 54, 55, 56, and 57. The Dolores/San Juan/San Miguel Basin Agricultural BRT participants indicated a desire and preliminary plans to irrigate an additional 4,000 acres in Montezuma County through the purchase of existing water rights and storage facilities. The Gunnison Basin indicated the desire to develop storage in the Upper Gunnison and in the Grand Mesa areas and restore lost storage in the Grand Mesa and North Fork areas. These would serve to improve supplies to existing irrigated lands and reduce shortages.

Table 3-1 provides an estimate of the range of potential changes in irrigated acres in each basin. Future changes will be impacted by many factors, including the development of additional storage to provide firm water supplies for agriculture, policies of M&I water users regarding the acquisition of agricultural water rights, M&I growth rates and the location of future growth, and whether there are cost-effective alternative sources of water to meet future M&I water needs.

Table 3-1 Breakdown of Potential 2030 Changes in Irrigated Acreage

Basin	Potential Decrease in Irrigated Acres resulting from transfers	Potential Decrease in Irrigated Acres resulting from urbanization of irrigated lands	Potential Decrease in Irrigated Acres for other reasons	Potential Increase in Irrigated Acres if additional supplies are developed	Range of Potential Net Change in Irrigated Acres
Arkansas	17,000-59,000	2,300-4,500	4,000-8,000	—	23,000-72,000 Decrease
Colorado	1,200-2,700	6,700-13,000	—	—	7,900-16,000 Decrease
Dolores/San Juan/ San Miguel	100-200	1,500-3,100	—	2,000-4,000	1,300 Decrease up to 2,400 Increase
Gunnison	300-1,500	2,200-8,500	—	—	2,500-10,000 Decrease
North Platte	No significant change expected	No significant change expected	No significant change expected	No significant change expected	—
Rio Grande	600-1,100	100-200	59,000-99,000	—	60,000-100,000 Decrease
South Platte	40,000-79,000	38,000-57,000	55,000-90,000	—	133,000-226,000 Decrease
Yampa/White/ Green	100-200	1,100-2,400	—	0-40,000	2,600 Decrease up to 39,000 Increase
TOTAL	59,000-144,000	52,000-89,000	118,000-197,000	2,000-44,000	185,000-428,000 Decrease

There could be significant additional reductions in irrigated acres in the South Platte and Arkansas Basins beyond the estimates provided in Table 3-1 if water providers are unsuccessful in implementing their identified plans such as developing additional storage to firm existing water supplies. Furthermore, the effects of Senate Bill (SB) 03-73, which revised the procedures for replacing out of priority depletions, was not fully evaluated during SWSI and greater reductions in irrigated lands may occur. Figure 3-1 illustrates an estimate of potential changes by basin. Additional detail on the estimates of potential changes in irrigated acres for each basin are included in Appendix F of the SWSI Report.



Source: Colorado's Decision Support Systems and Basin Roundtable/ Basin Advisor input.

Figure 3-1
Potential Changes in Irrigated Acreage by 2030

3.4 Logistics and Dynamics Associated with Agricultural Transfers and Select Economic Information

The total water available under a change of agricultural water rights typically depends on the historical CU of the water for agricultural purposes. CU is the best indicator for quantifying the available water right for transfer, not the historical gross diversions. In addition, the yield of an agricultural water right may depend upon the location of the new use of the water. For example, in general, if the water is to be diverted through the same ditch system as historically, a transfer to M&I use may allow diversions of all of the water previously diverted at the historical farm headgate; however, the historical CU cannot be increased. The water that may be diverted in a transfer of water from an agricultural use to an out of basin use will be limited to the historical CU. Meanwhile the historical return flows must be maintained; storage may be needed to ensure that other water rights that historically relied on return flows from the water right that is being transferred are protected. After the historical return flows have been replicated, it is legal for the transferred "consumable" water to be used and reused to extinction.

3.4.1 Dynamics Leading to Agricultural Transfers

There are a number of factors contributing to the practice of acquiring and permanently transferring agricultural water rights to other uses by M&I interests. These factors include:

- The complexity and uncertainty associated with developing future water supplies makes the purchase of existing water rights more attractive.
- Agricultural water rights generally have more senior priorities; these senior rights provide a more reliable supply since the water right will be in priority for longer periods than a junior or new water rights filing. Less storage is required to produce a firm annual yield from a senior right than from new in-basin water supply development projects with junior water rights.
- Permitting may be simpler for such transfers than for the development of a new water supply project, since the agricultural water to be acquired has already been diverted from the stream system and a portion consumed. This can result in a higher level of certainty than construction of a new reservoir storing junior water rights where environmental issues and the effects of new depletions will be evaluated.
- Municipal return flows attributable to the transferred historical CU are fully consumable and can be reused. As a result any return flows from the transferred water (permanent and temporary) that are a component of the historic CU are also consumable and can be reused. For example, a transferred agricultural water right may have a historic CU of 65 percent while the first use M&I CU may be only 45 percent. That portion of the effluent and lawn irrigation return flows from the M&I use that are attributable to the historic agricultural CU are thus reusable. Some new M&I appropriations can be decreed for use to extinction depending on intent.
- The local agricultural economy may be such that it is no longer viable or profitable to remain in irrigated agriculture. Greater returns can be achieved by selling the water rights, which may represent the single greatest asset of the agricultural user. A greater return on the agricultural user's assets may be achieved through the sale of the water rights than remaining in irrigated agriculture.

3.4.2 Economic and Social Considerations of Agricultural Transfers

Traditional agricultural water transfers resulting in permanent dry-up, though widely practiced in certain areas of the state as a water supply option for M&I users, have several potential issues and conflicts.

- Localized socio-economic impacts, such as reduced property taxes to schools and local governments and less revenue to local businesses may result from the permanent dry-up of agricultural lands unless the irrigated lands are converted to other productive uses such as residential, commercial, industrial, recreation, or income producing non-irrigated agriculture. Irrigation of agricultural lands has historically resulted in the development of a local economy. In addition to supporting the farmer or rancher, the associated economic activity may form the basis of the entire economy of the local community. This impact may be greater for more rural agricultural areas. Many of these areas are struggling due to the low returns currently realized by farmers. These impacts can be minimized; however, through the use of the formerly irrigated land by a combined use of dryland cropping and upland small game enterprises or fishing.

- Table 3-2 provides some information on selected crop enterprise budgets including projected gross receipts and net revenue per acre for various crops and irrigation methods. This information was prepared by Agriculture and Business Management Economists at the Colorado State University Cooperative Extension. This information indicates some irrigated crops can be grown for a net profit, while some irrigated crops would likely result in a loss. Profits and losses will vary based on the actual crop yield and market prices for the specific crop for that season. The crop budgets indicate that dryland crops would likely result in a net loss or a very minor profit and there are very narrow margins on which farming practice succeed or fail. Enterprise budgets are very sensitive to fertilizer and fuel prices, and are not intended to be predictive but rather to benchmark outcomes from a large set of specified inputs including prices and sales prices for outputs. This also complicates comparisons across years.
- Dryland cropping of agricultural land has a lower assessed value than irrigated agricultural land. In Colorado, unless the farm or ranch has development or recreation potential, much of the value of a farm or ranch may be derived from the accompanying water rights. Figure 3-2 illustrates the differences in 2005 assessed value for irrigated and dryland farmed agricultural land for the major downstream agricultural counties in the South Platte Basin. For these counties in the South Platte, the weighted average assessed value for sprinkler irrigated land is $89/acre, $102/acre for flood irrigated, and $21 /acre for dryland farmed (Colorado Department of Local Affairs 2005). As shown in Figures 3-2 and 3-3, assessed values for irrigated land in select counties in the South Platte and Arkansas Basins average 5 to 8 times the assessed value for dryland farmed agricultural land. Once the water rights are transferred and the land no longer irrigated, the assessed value is reduced, resulting in a lower tax base to the local governments and school districts than if the land remained in irrigated agriculture or was used for other beneficial purposes.
- Revegetation of formerly irrigated lands is required by law under certain circumstances. Colorado statute, in some instances, requires that an entity transferring and permanently drying up irrigated lands ensure that the land is revegetated with plants not requiring supplemental irrigation. This can be a difficult, costly, and time-consuming process. Maintenance of revegetated lands through subsequent changes in land ownership and/or lessees has proven problematic in the past. Conversion of cultivated farm ground to non-cultivated natural grasslands can create wildlife habitat.
- Maintaining land in agriculture preserves the open space nature of the property and benefits the general public. If water is transferred from irrigated lands, the land may be more susceptible to development for other uses, since nonirrigated agricultural use may be less economically viable.
- There is a potential loss of wetlands, terrestrial, and riparian habitat. Return flows from irrigated agriculture often result in the creation of local wetlands, terrestrial, and riparian habitat. While historic return flows must be maintained for a traditional agricultural transfer, these replacement return flows may not necessarily sustain other historic third party beneficiaries such as wetlands and habitat.

Table 3-2 Selected Crop Enterprise Budgets

Year	Crop	Location	Irrigation Type	Irrigation Detail	Gross Receipts per Acre	Total Direct Costs	Net Receipts After Factor Payments (Return to Management and Risk)
2004	Alfalfa	Northern Colorado	Irrigated	Surface	$273.21	$273.21	$176.79
2004	Alfalfa	Southeastern Colorado - Arkansas	Irrigated	Surface	$450.00	$294.74	$155.26
2004	Alfalfa	Northeastern Colorado	Irrigated	Sprinkler	$459.00	$391.77	$15.23
2003	Alfalfa	Western Colorado	Irrigated	Surface	$256.50	$132.76	$91.74
2001	Alfalfa	San Luis Valley	Irrigated	Surface	$415.20	$277.23	$137.97
2004	Corn (Grain)	South Platte Valley	Irrigated	Sprinkler	$400.58	$462.54	$(113.97)
2004	Corn (Grain)	Southeast Colorado	Irrigated	Surface	$369.80	$356.50	$13.30
2004	Corn (Grain)	Northeastern Colorado	Dryland	Dryland - Reduced Till in 3-year Rotation*	$116.93	$134.52	$(46.39)
2003	Corn (Grain)	Western Colorado	Irrigated	Surface	$387.60	$366.01	$(10.41)
2003	Corn (Grain)	Northern Colorado	Irrigated	Surface	$382.50	$374.59	$7.91
2004	Sunflowers (Oil)	Northeastern Colorado	Dryland	Dryland Reduced Till - in Two Crop in 3-year Rotation*	$89.20	$150.40	$(90.00)
2004	Sunflowers (Oil)	Northeastern Colorado	Irrigated	Sprinkler	$215.04	$270.99	$(107.95)
2001	Sunflowers (Oil)	Southeast Colorado	Dryland	Dryland - Reduced Till	$126.58	$119.89	$6.69
2004	Wheat - winter	Northern Colorado	Dryland	Dryland	$97.15	$84.48	$12.67
2004	Wheat - winter	Northeastern Colorado	Dryland	Dryland - Conventional Till - Wheat - Fallow Rotation*	$128.94	$148.45	$(51.52)
2001	Wheat - winter	Southeast Colorado	Dryland	Dryland	$86.63	$62.81	$23.81
2004	Wheat - hard red winter	Northeastern Colorado	Irrigated	Sprinkler	$198.88	$266.76	$(119.88)
2004	Wheat - hard red winter	South Platte Valley	Irrigated	Sprinkler	$211.20	$282.45	$(123.25)
2003	Onions	Northeastern Colorado	Irrigated	Surface	$6,000.00	$2,750.89	$3,249.11
2003	Onions	Western Colorado	Irrigated	Surface	$6,109.00	$2,508.28	$3,600.72
2003	Barley (Malt)	Northern Colorado	Irrigated	Surface	$375.00	$249.50	$125.50
2001	Barley (Malt)	San Luis Valley	Irrigated	Sprinkler	$336.00	$197.21	$138.79
2004	Millet	Northeastern Colorado	Dryland	Dryland Reduced Till - in Two Crop in 3-year Rotation*	$119.30	$111.65	$(21.15)
2004	Potatoes	Northeastern Colorado	Irrigated	Sprinkler	$1,888.00	$1,366.11	$469.89
2004	Potatoes	San Luis Valley	Irrigated	Sprinkler	$2,957.40	$942.08	$2,015.32
2000	Tomatoes	Southeast Colorado	Irrigated	Surface	$6,000.00	$2,610.82	$3,389.18
2003	Pinto	Northern Colorado	Irrigated	Surface	$360.00	$326.97	$33.03
2001	Pinto	Western Colorado	Irrigated	Surface	$330.75	$233.56	$65.19

Notes:
* Includes payments for crop insurance indemnity for certain reduced till dryland crops
Selected Crop Enterprise Budgets for Colorado, 2004
Agriculture and Business Management Notes, Section 3.1, July 2005
Compiled by Jeffrey E. Tranel, Rod Sharp, Norman L. Dalsted, John Deering, Dennis A. Kaan
Agriculture and Business Management Economists, Colorado State University Cooperative Extension

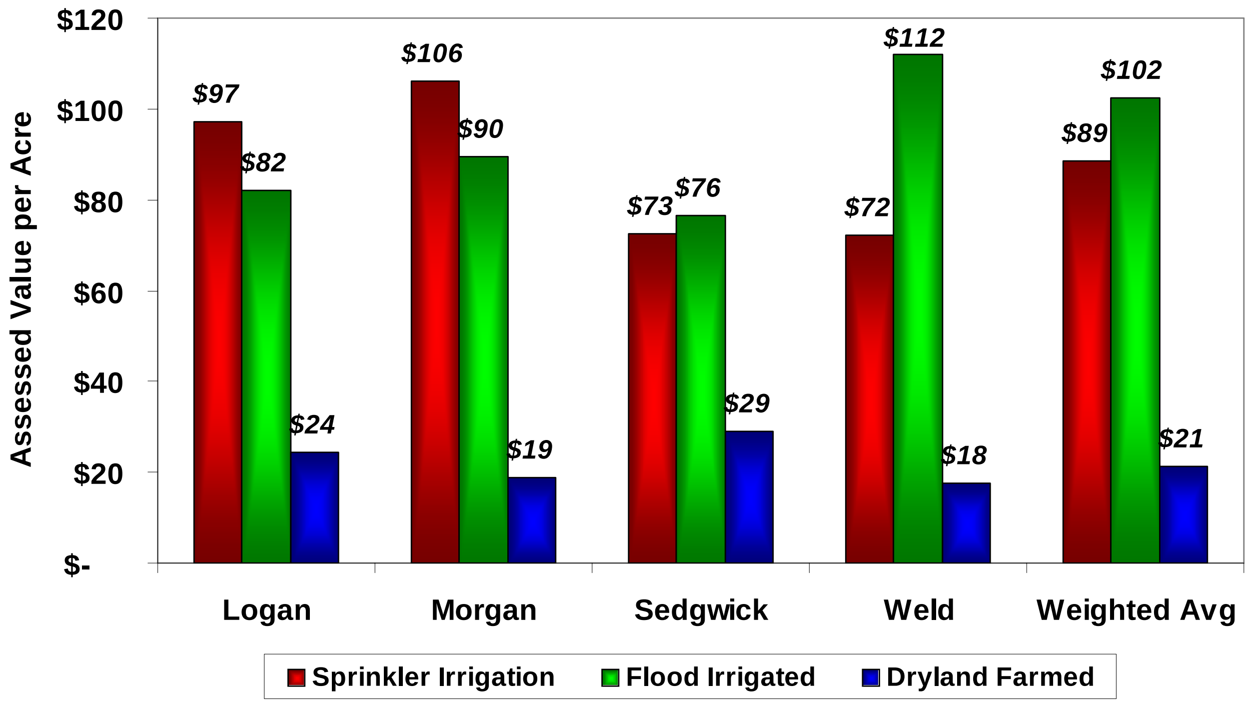


Figure 3-2
Assessed Values for Sprinkler and Flood Irrigation and Dry Farm Land for Select South Platte Basin Counties in WD 1 and 64

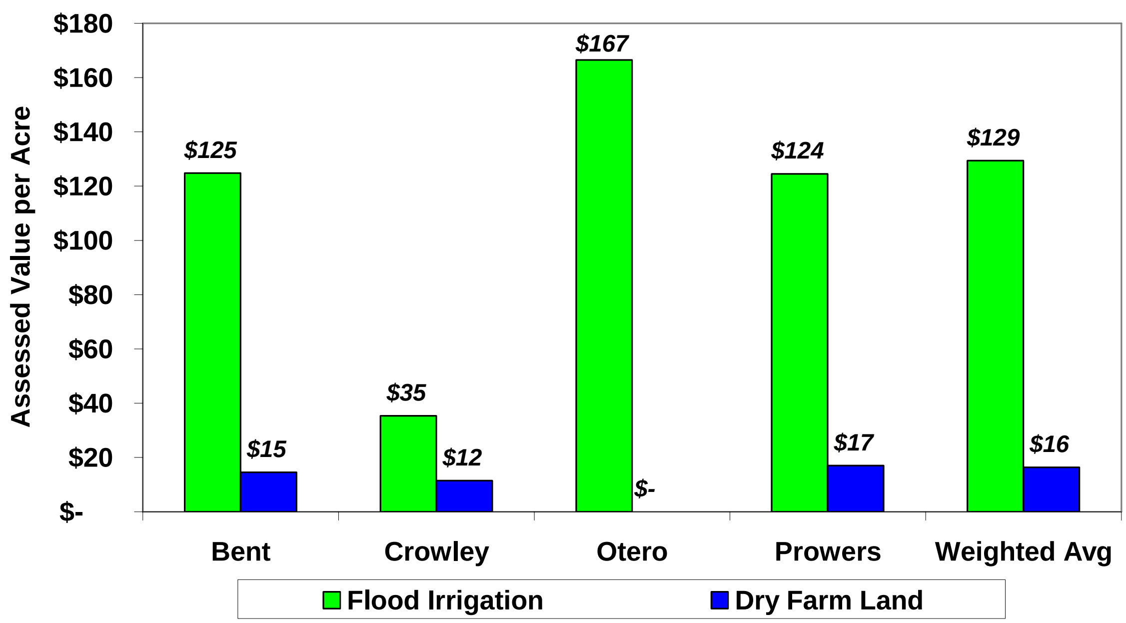


Figure 3-3
Comparison of Assessed Values for Flood Irrigated vs. Dryland Farmed Agricultural Land for Select Arkansas Basin Counties in WD 17 and 67

3.4.3 Logistical Considerations Associated with Agricultural Transfers

The following are logistical considerations associated with agricultural transfers.

- A water court procedure is required to change the use of agricultural water rights. This procedure can be a very lengthy and expensive process, and is not without risk. Both proponents and objectors may bear the burden of these costs and risks. In reviewing Figures 3-2 and 3-3 it should be noted that the differences in assessed value have many factors. Flood irrigation is not more agriculturally productive than sprinkler irrigation. The reason for the higher average assessed valuation is the historical coincidence that may be attributable to more senior irrigation water rights and some (not all or always) superior soils and locations for the lands irrigated with flood irrigation.
- Depending on the seniority of the acquired agricultural water right, storage will likely be required to carry over average year yield to provide a firm water supply during dry years. Agricultural transfer yields are not, by themselves, firm since they are typically seasonal and agricultural users typically endure larger shortages during droughts than municipalities can tolerate.
- The actual amount of agricultural water rights required to provide firm M&I yield is dependent upon the seniority of the right to be acquired and the amount of storage needed or capable of being built. Some irrigation ditches have a variety of priority dates. The amount of storage required to provide an AF of firm yield is dependent on: 1) the amount of average year yield that will be carried over to a dry year to supply firm M&I yield; 2) the amount of evaporation and seepage from the reservoir; and, 3) the amount of delayed return irrigation flows that must be maintained upon transfer to replicate historic stream conditions. An engineering analysis of the historic use of the ditch and the demands of the M&I user is necessary to examine these factors. Figure 3-4 shows estimated average to firm yield ratios and storage required to produce firm yield for several agricultural ditch systems in the South Platte Basin. These were derived from the Farmers Reservoir and Irrigation Company (FRICO) information and a water supply planning model developed by the City of Loveland for Big Thompson agricultural water rights that can be transferred to M&I use within its water supply system.

- There is a potential negative impact on groundwater tables and wells in the area unless historical returns are made in the exact historical location. Many domestic and irrigation wells are kept viable by historic return flows from irrigation.

3.5 Alternative Transfer Methods

There are several types of alternative agricultural transfer methods that have been proposed as alternatives to the traditional agricultural transfers that result in permanent dry-up of irrigated lands. These include:

- Interruptible supply agreements (ISAs).
- Long-term rotational fallowing.
- Water banks.
- Reduced crop CU.
- Purchase and leaseback.

These alternatives are briefly discussed below and formed the initial basis for discussion and evaluation by the TRT.

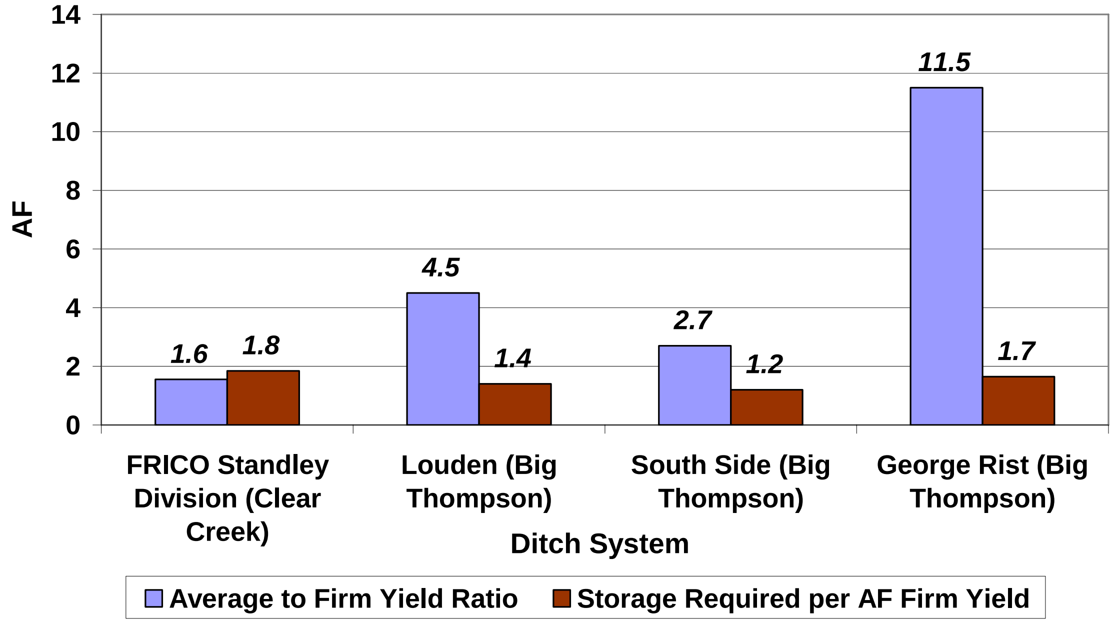


Figure 3-4
Examples of Average to Firm Yield Ratios and Storage Required for M&I Transfer of South Platte Agricultural Water Rights

Three fundamental elements often differentiate the alternatives described below: 1) the term length of an agreement; 2) which party retains ownership of the water right(s) throughout the term of any such agreement; and, 3) who, or what, triggers the temporary transfer of water to an alternative use. Variations of one alternative may quickly meld into the general description associated with another alternative since parties can structure these arrangements through negotiation to meet their particular objectives, subject to the no-injury principle.

3.5.1 Interruptible Supply Agreements

ISAs may consist of temporary or long-term arrangements in which agricultural water is temporarily transferred for other purposes in other locations while irrigation is temporarily suspended. Exercising an ISA is typically triggered on an as-needed basis and could include dry-year needs, drought recovery needs, and even wet-year needs. An ISA would include limitations as to the frequency in which the supply could be exercised throughout the term of the agreement. Current law allows the State Engineer to administratively approve temporary ISAs as long as they are not triggered more than three times in a 10-year period. A permanent ISA that could involve more frequent interruption of the agricultural use would require water court approval. The terms of such an ISA is within the party's discretion, as is the schedule of payments that might reflect frequency or repetition of exercise of the option.

ISAs offer several benefits:

- A permanent transfer of agricultural water rights may not be needed, avoiding some of the negative local socio-economic impacts, such as reduced property taxes to schools and local governments, and less revenue to local businesses associated with a permanent dry-up of irrigable lands.
- ISAs are useful during below-average runoff conditions, when the normal supplies to meet M&I, environmental, and/or recreational needs are reduced or not available.
- Relying upon an ISA could reduce/eliminate the need for M&I users to construct significant volumes of new storage and/or expensive new water supply projects to carry over water from average to above average runoff years for use in below average years. This consideration is

reinforced when the agricultural water right is relatively senior in priority.

- A better or more stable income to agricultural users can be assured, since during a drought water supplies may not be adequate to satisfactorily produce a crop. Presumably, if the option were exercised, the net income from an ISA could match or exceed the revenue that would be realized from farming in that same year. Moreover, smaller "take-or-pay" payments or reservation changes may be included to bolster net income in the years the ISA is not exercised.
- The assessed value of the land can be maintained at an irrigated agricultural valuation for most, if not all years.

There are several potential issues and conflicts with ISAs that may impede or hinder the usefulness of this alternative as a tool for meeting future water needs:

- ISAs may be of limited benefit in meeting long-range M&I water supply or other uses without some arrangement for permanency to the end user. If the agricultural user is free to sell the water to a different entity, the end user must then find other sources of water if there is an ongoing or permanent need for water supplies. Given the competition for limited water resources, it is likely that M&I users that have committed to perpetually serve its customers will seek permanent water supplies, such as outright acquisition of agricultural rights over ISAs. This issue can potentially be addressed if there is an arrangement where the M&I user can purchase the water that is part of the ISA if and when the owner sells them.
- One important and somewhat unusual feature of an ISA is that the owner of the water right is committing themselves and their successors to performance of the contract, so that any later uses of the underlying water right would be subject to the contract. This might most easily be accomplished by keeping the water in its agricultural use, but the commitment of the water right is not a commitment of the water right owner to tie up other resources or continue the agricultural activity or other use of the water in years when the ISA is not exercised. Just as a sale commits the resource permanently, this commits the resource for the stated and agreed duration of the contract. Buy-out or termination conditions would be negotiated by the parties. And, it seems very unlikely that any water right could be subject to more than one ISA under any similar conditions (though dry-year options might be compatible with wet-year options held by another if all parties were in agreement).
- ISAs must be evaluated on a case-by-case basis, as not all agricultural rights can easily be transferred to M&I or other water uses. For example, in the Denver Metro and South Metro subbasins of the South Platte there is very little agricultural water use in the area or upstream that can be interrupted on an annual basis and easily transferred to existing M&I intakes. Increasing supplies to these areas with ISAs would require significant infrastructure investments in pipelines, pump stations, and advanced treatment facilities in order to convey agricultural water from remote locations. An ISA may not provide the permanence/security to warrant large capital investments.
- It is usually desirable for the agricultural rights involved in the ISA to have dry-year yields. If the underlying water right or portfolio of water rights is not sufficiently senior in priority, agricultural water would not be available to transfer when it is most needed for other uses. Water rights to be used to refill reservoirs drawn down during a drought might be considerably less senior and still serve the purpose of recovering from the impacts of a drought than water rights to be used during droughts, which would need to be relatively senior in order to provide for drought yield. It is important to recognize that these arrangements will be case and place specific to the parties' interests.
- The determination of the transferable amount can be complicated; as in a water transfer by sale the rights of other vested water users must be protected. There must be a mechanism to ensure that the transfer does not result in an increase of

historical CU and that return flows are maintained during the temporary interruption. Colorado Revised Statutes (CRS) 37 92-309 and 37 92-308(4) allow the State Engineer to approve and administer temporary transfers under certain terms and conditions. Otherwise a change of water rights will be required.

- Soil, weed, labor, and equipment management issues must be considered during those periods when the interruptible or temporary transfer is exercised and irrigation water is removed from the farm(s).
- In some instances the establishment of a cover crop may require an early-season irrigation, which further complicates administration. Such an agricultural demand would reduce the amount of water available to the buyer unless it was completed in the preceding season or from identified carry-over water or winter water in some systems.
- Some perennial agricultural crops, such as orchards and vineyards, may not be appropriate for an ISA. The impacts to perennial forages as a result of random fallowing are uncertain.
- The annual "triggering" of an ISA should ideally be done prior to field preparation and planting dates to eliminate unnecessary costs associated with tilling and planting activities. Timing could be problematic for water suppliers, because planting decisions are often made before the water supplier knows the anticipated yields of their base supply.

It should be noted that many of the issues discussed above relating to water court and infrastructure needs would be similar to those faced with an agricultural transfer involving the permanent dry-up of irrigated lands.

3.5.2 Long-term Rotational Fallowing Program

This concept, generally called rotational fallowing, consists of a type of interruptible agricultural transfer arrangement involving several agricultural parties and one or more M&I, environmental, or recreational users. For example, as a means to provide additional water to meet new demands or to replace the existing yield of non-renewable groundwater supplies (a potential future need identified but not quantified in SWSI), each agricultural participant would agree not to irrigate for certain years out of a set period of years that could relate to the number of agricultural users or the irrigated area participating in the rotational fallowing program. On a broader scale, one could also envision such an agreement incorporating several ditch and/or canal companies. Rotational fallowing arrangements could be utilized to firm existing M&I supplies or provide "base" water for new/replacement demand. Most likely, if the yield from a rotational fallowing arrangement was used to provide water to a new and growing demand, a long-term or even a perpetual agreement would be essential.

An additional feature of a long-term rotational fallowing alternative might be the option to set aside a portion of the water from the fallowed agricultural lands each year and place it into storage to firm the yield available to the remaining participating agricultural users that are part of the program but are not fallowing in that year(s).

The benefits of this alternative rotational fallowing agricultural transfer approach include:

- M&I reliability is improved since there is a more predictable supplemental supply of water each and every year. This could be used to "top-off" storage levels and/or provide for new/replacement water demands.

- Multiple end uses (M&I, recreational, and environmental) may wish to participate in rotational fallowing arrangements. Rural and urban areas may seek to preserve water supplies or maintain the economic, open space, or other amenity values, environmental and wildlife interests may secure their interests in flow maintenance, habitat, and access, and recreational interests may seek timing of flows or additional flows. The new kind of supply possible from rotational fallowing program could address a large number of interests and needs, especially where the costs are spread to the third party beneficiaries as well as other users.
- A better or more stable income can be provided to agricultural users, since an income would be guaranteed during the fallowing year. Parties may also contract to spread payment in other ways, such as advancing some payment to cover agricultural, water conveyance, or irrigation technology investments, or to support investments in long-term improvements; the specific contractual approach would be aimed at addressing the transferors needs/desires. Mutual ditch companies or conservancy or conservation districts may consider managing the program, or other organizations could be established and financed to operate the programs as the parties wish.

- A permanent transfer of agricultural water rights may not be needed, avoiding some of the negative impacts associated with a traditional agricultural transfer. The ownership of the water rights determines who benefits from appreciation, if any, of their value, though parties could contract to allocate that risk and revenue sharing as they wish.
- This program, perhaps in tandem with an ISA program, could maximize the benefits of a non-tributary groundwater conjunctive use program. Non-tributary, non-renewable groundwater has a firm annual yield independent of surface water hydrology. The life of this groundwater resource could be extended by relying on a rotational fallowing program in average to above average years and pumping groundwater only during below average years, and an ISA triggered in wet years could be used to recharge storage when conditions allow.
- The assessed value of the land can be maintained at an irrigated agricultural valuation for most, if not all years.
- The Colorado legislature, in House Bill (HB) 06-1124, amended CRS 37-92-103, to clarify that rotational fallowing can be adjudicated through a water court proceeding.

There are several potential issues and conflicts with rotational fallowing arrangements that may impede or hinder the usefulness of this alternative as a tool for meeting future water needs:

- As with a long-term ISA, one important feature is that the owner of the water right is committing themselves and their successors to performance of the contract, so that any later uses of the underlying water right would be subject to the contract. This might most easily be accomplished by keeping the water in its agricultural use, but the commitment of the water right is not a commitment of the water right owner to tie up other resources or continue irrigation in those years when the fallowing is contractually required to produce yield to the end user.
- Long-term rotational fallowing may be of limited benefit in meeting long-range M&I water supply or other uses without some arrangement for permanency. If the agricultural user is free to sell the water at the end of the agreement, the end

user must then find other sources of water to meet permanent needs.

- Certain interests expressed concern that rotational fallowing is likely more expensive to an end user than a permanent conventional agricultural transfer, but there are no Colorado examples at this point. Incentives would likely need to be significant to entice an agricultural user to forego the right to interfere with performance of the contract during the term of the agreement, though these choices are very similar to those commonly made in the sale of conservation easements or other dedications. Annual payments would be payable to those agricultural users fallowing each year, and possibly a minimal payment to those producers not fallowing. Annual costs, as opposed to a lump-sum payment for purchase of water rights, could be much lower at the front-end but the sum of all payments could be much larger over the long term. The spreading of the costs may be important in regard to use of general obligation bonding finance capacity, revenue bonding, or water rates charged to users. Issues of matching the costs and benefits are important in such choices. In addition, the transaction costs to assemble and administer a fallowing program may be significant.
- Some perennial agricultural crops, such as orchards and vineyards, may not be appropriate for a rotating fallowing program. The impacts to perennial forages as a result of random fallowing are uncertain. On the other hand, transferors may arrange to allocate some of their water to make such crops possible, using internal arrangements and the new financing to pursue activities and horticulture that are currently infeasible.
- Agricultural supplies for a rotating fallowing program would have to be in an appropriate location and of sufficient quantity to meet the needs associated with the alternative demands. If used for M&I purposes, the water from the fallowed lands must be transferred to the M&I water supply intakes or delivered to the water treatment facilities and may likely require advanced treatment. This could require significant infrastructure investments in pipelines, pump stations, and advanced treatment facilities.
- A change of use from agricultural to M&I or other uses would likely be required. Determination of the transferable amount can be complicated and other vested water right owners must be protected. Legal and engineering costs will be incurred as with any other long-term change. Administration by the State Engineer's Office (SEO) must be clear and achievable and adequately funded.
- As with ISAs, soil, weed, labor, and equipment management issues must be considered on the fallowed lands. A farm operation involves not only the planting, irrigating, and harvesting of crops, but the hiring of labor and maintenance of equipment. In addition, the management of soil erosion and weed control will be issues on irrigated fields that are temporarily removed from agronomic production. Some of these challenges may be minimized by dryland cropping on the fallowed lands so long as adequate safeguards to prevent expanded use by sub-irrigation.
- M&I users would need storage to carry irrigation season water over to the non-irrigation months and to possibly re-time return flow obligations. In addition, if a new means of firming the remaining agricultural supply were included in the arrangement, additional storage would likely be required.
- In some instances the establishment of a cover crop may require early-season irrigation. Such an agricultural demand would reduce the amount of water available to the buyer and complicate administration.

It should be noted that many of the issues discussed above relating to water court and infrastructure needs would be similar to those involving the permanent dry-up of irrigated lands.

3.5.3 Water Banks

In addition to interruptible supply contracts and rotational land fallowing (i.e., rotational crop management contracts), water banks were also authorized by the Colorado legislature in 2003. Water banks have had varying degrees of success in the Western U.S. and have been applied to stored surface water, direct delivery water (i.e., run-of-the-river), and stored groundwater. In general, water banks act as a legal mechanism to transfer water from water right owners that may not need water in a given year (lessor) and water users having an annual or short-term demand (lessee) versus a long-term supply need.

Water banks may operate in a variety of ways. Important operational considerations include:

- Model Type: Water banks may operate as a deposit/withdrawal model or as a clearinghouse model. In the first, anyone qualified may "deposit" and the bank subsequently manages "withdrawals." This may involve a commitment to keep water available for some length of time or until withdrawn. In the second model type, the institution helps transferors and transferees find each other, usually imposing standard forms, information and assurance requirements, and rules.
- Funding: The bank may act with its own funding and with its own specific objectives in mind, or act solely as a service provider (i.e., impartial to any water transaction).
- Pricing: The bank may set prices at pre-defined levels, allow prices to float subject to a known index or market condition, or the parties may negotiate a price.
- Arrangement Duration: A transaction time between water "moving" among a transferor and a transferee can be short, as with banks that wheel direct flow waters, to indefinitely long, as may be the case for groundwater based banks.

Colorado's Pilot Water Bank

Colorado's pilot water bank program was established in the Arkansas Basin and provides a mechanism for leasing stored water on a short-term basis without permanently transferring the water right to another user and prohibited use outside of the basin. Hypothetically, the owners of stored water in the Arkansas River Basin have the option to lease that water during times of drought or simply during periods in which they desire to forego irrigation. However, this formal water bank had little usage. It should be noted that some of the discussions outlined below are broader in scope than aspects solely associated with the Arkansas pilot program. Colorado also has an informal water bank involving leasing of Colorado-Big Thompson (CBT) units in the Northern Colorado Water Conservancy District (NCWCD).

The lack of usage may be related to the restrictions placed on the type of water (only stored) and no demand due to lack of infrastructure to deliver to source of demand and restrictions on the market (only in basin uses). The informal water bank involving leasing of CBT units in the NCWCD has been more successful than the Arkansas water bank.

Depending upon the perspective of a water user desiring additional supplies, water yielded from a water bank could be considered water necessary in a dry year, drought recovery year(s), or for an average to wet year (as may be the case with a water provider heavily reliant on non-renewable groundwater).

The benefits of the water banking transfer approach include:

- Water supplies are improved for users acquiring water from the water bank and in a manner that may offer more flexibility than other alternatives. Moreover, agricultural use can be preserved by allowing alternative uses on an interim basis, without a permanent dry-up of irrigable lands.
- Agricultural income can be increased short-term, since the net income from a banking lease can exceed the revenue that would be realized from farming in a dry year.
- Provides for flexibility in water management, as there is a free market mechanism through which water supplies can be transferred. This flexibility may also help users meet unexpected demands.
- Provides a means where either the seller or user may secure investments in high-capital technology (e.g., orchards and green houses) where infrequent needs arise to maintain the investment. Benefits may be realized by either selling surplus water or purchasing needed water.
- Water banks often increase the transparency of a water market within a defined supply/demand region. Water lease values are typically in the public domain offering more stability to the marketplace.
- Water bank transactions can be defined as reversible. If a transferee realizes that following a water bank "purchase" the water is not needed, the water can be re-deposited into the bank for others to withdraw.
- If implemented properly and providing that there is the necessary infrastructure, per unit transaction costs can be lower than many alternatives, allowing many small volume transfers to take place. This increases flexibility available to all water users since there is no cost-of-water court barrier, and the time needed to work a deal can be measured in days instead of years.
- Assessed value of the land can be maintained at an irrigated agricultural valuation for most, if not all years.

There are several potential issues and conflicts associated with water banking that may impede or hinder the usefulness of this alternative as a tool for meeting future water needs:

- Water may not be available to be "withdrawn" from the water bank when needed by M&I, recreational, or environmental interests. Banking is voluntary, thus there is no guarantee or requirement for anyone to deposit its water in a bank for withdrawal by others.
- Determination of transferable amount can be complicated and other water users must be protected. This is perhaps less complicated when banking a senior storage right or a fully consumable groundwater right.
- A trading hub, such as a large regional reservoir and distribution/delivery system, is necessary to provide for storage and distribution of banked water to a large, regional customer base.

- Soil, weed, labor, and equipment management issues must be considered during the time when irrigation is not occurring on the lands forgoing irrigation. Also, dry-up must be enforced.
- There are significant challenges in starting a successful market. A banking entity needs to be responsible for developing the underlying rules, advertising to potential depositors and withdrawers, and maintaining the daily accounting of the bank. In the Arkansas pilot project, potential users have not utilized the water bank, since an effective market already existed.
- Revenue streams from water banks to agricultural users are irregular, and thus may inhibit a producer's willingness or ability to invest in technology that may improve farm gate profitability with reduced water supplies.
- Developing a water bank in a location that does not either have the necessary infrastructure to deliver water to new demands or where such infrastructure cannot be cost-effectively installed is likely futile.

3.5.4 Reduced Agricultural Consumptive Use through Efficiency or Cropping While Maintaining Historic Return Flows

Reducing Consumptive Use through Efficiency

It is possible that changes in cropping types, irrigation application methods, and/or timing of irrigation can result in a reduction of CU as compared to historical CU on the same agricultural parcel. Limited irrigation refers to idealizing the crop yield from a limited (rather than full evapotranspiration [ET]) amount of irrigation, while deficit irrigation more narrowly refers to timing irrigation so as to reduce plant growth during vegetative stages but not limiting growth in reproductive stages. A reduction in per acre CU from either method potentially could be transferred to an alternative "off-farm" use (i.e., M&I, environmental, recreational).

Reducing Consumptive Use through Cropping

This approach involves changing the historical crop type (perpetually or for a limited term) from crops having relatively high annual CU to crops having lower CU requirements. The differential between high CU and low CU crops could be as high as 12 inches of crop CU (per acre). A hybrid system of low CU crops coupled with deficit irrigation (intentional under-irrigation) methods could further leverage the possibilities. Transfers from this alternative would likely provide a fixed per annum water yield that could provide a supply necessary to increase an M&I user's firm annual yield.

The benefits of alternatives comprising cropping and/or irrigation practices are similar to those outlined within the Rotational Fallowing Arrangement section (above). One additional benefit, however, is that presumably all the land remains in irrigable (limited) production throughout the term of the program.

The potential issues and conflicts associated with the ability to reduce agricultural CU via modified cropping patterns and irrigation schemes include:

- A water court transfer would likely be required. Determination of the transferable amount would be complicated and other water users must be protected. To date limited research has been conducted in Colorado to assess crop ET under deficit irrigation schedules. Limited water use

information exists for many relatively new, low-CU crops (e.g., canola, sunflower, dry-beans) when compared to more traditional Colorado crops (e.g., corn, wheat, sugar beets). Legal and engineering costs will be incurred and likely be higher than other alternatives. Sub-irrigation must be avoided to prevent expanded use.

- Legislation may be needed to authorize water court transfers under this program. Administration issues would be more complicated and difficult to monitor.
- In some instances there may not be a market for the low water use crops.
- New farm equipment may be needed for planting and harvesting a different crop type.
- Reduction or elimination of irrigation of alfalfa during the summer months will likely affect the quality and quantity of subsequent cuttings.
- Adjusting to new crop types and limited irrigation schemes will likely require advancements to existing irrigation systems/ methods.
- Changing irrigation patterns or crop types still requires water to irrigate the planted crop. Consequently, this alternative will not provide as much "transferred" water (per acre) as a permanent or temporary dry-up.
- There will likely be fewer "inputs" (e.g., seed, fertilizer, fuel, etc.) acquired in the local economy.

3.5.5 Purchase by End User with Leaseback under Defined Conditions

The final alternative considered as a means to provide additional M&I, environmental, and recreational water supplies is Purchase by End User with Leaseback under Defined Conditions and is perhaps the most common means presently used within Colorado. A purchase and leaseback arrangement, while commonly only implemented for a fixed term of 5 to 10 years, can be a permanent agreement where the municipal, environmental, or recreational interest purchases agricultural water rights with the agreement that the new owner will lease back water to the farmer (or ditch system) under specified and pre-determined hydrologic circumstances. For example, a municipality may be limited to making a call on this new supply only during dry years or when there is a compact call in place. The farmer may lease the water during hydrologically average and wet years.

Purchase leaseback arrangements can be viewed as a more permanent variation of ISAs that provide more certainty to the purchaser. If the new owner of the water right begins using the water for "new" and growing demands (versus just for firming pre-existing supplies), a purchase and lease-back arrangement could eventually result in the permanent dry-up of irrigable lands or regions and in this case could be characterized as a "soft landing" transition period when moving from irrigated to non-irrigated farmland. Annual leases by M&I providers of previously purchased irrigation rights are quite common in the Arkansas Basin.

The benefits of purchase and leaseback arrangements include:

- Land remains in agricultural production during wet and/or normal years or other defined hydrologic conditions for some period of time.
- The purchaser holds title to the water rights and is guaranteed delivery under conditions when the water is needed. M&I reliability is improved since there is a guaranteed additional supplemental supply of water each year.

The potential issues and conflicts with purchase and leaseback arrangements for meeting future water needs include:

- May not sustain agriculture for the long term, but rather is a permanent transfer that is deferred for some period of time until the water is needed by the M&I user.
- Agricultural users relinquish appreciation of the water rights when selling the rights to the municipality or end owner.

- Like other alternatives, soil, weed, labor, and equipment management issues must be considered for the fallowed lands.

Many of the issues related to a purchase and leaseback arrangement are similar to those faced with an agricultural transfer involving permanent dry-up of irrigated lands or of a rotational fallowing program.

3.6 Underlying Financial Considerations

For some water users needing additional water supplies (i.e., M&I, environmental, recreational) the initial water costs associated with traditional agricultural water transfers may be overwhelming. Many of the alternatives outlined above may allow cash flows (between water recipient and water contributor) to better align temporally with the benefit received. As an example, rather than a municipality budgeting and spending significant capital or incurring debt to purchase "firming" water that may be necessary in a future drought, the municipality could participate in an ISA and expect to have only increased operational costs in those years when additional water yield is needed and the interruption occurs. As a result, water costs and water benefits occur nearly simultaneously. It is important to note, however, that if extensive supplemental infrastructure is necessary to transport and treat new supplies from their historical place of use to a new demand point, the upfront cash outlay for actually purchasing or leasing water supplies may be less significant in comparison to a total "project" cost.

Additional financial benefits to M&I users may include:

- Outright purchase of large quantities of water may require bonding. If implementing some of the alternatives above, municipalities could preserve bonding capacity to finance other, more pressing needs.
- Avoidance of interest costs of long-term indebtedness.
- Underlying agreements can be structured to take effect at a pace better matching urban development and revenues from tap fees while achieving the security of acquisition in the near-term.

Financial risks to M&I and other users include:

- If the water is needed for permanent uses and the ISA or rotational fallowing arrangement has a term, the end user must find replacement sources of water, once a contract expires, without an option to renew or a right of first refusal (ROFR) if the owner sells. Replacement sources may then no longer be available or the costs may have increased beyond the financial capabilities of the end user. Even a ROFR, which allows the end user to match any selling price, may present significant additional financial risk to the end user who cannot predict appreciation.

Financial benefits to farmer/transferor may include:

- Achieve security of long-term income stream soon, thus obtaining predictable revenue not easily gained in normal agriculture. Consistent revenue may allow for long-term planning to optimize investments, farm management opportunities, and opportunities for cooperative agricultural ventures.
- In many instances, equipment and machinery uses and needs associated with canal operations are comparable to those of a municipality. Costs of canal improvements needed to operate a rotational fallowing or ISA could be shared costs. Likewise, personnel expenses experienced by the ditch company could be offset by the municipality in compensation for additional accounting and management activities that will likely be integrated into most agreements.
- Arrangements can provide a planning horizon for both farmers and canal companies as they evaluate (or possibly develop) new technologies to manage agronomic systems with less, or limited water supplies.

3.7 Questions Addressed by Alternative Agricultural Transfer Roundtable

The following mission statement was adopted at the first TRT meeting:

Examine and illustrate how M&I and other water uses can be met with agricultural rights on a reliable basis without the permanent dry-up of irrigated agricultural land.

3.7.1 Technical Questions

Technical Subcommittee Questions

The technical subcommittee initially developed two main questions related to the technical issues associated with the implementation of alternative agricultural transfer techniques:

1. Are there suitable irrigated lands (having adequate water yield and water quality) available for an alternative agricultural transfer? If so, how do the infrastructure costs compare with a traditional agricultural transfer? How does geography (e.g., stateline vs. upstream water right) affect alternatives?

2. Water Quality Impacts - What effects will reduced river flows have on water quality issues in the future – TMDLs, salinity, etc.?

To compare alternatives, a common method for analysis was needed. The TRT members developed the following technical approach:

- Develop a consistent set of definitions.
- Create a matrix to evaluate opportunities for supply, demand and infrastructure.
- Develop an illustrative example of a rotational fallowing program to more fully describe opportunities and limitations.

A common set of definitions were developed as outlined earlier in this section. In addition, a conceptual example of how alternative transfer techniques might be implemented in the Arkansas Basin was presented. Due to time constraints, the subcommittee was not able to address the question related to water quality impacts.

Table 3-3, inserted at the end of this section, presents information on the various alternative transfer techniques and where each technique may have the most applicability. As noted, actual applications may tend to evolve as a blend of various techniques and Table 3-3 is presented as a guide for the applicability of the techniques.

3.7.2 Legal and Institutional Questions

Legal Subcommittee Questions

The legal subcommittee developed five questions related to the legal issues associated with the implementation of alternative agricultural transfer techniques:

1. Are legislative/regulatory changes needed to implement the proposed program(s)?

2. What is the water court process related to the program'(s') approach and implementation?

3. Should the program(s) be administered by the end user, governmental agency, or by the agricultural water rights owners or ditch and reservoir companies?

4. Can the program(s) be successful if the agricultural user is not required to bind the land and water to irrigation?

5. What program conditions are needed to ensure that private property rights are not impaired?

The legal subcommittee organized their evaluation into Table 3-4, inserted at the end of this section, which includes discussion of the above questions.

3.7.3 Financial Questions

Financial Subcommittee Questions

The financial subcommittee had three main questions related to the costs of each transfer technique, the compensation for participation in the program, and economic impacts of a rotational fallowing program:

- What are the costs to organize and administer a program and who are the parties that could contribute to the costs?
- What portion of the total land and water rights value will need to be paid to an agricultural user as compensation for enrollment in a program?
- How do the annual local economic impacts of a rotating fallowing program compare with a permanent dry-up that includes voluntary payment in lieu of taxes?

The financial subcommittee organized their evaluation into Table 3-5, inserted at the end of this section, which includes discussion of the above questions.

3.8 Development of Rotational Fallowing Examples

3.8.1 Organization of Rotational Fallowing Alternative Transfer Example

Rotational fallowing was selected as a detailed, but hypothetical example of an alternative agricultural transfer technique. The financial subcommittee's questions best lent themselves to using rotational fallowing as an example technique to examine program costs and provide an economic comparison between alternative techniques and permanent dry-up. In addition, a rotational fallowing example was created to describe how a fallowing program might work and to help answer the subcommittee's questions.

A general discussion of each of the alternative transfer techniques is also included in this section. The potential advantages, impediments, remedies, and remaining problems specific to each of the alternative transfer techniques are discussed.

3.8.2 Case Studies and Reports Utilized

Several agricultural water transfer case studies and documents were reviewed and utilized in completing this section. Many of the case studies were interviews conducted with irrigation districts and municipal water districts. These brief generalizations may not fully capture all legal obligations, nor does Colorado necessarily endorse the out-of-state programs described here for example purposes only.

- Metropolitan Water District (MWD) and Sacramento Valley, California One Year Transfer Options: MWD purchased 1-year options for water from 11 Sacramento Valley irrigation districts, mutual water companies, and others in 2003 and again in 2005. MWD exercised those options only in 2003, paying farmers an additional sum. Farmers in the water districts and water companies were required to fallow a certain amount of acreage. Additional infrastructure was not required to implement this program.
- MWD and Imperial Irrigation District (IID): This transfer agreement is part of the larger Quantification Settlement Agreement (QSA). The QSA is an agreement between four water agencies and the State of California that includes water transfers and other agreements that will reduce California's over use of Colorado River water to the level provided for under the Colorado River Compact. The MWD-IID agreement is for the transfer of water from IID to MWD of water realized solely as a result of IID canal lining.
- Coachella Valley Water District (CVWD) and IID: This agreement is also a part of the QSA and is a transfer of conserved water from IID to CVWD. IID water will be available for transfer to CVWD as the result of on-farm conservation practices and canal lining.
- MWD and Palo Verde Irrigation District (PVID): The Palo Verde Land Management, Crop Rotation, and Water Supply Program is a long-term rotational fallowing program. Growers

fallow between 7 and 35 percent of their land on an annual basis to provide between 25,000 and 111,000 AF of water to MWD each year. Additional infrastructure was not required to implement this program.

- San Diego County Water Authority (SDCWA) and IID: IID provides an increasing amount of water to SDCWA each year as a result of water conservation. Fallowing will be used as a tool only in the first 15 years of the 45 to 70 year agreement. An increasing number of acres will be fallowed each year, but no acres will be permanently fallowed as a result of this program. Growers apply to be a part of the fallowing program on an annual basis. Additional infrastructure was not required to implement this program.
- Denver Water and Grand County: Denver Water purchased Williams Fork River water rights from an irrigator in Grand County in the 1960s and began to lease the water back to the irrigator for an annual fee. The ranch changed hands in the mid 1990s, the lease was renegotiated, and Denver Water now lets the new rancher use the water free of charge when Denver Water does not need it. Denver Water has the right to the water when needed and did use that water in 2002, 2003, and 2004. The term of the leaseback agreement will end in 2013 and Denver Water does not plan on extending the contract.
- City of Aurora and the Rocky Ford High Line Canal Company: These entities entered into a 3-year lease of 37 percent of the shares in the canal. Water was only transferred during the last 2 years of this agreement and resulted in a fallowing of between 8,200 and 8,300 acres producing approximately 10,000 AF of water. In the last year of the lease, Colorado Springs took over half of the lease. The implementation of this lease was greatly facilitated by the ability of Aurora to use existing infrastructure and exchange rights, eliminating the need to construct additional facilities.
- Xcel Energy and the Arkansas Basin: Xcel purchased water in the Arkansas Basin many years ago. Xcel does not currently need the water and does not anticipate the need for it in the near future. They purchased a little less than half of the shares in a particular ditch and now lease the water back to about 60 farmers who collectively farm between 6,000 and 7,000 acres of land. The leases are contracted on an annual basis.
- Xcel Energy and the South Platte Basin: Xcel entered into an agreement with a ditch company (Fort Morgan Water Company) that has interest in reservoir rights, direct flow rights, and recharge rights. More recently Xcel entered into an agreement to lease water from the North Sterling Irrigation Company system. Xcel has contracted for the right to up to 2,500 AFY from the ditch company and that water can be supplied in a number of ways, including the possibility of fallowing. In recent years, the ditch company has cut back on some irrigated acres to meet the lease obligations.
- Broomfield and Platte Valley Irrigation Company: The City of Broomfield has an agreement with the Platte Valley Irrigation Company for 1,906 units of CBT water. The lease was signed 5 years ago, but as of 2006 none of that water has been used by the City of Broomfield. At the end of the 25-year lease agreement, the leased CBT units will be permanently transferred to Broomfield. No irrigated acres will be fallowed if or when Broomfield does use the contracted water, since the leased water is legally defined as a supplemental supply to the irrigation company's total water supply. Additional infrastructure will not be required to implement this program.
- San Antonio Water Supply (SAWS): SAWS has leased water for many years, but plans on reducing that activity in the future. As of 2006, SAWS has lease agreements to obtain a small amount of water from irrigators using Edwards Aquifer water rights who conserve water through on-farm conservation practices. Additional infrastructure was not required to implement this program.

- Parker Water and Sanitation District (PWSD) and Logan County: PWSD purchased land and water rights in Logan County in the past and currently leases the water back to irrigators in the county. PWSD plans on using a portion of the purchased water (about 20 percent) at some point in the future, but anticipates the rest will be available for continual leaseback. The CU portion of the water that will eventually be used by PWSD is not expected to be needed by the irrigators at that time as a result of on-farm conservation practices. This project is still conceptual and water court transfer affirming the reduction in CU will likely need to be approved before implementation and with administrative protection and to guard against expanded use.
- Northglenn and FRICO: The City of Northglenn entered into an exchange agreement in 1976 with FRICO for the first use of FRICO Standley Lake shares in irrigation use. Northglenn returned the water as effluent plus added a 10 percent water bonus. Northglenn also entered into 30-year ROFR with many of the FRICO irrigator shareholders. The FRICO Standley Lake supply was also part of the future supply for the cities of Thornton and Northglenn, who over the years purchased many of the shares. Due to the high costs of the initial infrastructure required for the program as well as high legal and transaction costs, Northglenn was financially unable to compete for the shares, including many of those for which they had ROFRs. Thirty years later these ROFRs are expiring and there will soon be insufficient shares for Northglenn to operate the exchange. Northglenn does not have the financial resources to acquire all of the shares needed to replace the water lost from the exchange due to the price appreciation from competition for the shares by other water providers.

3.8.3 Rotational Fallowing Example

Purpose and Use of an Example

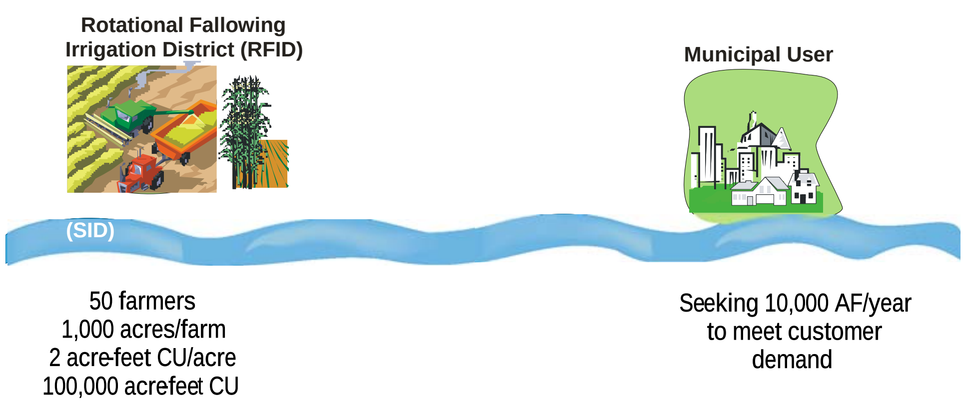
Figure 3-5 depicts a hypothetical illustration that can be used to demonstrate how a dynamic activity might actually work as an instructive example. Here, an example is used to flesh out one of the alternative agricultural transfer techniques—a rotational fallowing program. This example, developed by Harvey Economics, is based on case studies of actual rotational fallowing programs. This example is applicable to large agricultural areas that are not facing urbanization or other development pressures in the foreseeable future.

Creation of the Rotational Fallowing Example

In this case, the example consists of an irrigation district (termed "RFID" for Rotational Fallowing Irrigation District) willing to participate in a rotational fallowing program and a municipal user (MU) that would like to obtain additional water. Figure 3-5 illustrates the RFID and MU and provides a description of the fallowing program.

The creation of the rotational fallowing program would include several steps:

1. RFID cooperates in MU Feasibility Study (FS), which includes a survey of farmer interest, means for protecting yield transfer, plans for erosion and weed control, third party impact monitoring and mitigation plan, and an



Source: Harvey Economics, 2006

Figure 3-5
Rotational Fallowing Example

assessment of the RFID administration fee.

2. RFID makes changes in district by-laws as needed to allow the transfer.

3. RFID seeks a voluntary fallowing plan from each farmer, including acreage to be fallowed each year, CU savings estimates, and dollar amount desired from MU.

4. MU and RFID establish 10-year fallowing plan from farmer bids. If all the RFID farmers participate, 5,000 acres would be fallowed each year.

5. MU and RFID jointly prepare a water court application and pursue a change of use case as needed.

6. MU contracts with farmers for fallowed land water savings. A 10 percent fallowing program would yield 10,000 AFY, assuming senior water rights yielding 2 foot per acre CU.

7. MU pays costs and administrative fees to RFID.

Financial Subcommittee Question 1

"What are the costs to organize and administer a program and who are the parties that could contribute to the costs?"

Organization and administration costs of the rotational fallowing program would include costs associated with the provision of information to RFID farmers, meetings between participating farmers and the RFID, meetings between the RFID and MU, the management of contracts between MU and RFID and management of individual contracts between RFID and participating farmers, monitoring of fallowed acres for compliance with contract provisions, and other contracts or approvals from agencies such as the State Engineer, where applicable.

In addition to monetary costs, there is a time element associated with many of the organizational and administrative activities. Certain tasks, such as a change case in water court, may require a relatively long time to complete before a rotational fallowing program can be started and before any water can be transferred from agricultural use to other uses, although a program might potentially operate for a short period of time under a State Engineer administratively approved substitute water supply plan. MU internal costs and time will be considerable.

It is reasonable to expect that a comprehensive FS and tactical plan would be done before negotiations began for any fallowing program. The FS could include information on the expected participation rate of RFID farmers, the program payments, and details of the physical aspects of the water transfer. The fallowing programs used as a basis for the example indicate that costs for a FS could reasonably be in the range of $200,000 to $250,000.

Up-front administrative costs, generally on the part of the irrigation district, could be in the range of $25,000 to $50,000. Annual administrative costs, also on the part of the irrigation district, could run from $75,000 to $125,000. Although there could be some cost sharing among the parties involved, in most cases it would be the purchaser, or end user, of the water (MU) who ultimately pays for the administrative costs by reimbursing the irrigation district.

Supporting Information:

1. In the MWD-PVID program, MWD paid/pays for all administrative costs. MWD reimbursed PVID for all expenses.

2. In the SDCWA-IID program, there was some cost sharing between parties, mainly because the transfer agreement was part of the larger QSA.

3. In the agreement between Aurora and Rocky Ford, Aurora paid for most of the administrative costs.

4. In the MWD-Sacramento Valley program, administrative costs included several meetings between various parties.

Financial Subcommittee Question 2.

"Are annual payments made only to the agricultural participants fallowing for that year or to all program participants?"

In this example, all participants are fallowing each year and all are paid annually. MU would make annual payments to farmers who are fallowing on a per-acre basis, based on CU savings from the fallowed lands. Individual farmer contracts allow for different payments to individual farmers. Program participants benefit through generous administrative payments to RFID, reducing operation and maintenance (O&M) assessments to all RFID shareholders.

Generally, all participants would fallow some portion of their land in each year of the program and all participants would receive an annual payment. RFID farmers who choose not to participate in the program would not receive any payments from MU. But this approach creates large administration enforcement costs as all fields must be monitored for compliance with conditions.

Supporting Information:

1. In the MWD-PVID program, all fallowing participants are in the program for the long-term, all fallowed some acreage each year, and all are paid the same amount per acre fallowed.

2. In the SDCWA-IID program, fallowing participants varied by year, but in a given year each participant received the same per AF payment amount.

3. In the agreement between Aurora and Rocky Ford, annual payments were made to fallowing program participants on a per share (of the canal company) basis.

4. In the MWD-Sacramento Valley agreement, all fallowing program participants were compensated on a per AF basis.

Financial Subcommittee Question 3

"Are there regional or statewide benefits to an interruptible or rotating fallowing program, such as preservation of open space or providing for environmental flows? Should a portion of the program costs be borne by the public or third parties?"

In general, a rotational fallowing program could provide a variety of statewide or regional benefits, especially when compared to a permanent dry-up. There are indeed statewide benefits if the direct parties involved decided to maximize maintaining irrigated agriculture while meeting future water needs. If the goal of maximizing irrigated agriculture was clearly recognized as a statewide value, financial help with a FS, addressing third party impacts and benefits, or equalizing administrative costs (i.e., make more comparable to permanent dry-up), may be warranted. Additionally, if it is desirable to obtain some portion of water for environmental or recreational purposes, a financing mechanism would be needed and a partnership with the M&I and agricultural user could be pursued.

The long-term sustainability of agriculture, agri-business communities, and rural Colorado is the chief benefit of a rotational crop fallowing program. An important benefit would be the opportunity for the preservation of agriculture as water remains available for irrigation of farms, while at the same time some water is transferred to other uses. A rotational fallowing program could provide farmers who want to remain in agriculture with the financial support to do so. However, there are other agro-economic factors at play and the continued availability of water may not result in the long-term viability of local agriculture.

From the maintenance of agriculture, the sustainability of agri-businesses and other businesses that rely on the spending of farmers follows. Farmers in production would continue to spend money on labor, equipment, and other supplies for the farm, and would also continue spending on other goods and services in the community. Farming communities and regional centers will benefit as well.

Assuming historic return flows are preserved in the historical locations and amounts, the environmental benefits of a fallowing program would be reflected in the wetlands, other vegetative areas, and wildlife habitat in the area that might have disappeared as a result of a permanent transfer of agricultural water, depending upon the location and means of providing for historic return flows after the transfer.

Open space or green space preservation is another potential benefit if farming is preserved. Local government invests significant sums in the preservation of open space. The presence of ranching and open space also promotes recreation and tourism in certain areas of Colorado. Non-irrigated agriculture (dry-land farming) or not developing the land under a traditional agricultural transfer are other means to maintain the open space benefits. If the agricultural lands subject to an agricultural transfer are significant distances from urbanized areas, it is likely that the open space value of the land will be preserved, regardless of a traditional agricultural transfer.

Supporting Information:

1. In the MWD-Sacramento Valley program, historic return flows were preserved and no downstream environments or wildlife areas were adversely affected.

2. In the SDCWA-IID program, fallowing was incorporated into a larger transfer agreement for the purpose of supporting the environment of the Salton Sea area. Fallowing allowed a transfer of water for M&I use while at the same time providing water to the Salton Sea.

3. In the agreements between MWD- PVID, SDCWA-IID, Aurora and Rocky Ford and MWD-Sacramento Valley, financial support was given to farmers who wanted to remain in farming and farmers continued to spend money in both the farm and non-farm sectors of the economy.

Financial Subcommittee Question 4

"What portion of the total land and water rights value will need to be paid to an agricultural user as compensation for enrollment in a program?"

A useful benchmark would be the weighted average net income per acre for crops grown within the RFID plus an incentive payment to induce participation, plus costs of weed and erosion control and property taxes on the fallowed land.

Supporting Information:

1. In the Aurora-Rocky Ford program, payments to participants were partially based on the value of the expected yield of current crop types.

2. In the MWD-Sacramento Valley program, payments were based on commodity prices.

3. In the MWD-Sacramento Valley and the MWD-PVID programs, farmers were responsible for weed control and erosion, but program payments were higher.

Financial Subcommittee Question 5

"Are there additional incentives needed for agricultural users to participate in these programs when their rights can be sold for large sums to M&I users?"

Yes, RFID farmers must receive enough of a payment to supplement the finances on the remaining farming operation. This will vary from place to place.

Farmers who want to remain in agriculture are likely to be willing to participate in a program that will allow them to do so while providing some financial support. To remain viable as an agricultural operation, the financial incentive would have to more than cover the lost production from fallowed acres. Farmers who are more inclined to leave agriculture would need a larger incentive. Local agricultural users with pending urbanization represent a different case than is used in this example.

Supporting Information:

The SDCWA-IID, MWD- PVID and MWD-Sacramento Valley programs all involved farmers who wanted to remain in agriculture and where a strong agricultural economy existed.

Financial Subcommittee Question 6

> *"How do the annual local economic impacts of a rotating fallowing program compare with a permanent dry-up that included voluntary payment in lieu of taxes? (Loss of local tax revenue for schools, government, etc.)"*

Annual local economic impacts of a rotational fallowing program are at maximum the fraction of agriculture's economic contribution, which is subject to annual fallowing. In fact, impacts would be less due to MU payments to farmers and RFID. If fallowing shifts among different parties, re-classification of assessor land status is unlikely, so property taxes would be unaffected. Economic impacts have been debated in other alternative agricultural transfers, so no universal agreement on this point is evident. Impacts of the example discussed here would probably be minimal.

Although a smaller amount of crop production would occur on farms when acreage is fallowed, the economic effects of that lost production would be mitigated by the program payments made to participants. Participants would not experience a loss of income as program payments would be at least equal to lost revenue due to fallowing, if not more. In some cases, there may also be the possibility of dryland farming, which would allow for some additional income. There may be some third party losses of employment and revenues to local businesses, but as mentioned above, program payments made to participants would somewhat offset these losses. Farmers are likely to continue to spend money, including receipts for participation in the fallowing program, on farm operations, including labor, equipment and supplies, and in other businesses in the community.

Several of the larger fallowing programs also include considerable investments (third party mitigation) set aside for local community improvement programs. These programs are aimed at stimulating the local economy and mitigating the effects of any third party impacts, including any loss of employment, sales, or tax revenue.

In comparison to a traditional agricultural transfer, even if voluntary payments were made in lieu of taxes, this fallowing example would have a greater positive net economic effect compared to a permanent dry-up and fallowing of the land, unless the land was developed for other income-producing uses. Voluntary in lieu payments made by the purchaser of the water rights would go to local governmental entities to mitigate loss of tax revenues for services such as schools and other publicly provided community services. However, these payments are not likely to provide support to local, private sector, businesses that have lost a portion of their customer base due to the loss of farms, and farmer spending. These voluntary payments would not create jobs to mitigate the loss of employment due to decreased agricultural production. However, as noted above, if the land was dryland farmed or converted to another use, the loss of revenue may be lessened or perhaps revenue increased, depending upon the type of development and alternate use of the land.

The size and significance of third-party impacts have been debated as part of existing fallowing programs, but the economic drawbacks of fallowing programs would be minimal compared to a traditional agricultural transfer, unless the land were developed for other income producing uses, such as dryland farming, residential or industrial.

Applications and Limitations of the Example

An example based on reports, data, and anecdotes from actual fallowing programs provides some evidence for how future rotational fallowing programs could be organized and administered. However, the creation of the rotational fallowing example described herein and the outcomes provided reflect only the few existing cases. The process of creating and operating a new rotational fallowing program could be much different than the one illustrated in the example above, depending on the specific circumstances and characteristics of the parties involved. The terms of any transfer will be dependant on the water rights of the agricultural users, specific agricultural operations, the requirements of the buyer and other details of physical transfer, and the potential urbanization or conversion of the agricultural land to other uses.

There are several advantages and disadvantages to a traditional agricultural transfer program as compared with a rotational fallowing program, as shown in Table 3-6.

Table 3-6 Advantages and Disadvantages of a Traditional Agricultural Transfer Program as Compared with a Rotational Fallowing Program

Advantages of Traditional Agricultural Transfer	Potential Drawbacks of Traditional Agricultural Transfer
• Simple, clear, and certain. • Maximized benefit to any farmer whose family is really finished farming. • Rewards farmer's long-term investment. • Can do a water leaseback. • Can keep in open space through easements. • Buyer gets the water. • Buyer has maximum flexibility. • Buyer has certainty in cost and yield (after water court transfer completed).	• Loss of agricultural production. • Possible third party impacts to: - Other farmers, ranchers; – Local businesses; – Viability of local community; – Sense of community; and, – Local government jurisdictions. • Possible environmental and recreational impacts if historic return flows made in a different location. • Other institutions may be impacted due to loss of local economic activity if land is not used to produce other revenue. • Possible loss of open space if land is developed. • Loss of future business potential.

Table 3-7 summarizes the benefits and issues of a rotating fallowing program.

Table 3-7 Benefits and Shortcomings of a Rotational Fallowing Program

Benefits of Rotational Fallowing	Issues with Rotational Fallowing
• Encourages continuation of agriculture with hard dollars. • Encourages maintenance of open space. • Maintains bulk of historic return flows in all years. • Financial compensation to farmer including potential for long-term stability and support for ag operations. • Helps meet future water needs. • Limits third party impacts. • Preserves rural economy and lifestyle.	• Works best with larger irrigated areas. • Easiest to set up with a single lessor, i.e., irrigation district, large farmer. • Somewhat restrictive, invasive to farmers. • Substantial up-front effort can be required. • Less likely to have success in areas with development potential unless it is coupled with environmental or open space program. • Presents risk to end user unless agreement is perpetual or provides for acquisition or renewal by end user at end of contract or right of first refusal.

The benefits of this program are clear if the goal is preservation of the rural economy and lifestyle, but the drawbacks in terms of farmer participation and effort to establish can be underestimated. Although there are likely to be some challenges in getting a successful fallowing program started, there are many more advantages than drawbacks to this type of alternative transfer.

3.9 An Evaluation of Other Alternative Agricultural Water Transfer Techniques

An abbreviated evaluation of other transfer techniques that are discussed in this section is offered in the tables and discussion that follows. The discussions below are restricted to a comparison of the specific transfer technique with a traditional agricultural transfer. In each case, there will be circumstances or instances of applicability, but noteworthy shortcomings as well.

3.9.1 Interruptible Supply Agreements

Table 3-8 enumerates the major advantages and issues associated with ISAs.

ISAs function in similar ways to rotational crop fallowing, except that there is less predictability for the farmer and M&I water provider. These plans are like insurance to some extent and thus promote predictability. If wet conditions prevail the M&I provider will have sufficient supply and not care if the ISA is not triggered. In dry conditions, M&I gets the benefits of a backup supply. The advantages, however, are similar for an ISA and a rotational fallowing program: 1) the farmer can continue farming; 2) the farmer receives additional financial support; and, 3) third party impacts are minimized. The disadvantages with the ISA's are the increased uncertainty on the part of the farmer and M&I provider and, since the amount of water available to either the farmer or the buyer is uncertain in any given year, the value of the resource itself is depreciated in monetary terms.

3.9.2 Water Banks

Table 3-9 points out the major advantages and issues associated with water banks.

Water Banks have been successfully used in northern California and other states. The CBT project rental market has operated successfully in Colorado as an informal water bank. The advantage of a water bank is its unobtrusive, almost anonymous feature in putting water seller and buyer together to improve market transfer efficiencies. A bank helps establish a "spot market," particularly if adequately capitalized allowing payments on deposit. The primary drawback in this instance is that the water bank by itself is not really an alternative to traditional agricultural transfers. In fact, water banks are often used to either promote one-year, temporary water transfers or as an outright vehicle for sale. Water banks do not functionally recognize a transaction between the irrigator and the water buyer as a necessary condition for an alternative to a traditional agricultural transfer transaction.

Table 3-8 An Evaluation of Interruptible Supply Agreements Compared with Traditional Agricultural Transfers

Potential Advantages	Potential Impediments	Potential Remedies	Remaining Problems
• Allows farmer to continue farming	• Restricts land, water use	• Occasional interruption	• Commitment from farmer to tie up water rights for duration of contract
• Provides additional funding for farmer	• Senior water rights preferred	• Laddering of different water rights priorities possible	• Limits opportunities for ISA's
• Minimizes third party inputs	• Uncertainty of future availability	• Contract renewal at buyer option or buy-out option in contract	• Sacrifice by farmer to tie up water rights for duration of contract or right of first refusal
• Underlying value rests with farmer	• Limits flexible use by buyer	• None apparent	• Limited help in serving future growth, does not provide for permanent annual yield
	• Uncertainty in ultimate cost to end user	• Contract renewal at buyer option or buy-out option in contract	

Table 3-9 An Evaluation of Water Banks Compared with Traditional Agricultural Transfers

Potential Advantages	Potential Impediments	Potential Remedies	Remaining Problems
• Demonstrated success	• Bank organization	• Buyer-seller groups or state lead	• Requires will, leadership, and broad support
• Unintrusive for farmer and buyer	• Front-end investment in institutional arrangements and infrastructure	• Time, money	• Who will pay?
• Promotes efficient transfer	• Critical mass of buyers and sellers in right locations	• Screen basins for favorable conditions	• Limited application
	• Uncertain benefit to sellers	• May not get needed revenue	• Can't count on initially
	• Uncertain availability of useful supply for buyers	• May not find the supply that the buyer needs	• Can't count on initially
	• May not keep land in agriculture	• Must understand seller intentions	• Progress toward underlying goals uncertain

There are other drawbacks to water banks, not the least of which is considerable organization efforts and front end investment with considerable uncertain benefit to buyer and seller.

3.9.3 Alternative Cropping Practices

Table 3-10 lists the major advantages and issues associated with reduced agricultural consumptive use through efficiency or cropping.

Alternative cropping patterns and related conservation have been used in certain instances as an alternative to traditional agricultural transfers. The advantages are that on-farm conservation and alternative cropping patterns can allow for some water to be removed from the farm and made available to meet other water needs while maintaining existing agricultural operations. There are significant disadvantages; requiring agricultural water conservation or alternative cropping patterns is invasive to the farmers. A farmer needs the flexibility to adjust his agricultural activities and cropping patterns to meet a changing marketplace and if that flexibility is inhibited, it will reduce his viability and interest in participation. Further, on-farm efficiency oftentimes requires an up-front investment which further reduces the opportunity for the water buyer to establish a favorable price with the farmer as seller. Proof of water savings and measurement of that savings is also a disadvantage. There will be high administration enforcement costs and the SEO needs a way to recover administrative costs. Any savings must be in a reduction of CU that can be verified and monitored. This technique, however, may be of benefit to agricultural areas that are facing reductions in irrigated lands due to issues with tributary groundwater pumping, such as inadequate augmentation supplies or unsustainable levels of pumping. Alternative cropping could reduce the overall consumptive use, and the corresponding need for augmentation or retirement of irrigated lands.

3.9.4 Purchase and Leaseback

Table 3-11 lists the major advantages and issues associated with purchase and leaseback agreements.

Purchase and leaseback programs are one of the most common forms of agricultural water transfer in Colorado. They are a simple transaction where the farmer is able to continue for a temporary, and sometimes unknown, period of time and the purchaser gets control of the water and can use that water when needed. Importantly, the purchase and leaseback programs are not really alternatives to traditional agricultural transfers; these programs only temporarily delay traditional agricultural transfers for a period of time. Other drawbacks, for the farmer in particular, and agriculture in general, are the unpredictable nature of the transaction. The farmer has no indication of how long he or she will be farming, unless the leaseback period is specified at the time of sale.

Table 3-10 An Evaluation of Reduced Agricultural Consumptive Use through Efficiency or Cropping Compared with Traditional Agricultural Transfers

Potential Advantages	Potential Impediments	Potential Remedies	Remaining Problems
• "Creates" additional water for use	• On farm efficiency usually requires money	• Buyer could pay	• Raises water costs or reduces net dollars to farmers
• Maintains agricultural production	• On farm efficiency must produce effective net savings	• Farmer and buyer select efficiency program	• Potential disagreement over efficiency technique/savings
• Supports conservation and efficiency	• Reduces cropping choice and farming flexibility and economic opportunities	• Index CU, variable yield	• Reduces certainty for buyer, flexibility for farmer
	• Measurement of yield	• Careful monitoring vs. historic use (legally and administration)	• Uncertain yield • High administrative costs for state
	• Protection of yield	• Change of use case • Infrastructure investment	• Uncertain yield • Higher transaction costs

Table 3-11 An Evaluation of Purchase-Leaseback Compared with Traditional Agricultural Transfers

Potential Advantages	Potential Impediments	Potential Remedies	Remaining Problems
• Simple transaction	• Irrigated agriculture becomes temporary	• Long lead time for transfer notification	• Reduces commitment to agriculture long term
• Works well in urbanizing areas	• Eventually dry land unless developed for other purposes	• Easement to keep in open space, dry land agriculture	• Ultimately the land is likely to be permanently dried up
• Allows farmer to continue temporarily			

3.9.5 Summary

Through an example of a rotational crop fallowing program, this section responds to the key financial subcommittee questions. As site specific conditions change along with fallowing program stipulations, these responses will also change somewhat.

The costs to organize and administer the example fallowing program would be relatively modest by water acquisition standards, probably less than $500,000 for the rotational fallowing example. Annual costs might run between $75,000 and $125,000. The water buyer could pay the costs.

Program participants are generally required to fallow a portion of their land each year and therefore each receives a payment each year under the example. There are instances where a fallowing program can be organized through a district, irrigation company, or other organization, in which case, participants would not need to fallow each year. Under those circumstances, payments streams are negotiable.

There are certainly regional and statewide benefits to a rotational fallowing program including preservation of agriculture, continued viability of related businesses and farming communities, and preservation of open space in a sustainable manner. If rotational fallowing is a goal, and there are statewide third party benefits, it may be possible to garner statewide support for the program.

The amount required to pay a farmer as compensation is usually based upon the average net income per acre for the crop he or she has traditionally grown along with reimbursement for weed and erosion control costs and property taxes. An incentive payment on top of this amount is usually required. The incentive payment must be sufficient to induce an adequate number of farmers to participate in the program and may be more than the base compensation rate. That incentive is very site specific. If the land is in an urbanizing area, significant additional incentives might be needed.

The annual economic impacts of a rotating fallowing program are generally much less than a traditional agricultural transfer that results in a permanent dry-up with no development of the land. Farming is allowed to continue in an area; local businesses, communities, and local government continue to be viable under a rotational crop fallowing program. The small amount of production lost is offset to some degree by income received by the farmers which they also can expend in the local community. Although debates have arisen in some communities related to local economic impacts, the rotational fallowing example described herein would result in a minimal amount of third party economic impacts. If the land is converted to dryland farming or other revenue producing uses, the impacts might be less or even positive, if the land is developed for higher revenue generating uses. This development potential is limited, however, for areas that are significant distances from urbanizing areas.

Besides rotating crop fallowing programs, other alternative water transfer techniques offer certain advantages and disadvantages and might be appropriate in very specific circumstances. Purchase and leaseback water transfers are the most common form of alternative agricultural transfer in Colorado and are particularly advantageous in areas of pending urbanization of agricultural lands. Alternative cropping and related on-farm conservation programs have been utilized in California but as voluntary programs; these present challenges. Interruptible supply agreements, a variation of the rotational crop fallowing program, create more uncertainty for the farmer and the buyer, but might be attractive in certain circumstances.

Table 3-12 provides an example of some, though not all, of the goals that motivate two parties contemplating a water transfer. The preferred water transfer program in a particular location and point in time is based upon that program's ability to satisfy both the objectives of the buyers as well as the sellers, as outlined in Table 3-12.

Table 3-12 Typical Goals of Buyers and Sellers in an Agricultural Water Transfer Program

M&I Providers	Agricultural Users
• Increase in firm annual yields, minimal losses	• Maximize dollars, cash out (some users)
• Certainty	• Continue in agriculture (some users)
• Ease of permitting	• Protect private property rights
• Minimize direct environmental impacts subject to regulation	• Preserve water and agriculture in Basin (some users)
• Minimize infrastructure cost	• Supplement finances to support irrigated agriculture
• Compatibility with existing water portfolio system	• Minimal disturbance to agricultural operations, record keeping
• Minimize transaction cost	

Source: Harvey Economics, 2006

When considering alternative agricultural water transfer programs, it is important to recognize the site specific needs and desires of both the buyers, typically M&I users, and the sellers, typically irrigated agriculture.

3.10 Infrastructure Considerations for Rotational Fallowing for Major Gap Areas

Information from this TRT and report can be utilized to develop some initial concepts for addressing some of Colorado's future water supply needs. These concepts have been discussed and examined by the Gap TRT and the reader is encouraged to review that portion of the SWSI Phase 2 Report for more information. A brief summary of the general approach and conclusions are summarized in this section. SWSI identified M&I gaps in most basins. The two largest gap areas were the south metro Denver area in the South Platte and northern El Paso County in the Arkansas Basin. Both of these areas are on non-renewable groundwater and will need significant amounts of new renewable supplies, even if aggressive water conservation is implemented. The SWSI Report identified a 2030 gap of 50,000 AFY in the south metro area and 8,000 AFY in northern El Paso County. This gap estimate assumed that current levels of groundwater pumping could continue indefinitely. If groundwater pumping yields continue to decline, it is likely that the gap for these areas could increase to nearly 100,000 AFY at buildout of existing water providers. Other important gap areas include the north Denver metro area (12,500 AF), Weld and Larimer County areas (18,400 AF); and several headwater areas of the Arkansas, Colorado and Gunnison Basins.

The matrices presented in Section 3.9 describe where certain techniques may have the best applicability. For example, ISAs offer long-term opportunities for meeting environmental and recreational needs during low-flow conditions in headwater streams, especially where ranchland is not facing development pressure. This type of ISA could be coupled with a conservation easement on ranchland in headwaters areas to provide for continued irrigation in average to above average streamflow conditions with interruption of irrigation in below average stream conditions to provide for in-stream flow benefits.

Rotational fallowing or ISA's could also be used to provide for protection against the potential for interstate compact calls.

Rotational fallowing or ISAs could also be used to provide for protection against the potential for interstate compact calls. Those users, generally M&I, who have more junior priorities and would be among the first to be curtailed for a compact call, could enter into an ISA or rotational fallowing agreement with senior agricultural water rights holders. For example, in the basins tributary to the Colorado, there is approximately 1 million AFY of agricultural consumptive use that would occur in a dry year and that is senior to the Colorado River Compact.

As noted in Section 3.6.3, on average, approximately 1 to 2 AF of storage is required to produce 1 AF of firm annual yield for M&I use. Agricultural transfer yields are not, by themselves, firm since they are typically seasonal and agricultural users typically endure larger shortages during droughts than municipalities can tolerate. Storage for M&I use is needed to carry over agricultural supplies from the irrigation season to the non-irrigation months and to ensure that adequate water can be stored in average to above average runoff years for use in below average years. The actual amount required is dependent upon the seniority of the agricultural water rights to be transferred and the firm yield drought reliability required by the new M&I demand.

3.10.1 Meeting the South Metro and El Paso County M&I Gap with Rotational Fallowing Program

An illustrative example was developed to show how a rotational fallowing program could be developed to meet the future M&I gap in the south metro area and El Paso County. Similar approaches could be used for meeting the M&I gap in Larimer-Weld counties. M&I gaps in headwaters areas throughout the state could potentially be met with a variety of alternative transfer techniques including rotating fallowing or ISAs. The south metro area and unincorporated El Paso County providers have existing non-tributary wells and a conjunctive use arrangement could reduce the need for additional fallowed lands during droughts. If the fallowing program could provide average yield and negate the need for pumping non-renewable groundwater in most years, the existing groundwater resource could be relied on to provide additional yield in the more infrequent drought years.

A rotational fallowing program, as described in Section 3.10.3, would require a large amount of irrigated acres in the program in order to provide 50,000 to 100,000 AFY of supply for M&I use in the South Platte and Arkansas Basins. Using an estimated 1.5 to 2.0 AF per acre of transferable CU, an annual fallowing of 25,000 to 66,600 acres of irrigated land would be required. If firm yield and carryover storage were required or the agricultural rights did not provide sufficient yield in below average years, additional acreage would be required to provide for carryover into drier periods.

Assuming that, on the average, 25,000 to 66,000 acres would be fallowed; a rotational fallowing program that would result in 20 percent of the land being fallowed each year would require program participation of 125,000 to 333,000 acres. As noted in previous sections, the areas that may have a high probability for implementing a successful rotational fallowing program would be areas that are not facing urbanization or other development pressures or acquisition by other water providers. This amount of acreage in the South Platte and Arkansas is located in the lower reaches of each basin. Figure 3-6 shows the locations of irrigated acreage in the South Platte by Water District. The most likely geographic areas for a rotational fallowing program in the South Platte appear to be in Water Districts 1 and 64. Similarly, the most likely geographic areas in the Arkansas would be in the lower reaches of the Arkansas in Water Districts 14, 17 and 67, as shown in Figure 3-7.

To produce 100,000 AF of water supply approximately 330,000 acres of irrigated land would be needed to participate in a fallowing program and about 66,000 acres would need to be fallowed per year.

Significant infrastructure would be required to deliver agricultural water from the lower South Platte or lower Arkansas to the gap areas of the south metro area or northern El Paso County. As identified in the SWSI Report, there is very limited new exchange potential that would allow this water to be diverted upstream using existing infrastructure. This infrastructure would be needed even if a traditional agricultural transfer were to be implemented from the same geographic areas. Table 3-13 provides approximate distance, elevation difference from potential rotational fallowing areas to the south metro and El Paso County areas and the average total dissolved solids in the South Platte and Arkansas Rivers at the locations of the agricultural use. Total dissolved solids (TDS) are an indicator of the level of water treatment that would be required to produce an acceptable quality water. There is not a primary drinking water standard for TDS, but the secondary maximum contaminant level for TDS under the Safe Drinking Water Act is 500 milligrams per liter (mg/L). Recent customer surveys by the City of Aurora and East Cherry Creek Valley Water and Sanitation District (ECCV) suggest that customer acceptability of TDS is in the 300 to 450 mg/L range.

As shown in Table 3-13, approximately 60 to 100 miles of pipeline would be required to convey water from the agricultural areas to a centralized location near two major gap areas. Pumping facilities would also need to be constructed to lift the water the 1,500 to 3,500 feet. The water quality in the lower reaches of the South Platte and Arkansas are impacted by the successive use of water in the basin as shown by the TDS of 530 mg/L to 1,300 mg/L. There is a secondary drinking water standard of 500 mg/L of TDS and the water supplies currently used by south metro and El Paso County water providers have TDS significantly below this level. Advanced water treatment such as reverse osmosis would be required to lower the TDS and treat other pollutants present in the river to acceptable and regulated levels. It is estimated that the capital infrastructure costs to divert, pump, pipe, and treat 60,000 AFY would range from $900 million to $1.2 billion. Annual O&M costs for pumping, treatment, and water treatment waste stream disposal would add tens of millions of dollars per year.

The costs noted above do not include the water rights acquisition costs if a traditional agricultural transfer were to occur or the costs associated with a rotational fallowing arrangement.

Table 3-13 Distance, Elevation and Total Dissolved Solids for Agricultural Transfer/Rotational Fallowing Alternatives for Major Gap Areas

Description	Distance (Miles)	Elevation Difference (feet)	Estimated Average Total Dissolved Solids (mg/l)
South Platte – Greeley area to South Metro	72	1,500	650
South Platte – Ft.Morgan/Weldona area to South Metro	97	1,800	1,000
Arkansas –Avondale area to El Paso County	68	3,200	530
Arkansas – La Junta area to El Paso County	100	3,500	1,300

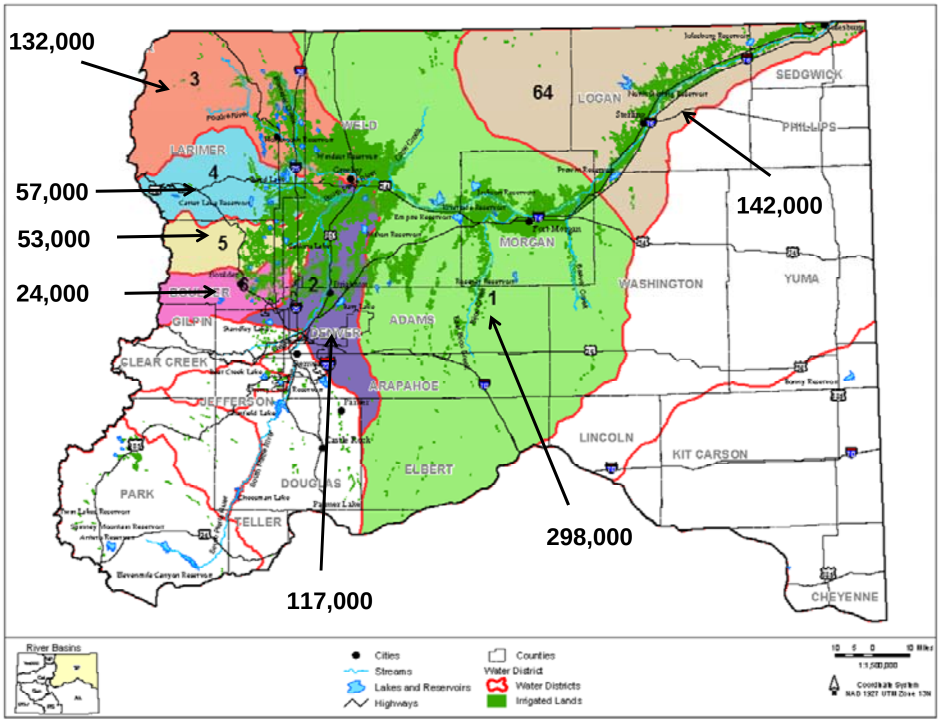


Figure 3-6
South Platte Irrigated Acres by Water District (2005)

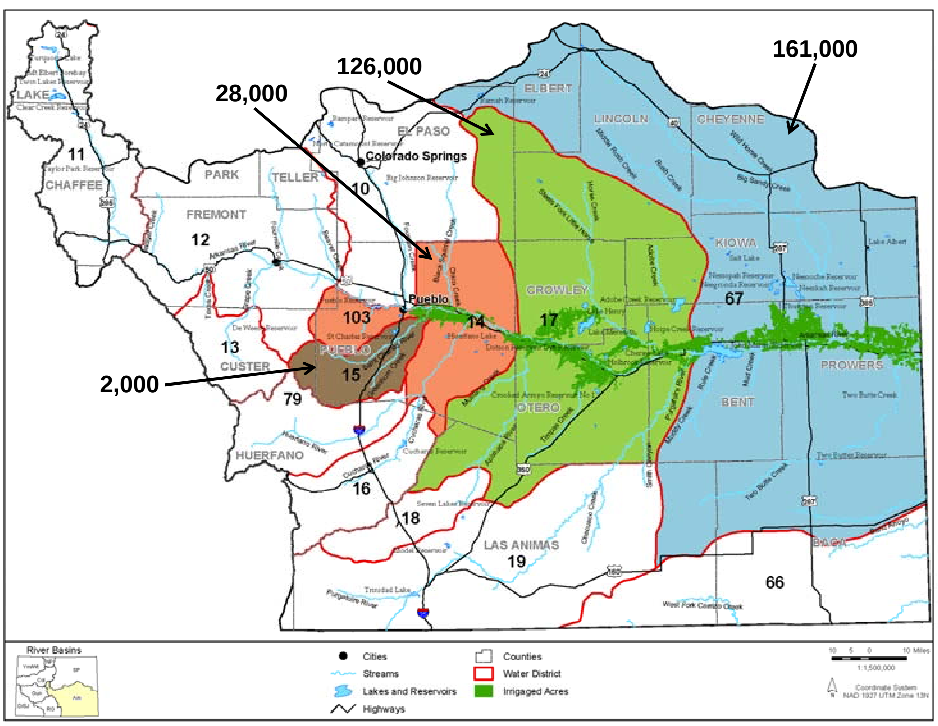


Figure 3-7
Lower Arkansas Irrigated Acres by Water District

3.11 Opportunities for Agricultural Efficiency Improvements

The evaluation of the potential for agricultural efficiency measures to address future water supply needs was originally assigned to the Water Conservation and Efficiency TRT. Due to lack of participation, this section was prepared without the input of the TRT and will now serve as an opportunity for statewide dialogue.

3.11.1 Agricultural Efficiency Measures

Agricultural conservation or agricultural efficiency implementation as a means to create new water supply must be carefully evaluated because the issue is very complex. These measures may involve increasing the efficiency of water used for irrigation, so that more of the water that is diverted from streams and rivers or pumped from groundwater meets the direct CU needs for agricultural crops. Typical agricultural efficiency measures include canal lining or the conversion of irrigation practices and technology from flood irrigation to gated pipe or the installation of sprinklers or drip irrigation systems. These measures are designed to reduce the delivery losses that occur as water is diverted from a stream or as groundwater is pumped and delivered to the farm or ranch or as it is applied to the crops. The opportunity to produce a water supply for additional or new uses in response to these efficiency measures are limited to situations where so called "losses" are not contributing to another users water rights and/or compact obligations. Consequently, the opportunities to produce water supply are extremely limited. Nevertheless, there are select locations and situations that should be explored.

The benefits of agricultural efficiency measures include:

- No new diversions are required from rivers or streams.
- Permits are not required for implementation.
- Increased ability to deliver water to the crops can stretch existing supplies. This benefit would apply to water short irrigators that would benefit if additional water could be delivered to their crops. If the irrigator that has water short crops typically experienced 50 percent losses, reducing those losses will result in an increased delivery to the water short crops and a resulting increase in crop CU and decrease in return flows.
- Agricultural efficiency may reduce non-crop CU. Some of the CUs and losses may be due to tailwater from irrigation ponding at the end of fields perhaps creating intermittent wetlands and evaporating, rather than returning as surface or groundwater return flows.
- There may be potential water quality benefits. Canal seepage and/or flood or furrow irrigation may result in the leaching of minerals from the soils that result in impacts to the water quality of the return flows. Lining canals or the installing sprinklers may reduce the leaching of these minerals. This must be examined on a site-specific basis, as some irrigated fields may require periodic flushing of salts and minerals that accumulate in the soils in order to remain productive. The benefits of these improvements accrue to many, and programs like the Colorado River Salinity Control Program exist to encourage these types of improvements.

There are a number of potential issues and conflicts that must be evaluated for the potential implementation of agricultural efficiency measures.

- Historical agricultural return flows are a vital part of the flows in all basins and downstream surface water diverters and downstream states have relied on these return flows.
- These return flows, in addition to satisfying downstream water rights, also create delayed flows that can have instream and riparian environmental benefits and maintain aquifers for domestic and irrigation wells.
- Typically, any water that is saved by efficiency measures such as canal lining or the conversion of irrigation practices and technology from flooding

to gated pipe, center pivot circle, and center pivot with corner can only be used on lands for which the appropriation was originally made. Selling or delivering "saved" water to other users would constitute an improper expansion of use. In addition, the Arkansas River Compact contains specific protections against these practices.

The above considerations assume the existing water rights system (laws, rules, etc.) does not change. It may not be likely but not impossible that some parts of the system could be modified to a small extent if the potential savings is significant.

The CWCB conducted an in-depth analysis of the issues related to water salvage in Colorado in the document "An Analysis of Water Salvage Issues in Colorado" that was adopted and approved for transmittal to the Colorado General Assembly on January 22, 1992 pursuant to HB 91-1154. This document is on the CWCB website.

3.11.2 Technical Subcommittee Questions

The following questions regarding agricultural efficiency were developed by the Conservation and Efficiency TRT as priorities to address during the TRT process.

1. What are the projected long-term savings from agricultural conservation and efficiency alternatives?

2. What are the issues with ability to pay for agricultural users?

3. What are the main institutional barriers associated with agricultural conservation besides cost?

4. Which agricultural efficiency measures are legal, but may have significant negative impacts to other water rights and the environment?

3.11.3 Screening Criteria for Evaluating Agricultural Efficiency Opportunities

The following screening criteria were developed by CWCB and CDM staff and presented to the TRT as proposed screening criteria. This screening exercise was not conducted due to lack of participation by subcommittee members, but it is proposed that future efforts should use the proposed screening criteria and approach to evaluate the potential for agricultural efficiency measures.

1. Compact obligations are would not be harmed if efficiencies were implemented in area. Determine which basins are eliminated or have limitations on the basis of compact obligations.

2. The reduction in return flows does not harm Colorado water rights. Select areas where reduction in return flows would not harm Colorado water rights. These are most likely going to be in water districts that are near the state line and do not have significant in-state water rights downstream or those downstream rights have other sources of supply and would not be injured from the potential efficiency improvements. South Platte, Gunnison, Colorado, Yampa, White and Animas are likely candidates.

3. Size of the system (e.g., 10,000 AFY diverted). Select systems that divert >10,000 AFY, using Decision Support Systems (DSS), and Hydrobase diversion records.

4. Areas that divert 4-5+ AF/acre at the headgate of the irrigation ditch system. The DSS could be used for those basins. In non-DSS basins, estimates of irrigated acres could be made from water commissioner records or other sources, in order to calculate AF/acre river headgate diversions.

5. Are return flows from inefficiencies supporting the environment (instream flows, wetlands, etc)? CWCB in stream flow rights,

RICDs and available environmental coverages could be used to determine if any critical areas are located downstream of return flows.

The following screening criteria may not be needed: **The overall irrigation system efficiency is less than 30 percent.** This screen is likely not needed, since any river headgate diversion >4.0 AF/acre will have an irrigation efficiency less than 30 percent and will be included in screening criteria #4.

Results of the screening exercise could be summarized in a table and maps. The purpose would be to identify areas with potential for further study. Other considerations would also need to be factored in the next phase of analysis. These would include issues such as which water rights might potentially benefit from the reallocation of the water, effects on streamflow basinwide from the reallocation, and examination of questions regarding ability to pay and institutional barriers.

3.12 Conclusions and Recommendations

3.12.1 Population Growth, Urbanization, and Issues Associated with Reliable Water Supply

Population growth, urbanization, and issues associated with reliable water supply availability are key factors that are leading to a reduction in irrigated farmland in Colorado. In addition there are significant financial, economic, and demographic factors (i.e., increasing average age of farmers and ranchers and fewer "young" people choosing it as a career) that are influencing the trend toward reduced farming and ranching in Colorado. Commodity prices, access to markets, fuel, equipment, and labor costs are a few examples of these factors. This report did not address these factors. It is essential to acknowledge that while one can examine and explore alternate methodologies to purchase and permanent transfer of water from agriculture and this may in turn assist in maintaining viable agricultural and ranching, unless these other factors are addressed the attractiveness and viability of farming and ranching overall will continue to be a challenge.

3.12.2 Future M&I Water

The M&I providers and users who need additional M&I water in the future have diverse needs including potential growth (rate and pattern), raw water infrastructure, and existing portfolio of water rights (i.e., water for base demand, water to replace non-renewable groundwater supplies, water for drought years, water for drought recovery, and water to replace interstate compact calls). For example, by 2030, water demand in Douglas and El Paso counties that are currently on non-renewable groundwater is projected to be near 100,000 AFY. Thus, there needs to be a number of alternative permanent agricultural transfer methods (interruptible supplies, fallowing, banks, etc.) available to match the irrigator's and users' needs. In addition, these alternatives must be flexible enough to allow variations to meet specific source and user situations. One size will not fit all.

3.12.3 Property Rights and/or Local Issues

Many subcommittee members expressed concern over how this process and involvement of the state might negatively affect the price of water, property rights, and/or local issues associated with water transfers. There are strong opinions on every side of the issue of water transfers; there are those that wish to retain their ability to sell water to the markets that provide the greatest returns; there are those that may not be part of the transfer and may wish to participate and share in the economic benefit; there are those that may not be part of the transfer that benefit (open space, views, wildlife habitat etc.) from the presence of the agricultural water user; and there are those that simply do not wish to see transfers. In addition to these opinions, the other key driver that influences how transfers are perceived and implemented relates to who retains ownership of the water (the agricultural user or the new end user) and what type of organizational/ institutional structure is "best" to ensure equity for those involved in the transfer and those affected by the transfer.

3.12.4 Economic and Social Impacts

Generally, in areas of the state where urbanization and transfer of water is occurring there is less concern over economic and social impacts as other industries and benefits accrue to the local community. In these areas the loss of open space and diverse landscapes can be a factor. In more rural areas with no significant development potential, when water is or may be transferred there is a deeper concern over the impact to the local economy and the long-term viability of the community. This can result in a division between the benefits that can accrue to the water rights holder versus potential impacts to the overall community.

3.12.5 Third-Party Impacts

The cost of third-party impacts from traditional agricultural transfers have not been, but should be, quantified so that the alternatives can be accurately compared.

3.12.6 Role of the State of Colorado

There may be a role for the state, through the CWCB for example, to "level the playing field" through the use of incentives to encourage M&I providers and users to use alternatives to traditional agricultural transfers in order to foster the maximum utilization of the state's waters and to ensure that other non-market values (open space, wildlife habitat) are retained.

The CWCB recently developed a grant program of up to $1.5 million for the Arkansas and South Platte Basins to help facilitate the evaluation of alternatives to traditional agricultural transfers. The grant(s) are available on a competitive basis and are aimed at helping advancing alternatives to traditional agricultural transfers.

3.13 Technical Roundtable Membership

The membership of the Alternatives to Permanent Agricultural Dry-Up TRT was based on an e-mail request to the original SWSI BRT members for volunteers and recommendations of other people that may be interested in this issue and/or had professional expertise in the area of agricultural water use and water transfers. Additional members were added in order to provide for broad geographic river basin and interest group representation. Table 3-14 provides the names of members that participated or volunteered to serve on the TRT. Due to travel and other commitments, some TRT members were unable to attend some or all of the meetings.

Table 3-14 Prioritize and Quantify Alternatives to Permanent Agricultural Dry-up TRT Membership

Member	Organization	Interest Category
Gary Barber	El Paso County Water Authority Arkansas River Basin	Local Government
Janet Bell	Jefferson County South Platte River Basin	Local Government
Cortney Brand	Colorado Springs Utilities Arkansas River Basin	Municipal Water Providers
Jim Broderick	Southeastern Colorado Water Conservancy District Arkansas River Basin	Water Conservancy and Conservation Districts
Marc Catlin	Uncompahgre Valley Water Users Assn. Gunnison River Basin	Water Conservancy and Conservation Districts
Tom Cech	Central Colorado Water Conservancy District South Platte River Basin	Water Conservancy and Conservation Districts
Steve Child	Rancher Colorado River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
Floyd Ciruli	Ciruli Associates Statewide	Municipal Water
Richard Connell	Colorado Farm Bureau Colorado River Basin	Agricultural, Ranching, Ditch and Reservoir Companies

Table 3-14 Prioritize and Quantify Alternatives to Permanent Agricultural Dry-up TRT Membership

Member	Organization	Interest Category
Carlyle Currier	Rancher Colorado River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
Kathleen Curry	Colorado House of Representatives Gunnison River Basin	Water Conservancy and Conservation Districts
Reed Dils	Former Rafting Company Owner Arkansas River Basin	Recreation and Related Organizations
Larry Dirks	Denver Water South Platte River Basin	Municipal Water Providers
Harold Evans	City of Greeley Water & Sewer Board South Platte River Basin	Local Government
Joe Frank	Lower South Platte Water Conservancy District South Platte River Basin	Water Conservancy and Conservation Districts
Steve Glazer	High Country Citizens Alliance Gunnison River Basin	Environmentalists and Related Organizations
Jim Hall	Colorado Division of Water Resources South Platte River Basin	Technical Advisor
Ed Harvey	Harvey Economics Statewide	Technical Advisor
Matt Heimerich	Crowley County Board of Commissioners Arkansas River Basin	Local Government
Dan Henrichs	Rocky Ford Highline Canal Arkansas River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
Frank Jaeger	Parker Water Supply District South Platte River Basin	Municipal Water Providers
Lynda James	Park County Land & Water Trust Fund South Platte River Basin	Environmentalists and Related Organizations
Bill Jerke	Weld County Government South Platte River Basin	Local Government
Gregg Johnson	La Plata Archuleta County Farm Bureau Dolores/San Juan/San Miguel River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
Melinda Kassen	Trout Unlimited Statewide	Environmentalists and Related Organizations
Doug Kemper	Colorado Water Congress formerly City of Aurora South Platte River Basin	Municipal Water Providers
Ken Knox	Division of Water Resources Statewide	Technical Advisor
Mark Koleber	City of Thornton South Platter River Basin	Municipal Water Providers
Frank Kugel	Colorado Division of Water Resources Gunnison River Basin	Technical Advisor
Dave Little	Denver Water South Platte River Basin	Municipal Water Providers
Steve Miller	CWCB Statewide	Technical Advisor
Manual Montoya	FRICO South Platte River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
Peter Nichols	Trout, Raley, Montano, Witwer & Freeman, P.C. Statewide	Technical Advisor
Greg Peterson	Gunnison County Stockgrowers Gunnison River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
Kelly Roesch	High Plains A&M Arkansas River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
Dave Sarton	Colorado Springs Chamber of Commerce Arkansas River Basin	Local Government
Donald Schwindt	CWCB Dolores/San Juan/San Miguel River Basin	Technical Advisor

Table 3-14 Prioritize and Quantify Alternatives to Permanent Agricultural Dry-up TRT Membership

Member	Organization	Interest Category
Jim Sharkoff	USDA Statewide	Agricultural, Ranching, Ditch and Reservoir Companies
Tom Simpson	City of Aurora South Platte River Basin	Municipal Water Providers
Albert Slap	The Nature Conservancy Statewide	Environmentalists and Related Organizations
Danny H. Smith	Colorado State University Statewide	Technical Advisor
Travis Smith	San Luis Valley Irrigation Dist. Rio Grande River Basin	Technical Advisor
Syd Snyder	San Juan Basin Farm Bureau Statewide	Agricultural, Ranching, Ditch and Reservoir Companies
Greg Ten Eyck	Leonard Rice Engineers Arkansas River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
Bill Trampe	Rancher Gunnison River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
Chris Treese	Colorado River Water Conservation District Colorado River Basin	Water Conservancy and Conservation Districts
Steve Vandiver	State Engineer's Office Rio Grande River Basin	Water Conservancy and Conservation Districts
Fred Walker	Weld County Farm Bureau South Platte River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
John Wiener	University of Colorado South Platte River Basin	Technical Advisor
Eric Wilkinson	CWCB Board Member South Platte River Basin	Technical Advisor
Brad Wind	NCWCD South Platte River Basin	Water Conservancy and Conservation Districts
Jay Winner	Lower Arkansas WCD Arkansas River Basin	Water Conservancy and Conservation Districts
Steve Witte	Division 2 Engineer Arkansas River Basin	Technical Advisor
Duane Woodard	Arkansas High Plains Arkansas River Basin	Agricultural, Ranching, Ditch and Reservoir Companies
Ray Wright	Former CWCB Board Member Rio Grande River Basin	Agricultural Water User

Table 3-3 Alternative to Permanent Agriculture Dry-Up Applicability – Technical Subcommittee

Proposed Water Use (Category)	Type of Water Need	Examples (i.e. gap areas or providers that have such needs)	Interruptible Supply Agreements		Long-term Rotating Fallowing Program		Water Banks		Reduced Agricultural Consumptive Use through Efficiency or Cropping While Maintaining Historic Return Flows		Purchase by End User with Leaseback under Defined Conditions	
			Applicability	Discussion	Applicability	Discussion	Applicability	Discussion	Applicability	Discussion	Applicability	Discussion
M&I	Domestic Well Augmentation	Headwaters counties in most basins where augmentation is needed to senior agricultural, instream flow, and recreational in channel diversions, and existing sources of augmentation are downstream of impacted stream reaches.	Low	Water is needed every year to replace ongoing depletions.	Medium	Water would be provided for M&I use in each year from different fallowed lands. Domestic well augmentation needs are relatively small and permanent dry-up and transfer may be more cost-effective.	Low	Water is needed every year to replace depletions. There is no guarantee water will be available every year.	High	Water would be provided for domestic well augmentation use in each year from reduced agricultural consumptive use.	Low	Water is needed every year to replace ongoing depletions. Water could be available for leaseback in above average water supply conditions.
M&I	Dry Year Yield	Many Providers	High	Ag rights have adequate dry year yield and can be used for compact call.	Low	Water is only needed in dry years, so fallowing would only be needed for those years. Ag rights and have adequate dry year yield and can be used for compact call.	Medium	Market prices may result in supplies offered to water bank, but there is no guarantee water will be available. Ag rights have adequate dry year yield and can be used for compact call.	Low	Water is only needed in dry years. Program costs may be too expensive to implement only for those years. Ag rights must be senior in priority and have adequate dry year yield.	High	Ag rights must be senior in priority and have adequate dry year yield. Water could be leased back to agricultural users in average to above average water supply conditions.
M&I	Additional Annual Base Supply	Northglenn, Adams, northern El Paso and southern Weld counties, South Metro area (gap).	Low	Yield is needed every year.	High	Water would be provided for M&I use in each year from different fallowed lands. Crops must be suitable for rotating fallowing.	Low	Water is needed every year to replace depletions. There is no guarantee water will be available every year.	High	Water would be provided for M&I use in each year from reduced agricultural consumptive use.	Low	Yield is needed every year. Water might be available for lease back in above average water supply conditions.
M&I	Drought Recovery	Water providers having storage and junior water rights.	High	Ag rights can be a combination of seniority. Ag lands will be interrupted until municipal system has recovered to pre-drought storage levels.	Medium	Water is needed following a drought so a permanent fallowing program would only be needed following a drought and interruptible supply agreements may be more cost-effective.	Medium	Market prices may result in supplies offered to water bank, but there is no guarantee water will be available.	Low	Water is needed following a drought so program costs may be too expensive to implement only for those years. Interruptible supply agreements may be more cost-effective.	Low	Water is needed following a drought so program costs may be too expensive to implement only for those years. Interruptible supply agreements may be more cost-effective.
M&I	Renewable Supply for Denver Basin Users (with groundwater providing dry year firming)	South Metro and northern El Paso County (gap).	Medium	M&I groundwater users can use existing groundwater resources in dry years. Interrupted ag supplies would be used to meet average and wet year M&I demands, with some opportunity for groundwater recharge in wet years.	High	M&I groundwater users can use existing groundwater resources in every year or in dry years as a supplemental supply. Goal is to reduce overall dependence on non-renewable supplies.	Low	Water is needed every year to replace depletions. There is no guarantee water will be available every year.	High	M&I groundwater users can use existing groundwater resources in every year or in dry years as a supplemental supply. Goal is to reduce overall dependence on non-renewable supplies.	Medium	M&I groundwater users can reduce reliance on existing groundwater resources. Transferred water could be used to meet dry, average or wet year M&I demands, with leaseback terms to be negotiated. Leaseback could reduce opportunities for groundwater recharge in above average water supply conditions.
Environmental	Dry Year Flows	All streams critically impacted by low flows during dry years.	High	Ag rights must be senior in priority and have adequate dry year yield. Historic return flow quantity, rate of flow, timing and temperature may be concerns.	Low	Ag rights must be senior in priority and have adequate dry year yield. Flows are need only in dry years. Historic return flow quantity, rate of flow, timing and temperature may be concerns.	Medium	Market prices may result in supplies offered to water bank, but there is no guarantee water will be available. Ag rights must be senior in priority and have adequate dry year yield. Flows are need only in dry years. Historic return flow quantity, rate of flow, timing and temperature may be concerns.	Low	Ag rights must be senior in priority and have adequate dry year yield. Flows are need only in dry years. Historic return flow quantity, rate of flow, timing and temperature may be concerns.	High	Ag rights must be senior in priority and have adequate dry year yield. Historic return flow quantity, rate of flow, timing and temperature may be concerns. Water could be leased in average to above average streamflow conditions.
Environmental	Supplement Base Flows (in most years)	Streams impacted by water development activities.	Low	Yield is needed every year.	High	Flows can be provided every year, but agricultural rights must be senior in priority and have adequate dry year yield.	Low	Water is needed every year. There is no guarantee water will be available every year. Historic return flow quantity, rate of flow, timing and temperature may be concerns.	High	Flows can be provided every year, but agricultural rights must be senior in priority and have adequate dry year yield.	Low	Yield is needed every year.

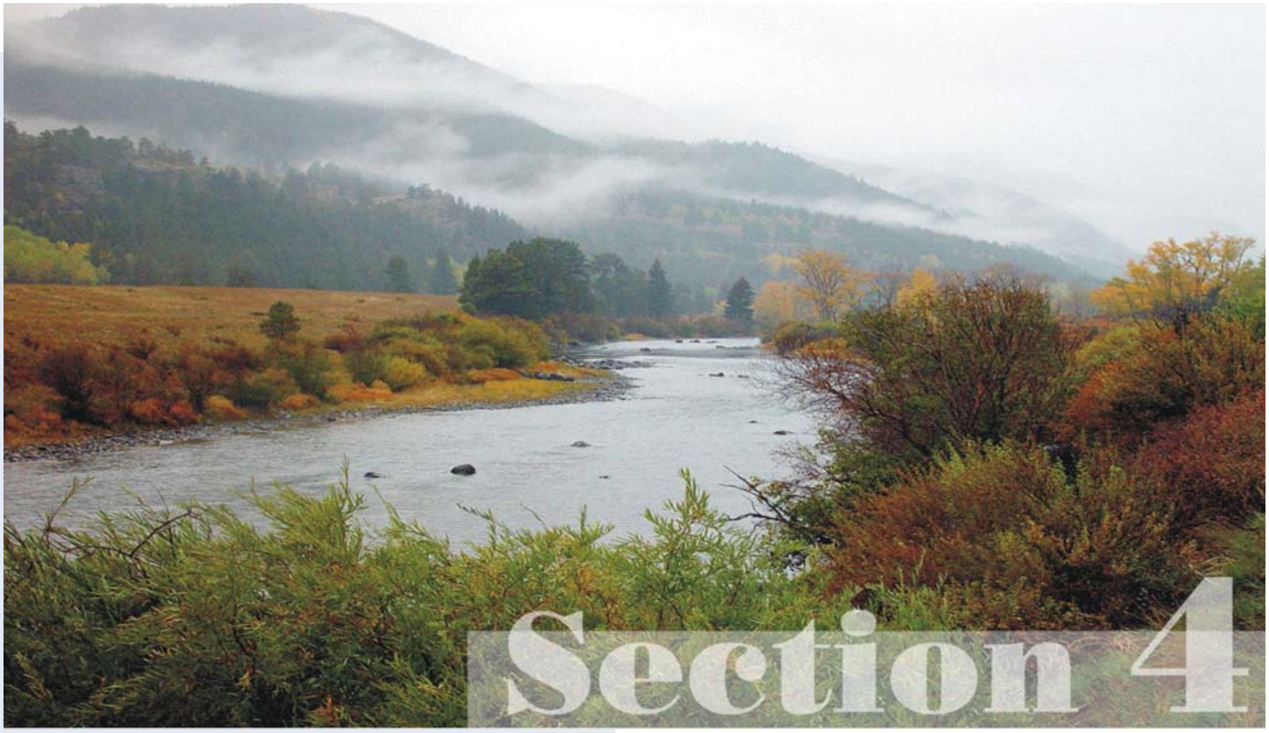
Table 3-4 Alternatives to Agriculture Dry-Up Implementability – Legal Subcommittee

Question	Type of Transfer				
	Interruptible Supply Agreements	Long-term Rotating Fallowing Program	Water Banks	Reduced Agricultural Consumptive Use through Efficiency or Cropping While Maintaining Historic Return Flows	Purchase by End User with Leaseback under Defined Conditions
1) Are legislative/ regulatory changes needed to implement the proposed program(s)?	CRS 37-92-309 allows the State Engineer to approve and administer interruptible transfers when there is to be a temporary change in diversion and location or type of use. Otherwise a change in water right under the water court is needed. Clarification of consumptive use issues (Entz bill) needs to be researched. Ditch company bylaws need to be changed.	No consensus.	During the 2003 legislative session, CRS 37-80.5-101 to 105 were amended to authorize the State Engineer to create water banks within each water division, and to adopt rules governing their operation. The aim of this legislation is to simplify the process for temporary transfers of water rights by eliminating the adjudication proceeding required for a permanent change of water rights. Water banks are repealed July 1, 2007. To make water banks more attractive markets need to be flexible and statutory and/or regulatory changes may be needed, including addressing anti-speculation.	May not be allowable under current statute. This is a new approach, and many details need to be worked out before this program may be established (e.g. who is to administer and monitor programs). Administrative process appears to be more difficult. Legality and ability to administrate may be problematic.	No.
2) What is the water court process related to program(s) approach and implementation?	Long-term Interruptible Supply Agreements not covered under existing statute would require water court approval. End user may need to be clearly identified to avoid anti-speculation issue.	Permanent fallowing agreements would require a water court change case similar to a traditional ag transfer.	CRS 37-80.5-101 to 105 provides that the rules shall allow for the "lease, exchange, or loan of stored water within a water division," including a transfer to the CWCB for instream flow purposes, without the need to submit to any adjudication proceeding. Not withstanding the fact that the lease, exchange, or load is not adjudicated, such arrangement will still be subject to administration by the Division Engineer, within the priority system, to prevent material injury to other water users. Under a more flexible water bank program, new legislation would be required and water court procedures delineated.		Same as a standard buy and dry transfer, but the issues with dry-up must be addressed. When the end user is using the water for the new use, consumptive use and return flows are handled through the change decree. If the water is used by the original agricultural user, then consumptive use and return flows should be similar to historic.
3) Should the programs be administered by the end user, governmental agency, or by the agricultural water rights owners or ditch and reservoir companies?	For short term agreements, the end user, water right owners, or ditch/reservoir companies could administer pending on the terms of the agreement signed by all involved parties.	A multi-ditch fallowing program would likely require administration by some agreed upon organization. This program could involve a large group of participants for a substantial period of time. An independent agency is needed to collect and distribute payments and monitor operations. All involved parties would need to reach consensus on the administration and operations of the program upon signing of the program agreement. A single ditch fallowing program could be administered by the ditch company and the end user.	Current statute limits water banks to water conservation or water conservancy districts, except in the Arkansas, where State Engineer can create. If new legislation allowed more flexible water banks, the end user and ditch/reservoir companies would be most appropriate for the program.	An independent governmental agency may be appropriate for long-term programs with a large number of participants. The end user or ditch/reservoir companies may be appropriate for smaller programs of short duration. Independent verification may be helpful.	The end user or ditch/reservoir companies would be most appropriate for these programs.
4) Can the program(s) be successful if the agricultural user can sell or otherwise dispose of the water so that it is not available to the end user?	In order for this program to provide long-term water supply alternatives for an end user, the end user needs to be guaranteed that water will be available through the term of the agreement. Otherwise, the agricultural user could sell the water rights and the end user would need to find replacement sources.	In order for this program to be successful, the end user needs to be guaranteed that water will be available through the term of the agreement. Otherwise, the agricultural user could sell the water rights and the end user would need to find replacement sources. A right of first refusal could provide some assurance for the end user.	In order for this program to provide a reasonable water supply for an end user, the water needs to be available for the term of the agreement. Water banks are generally viewed "as available" short-term arrangements.	This alternative may require ownership by the end user due to concerns over administration.	N/A, since the end user owns the water rights.
5) What program conditions are needed to ensure that private property rights are not impaired?	Approval by the State Engineer would not satisfy many potentially impacted parties that would want the option to participate in a water court proceeding. The current statute limits agreements to 3 out of 10 years.	Potentially injured parties can participate in the water court change case.	For the Arkansas River Pilot Water Bank, the bank operator in consultation with the Division Engineer, reviews a set of required information before granting eligibility to the seller to bank water. Prior to the transfer, notification is sent to those that prescribe to the Water Bank Notification List and on the bank's website. A 30-day comment period is available where injury claims may be submitted to the Division or State Engineer prior to approval of the transfer. Similar conditions may be appropriate for other types of water banks.	Potentially injured parties can participate in the water court change case. Future program administration will be an issue to ensure that decree conditions are followed.	Potentially injured parties can participate in the water court change case.

Table 3-5 Alternatives to Permanent Agricultural Dry-Up Financial Subcommittee

Types of Costs	Timing	Type of Transfer: Interruptible Supply Agreements	Long-term Rotating Fallowing Program	Water Banks*	Reduced Agricultural Consumptive Use through Efficiency or Cropping While Maintaining Historic Return Flows	Purchase by End User with Leaseback under Defined Conditions
Administrative	Capital	Develop accounting procedures and land monumenting	Develop accounting procedures and land monumenting	Higher level of upfront costs relative to other non permanent water transfers. Operating costs may be chargeable to users.	Develop accounting procedures and install monitoring equipment (e.g., lysimeters)	Develop accounting procedures. Costs should not be significantly greater than "buy and dry"
	O&M	Annual operating costs include accounting, management, monitoring of operations, and ditch assessment fee	Annual operating costs include accounting, management, monitoring of operations, and ditch assessment fee	Administration of website or trading forum. Operating costs may be chargeable	Accounting and monitoring	Annual operating costs include accounting, management, monitoring of operations, and ditch assessment fee
	Frequency	As needed, approximately 1 out of every 3 years	Every year	Minimal transaction costs once set up	Every year, or as needed	As water is needed for new end user, approximately 1 out of every 2-4 years
Legal	Capital	Adjudication of transferable quantities, application(s) to water court, negotiation of contract terms, negotiation of additional agreements (e.g. third party agreements)	Adjudication of transferable quantities, application(s) to water court, negotiation of contract terms, negotiation of additional agreements (e.g. third party agreements)	Establishment and pre-qualification or determination of transferable quantities are up-front costs; operator may bear initial costs. Where prior determinations are found acceptable (e.g., Arkansas Pilot Project), costs greatly reduced.	No legal authority required to change agricultural practices, but legal authority required to transfer water; this change may "supply" water for the forms of transfer considered.	Adjudication of transferable quantities, application(s) to water court, negotiation of contract terms, negotiation of additional agreements (e.g., third party agreements)
	O&M	Minimal	Minimal	Minimal	Minimal	Minimal
Future Infrastructure	Capital	Will vary given specific transfer condition of agreement and infrastructure needed. Use the form of transfer to add water supply to existing infrastructure as much as possible. Transferor may have costs to improve ditch or other facilities to operate; transferee may have transportation costs. There may also be infrastructure permitting (e.g., EIS) and engineering costs.	Will vary given specific transfer condition of agreement and infrastructure needed. Transferor infrastructural costs may include improvements and additional capital facilities; transferee may need infrastructure similar to that for "buy-and-dry." There may also be infrastructure permitting (e.g., EIS) and engineering costs.	Will vary given specific transfer condition of agreement and infrastructure needed. Where used for short-term transfers there should be minimal infrastructural costs though some ditches may decide to invest in adjustable headgates to allow shareholder choice of participation.	Costs of infrastructural improvement are function of change of technology or irrigation facility, and may include in some cases dedication of some flow in order to maintain return flow obligations where canal or ditch modification reduces seepage or conveyance loss.	Will vary given specific transfer condition of agreement and infrastructure needed. Frequency of leaseback is negotiable. Infrastructural costs or savings will vary with intended operation and duration of agreement to lease back as well as place specifics of the case. Costs should not be different than "buy and dry."
	O&M	Could vary (see above)	Could vary (see above)	Could vary (see above)	Could vary (see above)	Could vary (see above)
Engineering (transit loss calculations, conveyance, etc)	Capital	Conventional analyses required for all forms of transfer except water bank. These include water court application analysis of consumptive use and return flow obligations. Rationale of assuring "no injury" applies.	Conventional analyses required for all forms of transfer except water bank. Rationale of assuring "no injury" applies.	Significant savings if prior determinations are acceptable. No injury applies but short-term and reversible nature of transfer reduces need for full determination and allows delegation to state engineer.	May be deferred or not needed if there is no transfer; but needed if water use is to be moved away from ditch.	Conventional analyses required for all forms of transfer except water bank. Rationale of assuring "no injury" applies.
	O&M	Infrastructure costs - will vary given existing infrastructure	Infrastructure costs - will vary given existing infrastructure	Minimal	Infrastructure costs - will vary given existing infrastructure	Infrastructure costs - will vary given existing infrastructure
Maintenance of existing system	Capital	Distribution of costs is negotiable between the parties; transferor facilities will require on-going maintenance but not necessarily new or additional; case-specific. Maintenance costs include ditch maintenance, infrastructure (e.g., flumes, headgates,) erosion and weed control on ditch systems.	Distribution of costs is negotiable between the parties; transferor facilities will require on-going maintenance, but not necessarily new or additional; case-specific. Maintenance costs include ditch maintenance, infrastructure (e.g., flumes, headgates), erosion and weed control on ditch systems.	Use of water bank may change ditch management needs. Maintenance costs include ditch maintenance, infrastructure (e.g., flumes, headgates), erosion and weed control on ditch systems.	Facility and technology specific conditions apply; e.g., subsurface drip irrigation requires different maintenance from sprinklers. Distribution of costs may be negotiated by parties.	Little reason to maintain unless long-duration of guaranteed lease-back. If long-term, same as interruptible supply.
	O&M	Will vary given existing infrastructure	Will vary given existing infrastructure	Minimal - will vary	Will vary given existing infrastructure	Will vary given existing infrastructure
Resource costs to purchase a water lease	Capital	Water leasing water costs will vary given scale of transfer, market value, and terms of agreement. Parties may negotiate for annual payment or separate payment for use of water only, or both.	Parties may negotiate; may agree on use of water payment to farm suspending use, or annual payment to all participants, or both, and companies may be also compensated separately or not.	Spot market and short-term uses of this form of transfer allow price paid to float and be negotiated on "spot" basis. Note: many kinds of water banks use different arrangements. See references on different forms.	Not applicable until transfer contemplated.	Water leasing water costs will vary. The appreciation can be negotiated. Highly variable; parties may negotiate; may make supply back a part of acquisition cost.
	O&M	Minimal	Minimal	Minimal	Minimal	Minimal

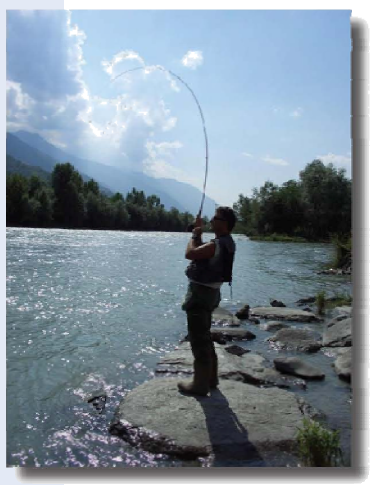
* Costs associated with water banks will be significantly different relative to the other transfers.



Delineating and Prioritizing Colorado's Environmental and Recreational Resources and Needs

4.1 Introduction

This section of the Statewide Water Supply Initiative (SWSI) Phase 2 Report summarizes the results of the technical roundtable (TRT) that was formed to further address environmental and recreational water uses and needs. In 2003 the Colorado Water Conservation Board (CWCB) began implementation of SWSI. The initiative examined current and future water use and needs in Colorado and established the goal of providing an adequate water supply for our citizens and the environment as a principle challenge. In 2004, the CWCB developed the initial report, which can be viewed at http://www.cwcb.state.co.us/iwmd/general.htm.



Statewide Water Supply Initiative

The 2004 SWSI Report identified the importance of environmental and recreational needs in two of the study's key findings:

Significant increases in Colorado's population – together with agricultural water needs and an increased focus on recreational and environmental uses – will intensify the competition for water.

Environmental and recreational uses of water are expected to increase with population growth. These uses help support Colorado's tourism industry, provide recreational and environmental benefits to our citizens, and are an important industry in many parts of the state. Without a mechanism to fund environmental and recreational enhancement beyond project mitigation measures required by law, conflicts among municipal and industrial, agricultural, recreational, and environmental users could intensify.

The initial SWSI Report identified important information regarding environmental and recreational resources and methodologies used to delineate and quantify needs. However, the CWCB and many involved in the SWSI process felt that additional work was needed to further prioritize and quantify our environmental and recreational needs.

CWCB, recognizing the importance of furthering the understanding of environmental and recreational values of Colorado's water resources, established the Environment and Recreation TRT (formally the Prioritize and Quantify Environment and Recreation Needs TRT). The Environment and Recreation TRT developed a broad mission statement (Section 4.2.1) and a series of questions (Section 4.2.2) to further our understanding of environmental and recreational needs statewide. Subcommittees were then formed to address the series of questions.

The subcommittees and full Environment and Recreation TRT worked diligently to address its key questions and mission statement. During this process, the members recognized the enormity of the challenges associated with describing and addressing Colorado's environmental and recreational water needs. The TRT made significant strides in identifying statewide environmental and recreational resources, which are referred to as "attributes" in this report. These resources or attributes have been delineated and summarized in geographic information system (GIS) coverages and are included in this report and are available as a DVD in Appendix D. The TRT did not make as much progress as it had hoped in prioritizing and quantifying environmental and recreational needs associated with the identified attributes. The results of the Environment and Recreation TRT should be considered in this context. Biological systems and recreational values are complex and dynamic and will likely change over time. In addition, the geographic scope of the effort and emerging scientific views and social and economic factors further complicate the task of prioritizing and quantifying our environmental and recreational needs. The recommendations and conclusions of the section will further explain that this TRT's efforts are one step in a continuing process to address environmental and recreational needs statewide.

The remainder of this section of the report describes the activities and outcomes of the Environment and Recreation TRT. Detail on specific TRT efforts can be found in the following subsections:

- Section 4.2 Environment and Recreation Roundtable—describes the mission and objectives of the TRT, the questions the TRT focused on, and the subcommittees formed to address the questions.
- Section 4.3 Technical Subcommittee—describes the products that were developed by the technical subcommittee.
- Section 4.4 Financial Subcommittee—describes the products that were developed by the financial subcommittee.
- Section 4.5 Legal/Water Rights/ Institutional/ Political Subcommittee—describes the products that were developed by the legal/water rights/ institutional/political subcommittee.

- Section 4.6 Overview of Select Environmental and Recreational Projects—describes examples of select case studies and options to address environment and recreation projects brought up by all three subcommittees.
- Section 4.7 Conclusions—describes the overall conclusions of the Environment and Recreation TRT efforts.
- Section 4.8 Recommendations—provides recommendations based on outcomes of the Environment and Recreation TRT.
- Section 4.9 Environment and Recreation Technical Roundtable Membership—provides a list of members who volunteered to participate in this TRT.

4.2 Environment and Recreation Roundtable

4.2.1 Mission and Objectives

The following draft mission statement was presented at the first Environment and Recreation TRT meeting:

> Identify opportunities in each of Colorado's eight major river basins to address environment and recreation priorities

This mission statement was modified during the first meeting to include the following:

> Sustain and optimize water related recreational and environmental components of Colorado's economy and values

> Identify generally accepted approaches to quantify environmental and recreational water needs

> Identify and utilize existing and newly created physical, institutional, legal, and financial mechanisms designed to serve those needs and values

Additionally, during the first meeting objectives were identified, but were never formally adopted. However, they were incorporated into the final questions to be addressed by the Environment and Recreation TRT.

4.2.2 Environment and Recreation TRT Meetings

Three Environment and Recreation TRT meetings were held to discuss the items shown in Figure 4-1. Additionally, an interim meeting was held between the second and third meetings to discuss potential methods of identifying and prioritizing environment and recreation needs. Subcommittees were also formed and met numerous times over the last 2 years.

TRT 1

- Presentation of an initial white paper that summarized information from SWSI and other relevant sources.
- Development of the TRT Mission Statement.
- Discussion of objectives.
- Discussion of key issues raised in initial white paper and selection of questions to be addressed by TRT.
- Establishment of subcommittees to address final questions.

TRT 2

- Presentation of an overview to the approach of addressing questions.
- Discussion of approaches to questions and TRT schedule.

TRT 3

- Review of white paper report schedule and interaction with SWSI TRT that was formed to address the gap between current and future municipal and agricultural water needs.
- Environmental and recreational resource/attribute mapping and data quality objectives.
- Discussion of case studies.
- Environmental and recreational project identification.
- Discussion of final work products and schedule.

Figure 4-1
Environment and Recreation TRT - Meeting Discussion Topics

At the first meeting, the following questions were determined as priorities for the Environment and Recreation TRT to address throughout the process.

Technical

1. What are the examples of projects (or programs) that benefit multiple users that could serve as a model for the state?

2. Can we develop geographic coverages of environment and recreation attributes that would help basins prioritize key river and wetland resources?

3. How can Conserve, Protect, and Restore priorities be implemented and integrated into a prioritization process and how might that process interface with CWCB's Instream Flow (ISF) Program?

Financial

1. What are sources of funding and payment for projects that enhance environment and recreation?

Legal/Water Rights/Institutional/Political

1. Can incentives be developed for entities to donate their water rights for instream or recreational uses?

   — What are other legal changes that need to occur to protect water-related environment and recreational uses?

   — What incentives can be developed to encourage entities to donate their water rights?

2. How can an acceptable balance be achieved between competition for the same sources of water with existing uses such as agricultural and municipal and industrial (M&I)?

3. Can a prioritization scheme be developed where there is consideration of environment and recreation needs, M&I needs, and agricultural needs?

As the TRT began to look at approaches to addressing these complex questions, a diverse set of views and opinions were expressed. TRT members recognized the value of answering the questions but also realized that in some cases it was difficult to obtain consensus on the approach and/or there was a low probability of obtaining a definitive answer. Consequently the TRT chose to focus on Technical Questions 1-3, Financial Question 1, and for the Legal/Water Rights/ Institutional/Political Question concluded that they would like to primarily focus on the legal mechanisms and tools that can be used for environmental and recreational flow needs and summarized collaborative case studies.

Comments on the initial draft report by TRT members can be found in Appendix C. Several TRT members raised critiques of the report regarding the tenure and perceived conflict they felt was being portrayed between consumptive uses of water and environmental and recreational uses of water. The four questions that the TRT choose not to address hits at the heart of this conflict. Potential conflicts do appear to exist and fully addressing quantification of environmental and recreational uses of water will require resolution of those issues raised by these questions.

Formation of Subcommittees

The TRT formed subcommittees to address the questions chosen by the TRT. Figure 4-2 shows the subcommittee members.

Technical	
Tom Iseman (Chair)	Lynda James
Jay Skinner (Chair)	Don Kennedy
Peter Butler	Dan Merriman
Steve Craig	SeEtta Moss
Kristine Crandall	Karen Shirley
Jeff Crane	Patrick Tooley
Todd Doherty	Rob White
Taylor Hawes	Lane Wyatt

Financial	
Steve Harris (Chair)	Jeff Crane
Jeff Baessler	Reed Dills
Bill Baum	Chuck Wanner
Peter Butler	John Wiener

Legal/Water Rights/Institutional/Political	
Taylor Hawes (Chair)	Ted Kowalski
Mark Pifher (Chair)	Ken Neubecker
Linda Bassi	Rick Sackbauer
Bill Baum	Karen Shirley
Barbara Biggs	Albert Slap
Travis Bray	Patrick Tooley
Jack Gyers	Chuck Wanner
Steve Glazer	Patrick Wells
Dave Graf	Lane Wyatt
Steve Harris	

Figure 4-2
Subcommittee Members

4.3 Technical Subcommittee

4.3.1 Focus of Subcommittee

The following technical questions were addressed by the Technical Subcommittee:

1. What are examples of projects (or programs) that benefit multiple users that could serve as a model for the state?
2. Can we develop geographic coverages of environment and recreation attributes that would help basins prioritize key river and wetland resources?
3. How can Conserve, Protect, Restore priorities be implemented and integrated into a prioritization process and how might that process interface with the ISF program?

Efforts to address the three questions are discussed in the following subsections, respectively:

4.3.2 Geographic Coverages

To address the second question, the technical subcommittee decided that mapping the distribution of select environment and recreation "attributes" was a key tool to begin identifying priority areas. Table 4-1 lists the GIS coverages for the attributes developed by the technical subcommittee. These coverages are shown as Figures 4-3 through 4-28 at the end of this section. A description of the types of coverages and the method for generating them can be found in the following subsections. Each of these coverages was chosen for its potential to allow decisionmakers to determine areas of priority.

- Section 4.6 Overview of Select Environmental and Recreational Projects—describes examples of select case studies and options to address environment and recreation projects brought up by all three subcommittees.
- Section 4.3.2 Geographic Coverages—describes the geographic coverages that could be used to help prioritize environment and recreation areas.
- Section 4.3.3 Prioritization Process—describes the identification, prioritization, and quantification process for environment and recreation needs.

Table 4-1 Geographical Coverages

CWCB Instream Flow		
CWCB ISF Water Rights where water availability may have had role in appropriation	CWCB Natural Lake Level Water Rights (updated from SWSI 1)	CWCB ISF Water Rights (updated information from SWSI 1)
Environmental		
Audubon Important Bird Areas	Water Quality Control Division • Monitoring and Evaluation List – Aquatic Life Use – Sediment • 303(d) List – Aquatic Life Use – Sediment	Colorado Natural Heritage Program • Rare Riparian Wetland Vascular Plants • Significant Riparian/Wetland Communities
Colorado Division of Wildlife (CDOW) • Boreal Toad Critical Habitat (updated information from SWSI 1) • Federal Candidate Species – Arkansas Darter (updated information from SWSI 1) • Greenback Cutthroat Trout Federally Listed Critical Habitat (updated information from SWSI 1) • Colorado Pikeminnow Distribution (updated information from SWSI 1)	• Bonytail Chub Distribution (updated information from SWSI 1) • Flannelmouth Sucker Distribution • Colorado River Cutthroat Trout Distribution • Razorback Sucker Distribution (updated information from SWSI 1) • Humpback Chub Distribution (updated information from SWSI 1)	• Greenback Cutthroat Trout Distribution (updated information from SWSI 1) • Bluehead Sucker Distribution • Rio Grande Cutthroat Trout Distribution • Arkansas Darter Distribution (updated information from SWSI 1) • Roundtail Chub Distribution
Recreation		
SWSI 1 Coverages • Gold Medal Trout Streams • Gold Medal Trout Lakes	Southwest Paddler Kayak reaches by basin	American Whitewater Rafting Reaches by basin (updated information from SWSI 1)
Recreational In-Channel Diversions (RICDs)		

Additionally, these coverages, associated metadata, and a description of how to use ArcReader for reviewing the GIS data are included in Appendix D. Each GIS coverage in the Environment and Recreation TRT can be viewed and queried with ArcReader, which is interactive, and specific information can be viewed by technical and Basin Roundtable (BRT) members to determine watershed management priorities. For example the "ISF Water Rights where Water Availability may have had a Role in Appropriation" coverage could be overlaid on the "Flannelmouth Sucker Distribution" coverage. If there are areas where there is comparability between the two data layers, then it may indicate an area of priority for investigating ISF or habitat considerations. The following sections describe the various GIS coverages and methodologies.

CWCB Instream Flow Coverages

CWCB, acting through the Stream and Lake Protection Section, has exclusive statutory authority to appropriate water to preserve the natural environment to a reasonable degree and acquire water rights through acquisition to improve the natural environment. The Stream and Lake Protection Section manages a database that contains information on all ISF and natural lake level appropriations and proposed appropriations, which are held by or that are being evaluated for appropriation by the CWCB. This database was used to prepare three coverages:

- A map of the approximately 8,500 miles of streams that are part of the ISF Program (for an example see http://cwcb.state.co.us/Streamandlake/Images/StatewideISFmap.jpg) (Figure 4-3).
- A map of CWCB's natural lake levels water rights (Figure 4-4).
- A map showing ISFs where water availability may have had a role in the appropriation (Figure 4-5).

The first two coverages were prepared by simply querying the database for streams and lakes that currently have ISF and lake level water rights and then mapping each waterbody. The methodology for creating the third coverage was more complex and is discussed below.

Role of Water Availability in Appropriation

Members of the Environment and Recreation TRT thought it might be useful to identify stream segments that have decreed instream water rights where water availability may have played a role in the quantity of water that was appropriated. To gain insight on this, the database was searched to identify stream reaches that had the following data qualifiers:

1. ISF appropriations that have three or more flow periods.

2. ISF appropriations that have a downstream terminus at a headgate.

Stream Reaches with Multiple Flow Periods

For all ISF appropriations, CWCB is required to determine:

- That there is a natural environment to preserve.
- That water is physically available for the Board to appropriate.
- That the natural environment can exist without material injury to existing water rights.

Typically, most ISF recommendations consist of two parts—a winter and summer flow. When determining water availability, staff occasionally find periods of the year where the recommended flows are not present. In these cases, staff will often recommend an additional, reduced flow period to better reflect the natural hydrologic conditions of the stream. For instance:

Happy Creek	ISF Amount (cfs)	Dates
	6.00	Apr 1 to Jun 14
	4.00	Jun 15 to Oct 31
	2.25	Nov 1 to Mar 31

Source: CWCB http://cwcb.state.co.us/

In this example, the summer flow recommendation of 6 cubic feet per second (cfs) from April 1 to October 31 reduced to 4 cfs from June 15 to October 31 based on water availability. ISF appropriations with three or more flow periods will help to identify the streams where water availability was limited during some periods of the year. These streams could then be candidates for additional strategies such as the acquisition or donation of senior water rights for ISF purposes. It should be noted that the modification of flow recommendations may not be due to water diversions, but may result from natural stream conditions. Consequently, the information from the database should be viewed as an initial screening tool. If the subject reach is deemed to be of interest, additional data gathering would be recommended to obtain more information regarding water availability.

Instream Flow Appropriations That Have a Downstream Terminus at a Headgate

ISF appropriations that have a downstream terminus at a headgate also relate to CWCB's water availability determinations. During the ISF process investigation, CWCB may determine that a particular diversion structure diverts a portion of the stream where an ISF appropriation is proposed. In this case, CWCB may recommend that the downstream terminus of the proposed ISF water right end at the headgate. These streams could also be candidates for additional strategies such as the acquisition or donation of senior water rights for ISF purposes. It should be noted that there may be additional factors or reasons why a diversion structure was chosen as the downstream termini other than water availability.

Role of Water Availability in Appropriation Coverage Generation

The Stream and Lake Protection Database was searched to determine streams that have three or more flow periods and/or those that contain the following terms in the lower terminus description: headgate, headgate diversion, and ditch. The entire database can be viewed at http://cwcb.state.co.us/streamandlake/tools.htm.

Three searches of the database were performed to produce the requested information. The first was limited to streams where headgate, headgate diversion, or ditch was contained in the lower terminus description. The next two searches worked together to identify ISF appropriations or proposed appropriations with three or more flow periods. One search was performed to identify which segment IDs (water court case number or initial case identification number for proposed appropriations) had three or more flow periods. Once this was accomplished, additional information (i.e., name of stream, water division and district, appropriation date, etc.) was obtained from the database. The resulting information was then summarized in a tabular report, which is shown in Appendix E.

The tabular information was then used to produce GIS layers for mapping purposes. First, the data produced from the database searches described above were combined and sorted by ID. Then these streams were denoted by hand as "3 or more" or "headgate" and saved as a tabular file and imported into ArcMap. This information was joined to an existing ISF reach shapefile, with a condition on the join to keep only those records that have a match in the table. Finally, these data were then exported into a new shapefile, which was used to produce the maps shown in Figure 4-5.

Environmental Coverages

Audubon Important Bird Areas

Audubon Important Bird Area coverages were provided by The Nature Conservancy (TNC) and Audubon Colorado (Figure 4-6). An Important Bird Area is a site that provides habitat to one or more bird species during some portion of the year, including breeding season, migration, and/or winter. An Important Bird Area may be on private or public land, may or may not be currently protected, and may range in size from a few acres to hundreds of thousands of acres. The recognition of a site does not confer any legal or regulatory status, and is entirely voluntary on the part of landowners and land managers. A range of individuals, including local Audubon chapter members, public land managers, or local residents, may nominate sites. The sites were derived by the Audubon Colorado website: http:// www.audubon.org/chapter/co/ co/wildlife.htm.

Water Quality

The Clean Water Act (CWA) requires states to develop a list ("303(d) list") of impaired and threatened waters and then remediation strategies to restore the beneficial uses of water. The purpose of developing the 303(d) list is to identify which waters need to have total maximum daily loads (TMDLs) completed so that water quality standards can eventually be met for 303(d) listed segments. The Environment and Recreation TRT determined that 303(d) listings for aquatic life use based on biological data and sediment listings were most closely related to hydrology of the stream. Therefore, these two listings were mapped as a part of SWSI Phase 2. In other words these two listings could represent areas where flow or habitat could potentially be a factor in the listing of the stream segment. Other factors that could be involved in the listing are water quality or temperature impairments. Coverages are included from the Water Quality Control Divisions 2006 303(d) List and Monitoring and Evaluation List for aquatic life use and sediment impairments was obtained from the Colorado Department of Public Health and the Environment (CDPHE). These coverages (Figures 4-7 through 4-10) can also be viewed at the Water Quality Control Commissions website: http://www.cdphe.state.co.us/op/wqcc/ index.html and http://emaps.dphe.state.co.us/website/ 303dlisting/viewer.htm.

Natural Heritage Program

In order to protect native species and ecosystems, land and water managers must first know where they occur, how important they are, and what they need to remain viable. Over many years, TNC with its partner organizations, particularly the Colorado Natural Heritage Program (CNHP), has developed a system of identifying and tracking the conservational importance of plants and plant communities (roughly equivalent to habitat type) called Nature Heritage Methodology. CNHP data can assist planners in evaluating the conservation value of a river reach or a watershed by showing locations of high-priority plants and plant communities that may be impacted by human activity.

Among the riparian and wetland conservation targets tracked by CNHP, 97 are vascular plants and more than 270 are plant communities. Only a subset of these tracked targets occurs in any one river basin. Tracking by CNHP confers no legal status; only a few plants and no communities have legal status, e.g., Endangered Species Act listing. The plants shown in Figure 4-11 include those with fewer than 100 known populations in the world (imperilment rank G1-G3) and have fair to excellent estimated viability (A-C viability rank). Locations of plant communities with conservation value include both rare (G1-G3) communities with A-C viability rank as well as more common communities (G4 and G5) with excellent estimated viability (A rank). The species or plant community is ranked from A through D, where A indicates excellent estimated viability and D indicates poor estimated viability. For example, an A-ranked occurrence might be a large willow stand in the headwaters of the Yampa River where flows are unaltered from natural flow, there are few weeds, and the surrounding landscape is natural. A D-ranked occurrence might be a small cottonwood stand on the Arkansas River where flows are used for multiple purposes and tamarisk is abundant. Based on the Natural Heritage Methodology, all locations included on the maps have conservation value.

Data included on these maps have been collected over the past 2 decades by a wide range of not-for-profit and agency scientists working on many types of projects. However, most data have been collected by CNHP scientists during efforts to classify Colorado's riparian and wetland vegetation and during county-wide surveys for potential conservation areas. CNHP data collection efforts began in 1990 and continue through the present. Although CNHP data indicate much about what occurs in an area, they do not necessarily indicate anything about areas where nothing is mapped. Blank spots on the map can occur either because there really is nothing of conservation value there, or simply because the area has not been evaluated. Also, mapped locations are only the known areas with conservation value; these data in no way suggest that because an area is not mapped, it is not important.

Wildlife

Wildlife coverages depicting distribution information were originally developed for the SWSI Phase I by the Colorado Division of Wildlife (CDOW) and updated for this Phase 2 effort (Table 4-2 and Figures 4-12 through 4-24). Each species map delineates the current distribution of the species based on actual field sampling within the designated stream or lake. Point sampling data for stream populations have been evaluated by using the best professional knowledge to expand and define the stream reach that is most likely to be occupied by the species. These delineations represent the CDOW's best attempt to describe the habitat that is known to be populated by the species at specific sampling sites and reaches in between those sites. It must be recognized that due to temporal and spatial distribution characteristics of the species, all segments along the entire stream reach may or may not be populated by the species at any given time.

Furthermore, the streams and lakes designated as specific habitat describes only those waters where the species has been recently sampled (last 25 years). The total habitat for the species is not necessarily limited or fully described by this depiction. CDOW is expected to refine occupied habitat locations as time and resources allow for the completion of species surveys of all potential habitat.

Hydrologic Unit Code (HUC) 10 and HUC 12 distribution polygons are included to illustrate the drainages that are connected to habitat that is currently occupied by the species. These larger geographic units are known to have or are likely to possess habitat attributes that provide for the protection or continued persistence of the species populations within those units. The HUC 10 and 12 areas provide the user with a visual representation of terrestrial areas that have the potential to affect the habitat for each species that may be considered by the CDOW.

In response to requests for data and map products, field sampling data for aquatic species in the State of Colorado were drawn in part from the aquatic relational database that, in some cases, contains records related to sampling surveys as far back as 1875. A work-in-progress, the database is constantly being updated through internal review as well as with the additions of past and current field data. Each survey represented in the database is recorded in three main transaction tables. The tables store data pertinent to the location of the survey, to the event itself and to the collected raw fish data. Spatial relationships to survey locations are maintained through the use of Universal Transverse Mercator (UTM) coordinates and National Hydrography Dataset (NHD) reach coding stored in the location table and linked to a point layer in the CDOW GIS.

Recreation

The recreation GIS coverages consist of Gold Medal Stream and Lakes from CDOW (Figures 4-25 and 4-26), rafting reaches from American Whitewater (Figure 4-27), and kayaking reaches from Southwest Paddler (Figure 4-28). The American Whitewater and Southwest Paddler information was derived from the following websites: http://www.americanwhitewater.org/ and http://www.southwestpaddler.com/.

The Mountain Buzz website (http://www.mountainbuzz.com/) was also researched and provides good recreational information. The Southwest Paddler site had more information on flow considerations and was therefore selected for inclusion and reference.

It is unclear how the Southwest Paddler, the American Whitewater, and Mountain Buzz websites determine what flows are appropriate for different identified recreational experiences. Additional work is necessary to provide objective flows for different recreational experiences on different waterways.

Flow information was not available for all reaches. The available flow information can be accessed within the GIS ArcReader tool by using the information toolbar and selecting the reach of interest.

Combining the recreation coverages with the various CWCB and environment coverages provides decisionmakers with important information that may help them identify priority resource management areas.

4.3.3 Prioritization Process and Interface with Instream Flow Program

During the TRT process, there was general discussion on approaches for prioritization and quantification of environmental and recreational flows. This was largely discussed during the interim meeting that was held in March 2006 and at the last TRT meeting. The TRT did not come to resolution on a process; however, it recognized that prioritization is a local process that would require input from the basin roundtables and other stakeholders. Potential processes for prioritization could be based technically, on threats, on biological integrity, or on political, social, or economic factors.

This section summarizes technical elements that could be utilized in a prioritization process as well as techniques for quantifying environmental and recreational flows. Additionally, CWCB's Instream Flow Water Rights and stream protection efforts are summarized in this section.

Approaches for Prioritization and Quantifying Environmental and Recreational Flows

As part of the TRT process, the tools and concepts that could be used for establishing priorities and estimating environmental flow needs were discussed. These tools and concepts are summarized in Table 4-2. As part of each basin roundtable's nonconsumptive needs assessment[1], these tools and concepts may be relied upon in developing priorities and quantification of needs.

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[1] Permanent basin roundtables were formed at the end of the first phase of SWSI. For more information on the Basin Roundtables, visit www.ibcc.state.co.us.

Table 4-2 Summary of Approaches to Maintaining Environmental Integrity in Statewide Water Supply Management

Approach Name	Organization	Approach Objectives	Key Technical Elements	Potential Applications	Data Needs/ Comments
Identifying and Prioritizing Environmentally Sensitive or Impaired Areas:					
Aquatic GAP	Colorado Division of Wildlife in partnership with Colorado Watershed Network (CWN)	• Preserve aquatic biodiversity though better identification of species, community types or representative ecosystems.	• GIS tools to provide spatial data and mapping related to species habitat. • Hierarchical breakdown from large geographic units down to specific habitat types (8 levels). • Tying species existence with mapped habitat types to locate sensitive areas.	• Predict historical and current locations of native species. • Identification of rare habitat types. • Identification/prioritization of sensitive areas. • Uses existing species locations to predict potential occurrences.	• GIS basemap coverages. • Biological data (fish surveys). • Physical habitat data. • Water quality data. • Land use data. • Some of this data already in system.
Environmental Monitoring and Assessment Program (EMAP)	USEPA – Region 8 in partnership with Colorado Water Quality Control Division (WQCD), CDOW, and CWN	• Estimate current ecological status of streams. • Rank stressors that affect ecology of streams. • Establish relationships between stressors and ecological status.	• Comprehensive monitoring of physical, chemical, and biological characteristics. • At least 50 sites in each state; a total of approximately 100 sites in Colorado. • Streams must be perennial and wadeable or boatable. • Ecology: fish, macroinvertebrates, periphyton. • Stressors: habitat, water quality, tissue contaminants, land use.	• Identifying stressed streams and the source of that stress. • Guide water supply alternatives analysis with respect to impacts on ecology. • Identification/prioritization of sensitive areas. • Generation of Indices of Biological Integrity for fish, periphyton, and macroinvertebrates for Colorado's plain, mountain, and xeric ecoregions.	• Data is complete and available. • Draft report currently under review.
Freshwater Methodology	The Nature Conservancy	• Identify freshwater conservation targets (coarse filter) based on biodiversity.	• Classification of water bodies according to hierarchical system and physical factors (e.g. size, gradient, flow permanence, geology). • Intended for GIS mapping.	• Identify/prioritize potential environmental conservation areas and water bodies to guide water supply alternatives analysis and management.	• Depends on assumed link between physical. characteristics and biodiversity • No indication of what has been accomplished in Colorado.
Mapping Playa Lakes	Playa Lakes Joint Venture	• Map playa lakes that are critical to bird species.	• GIS. • Thermal imagery. • Precipitation data. • Infrared aerial photos. • Delineation of playas using this information.	• Identify/prioritize ecologically important playa maps in state to guide water management.	• How much mapping has already been done.

Table 4-2 Summary of Approaches to Maintaining Environmental Integrity in Statewide Water Supply Management

Approach Name	Organization	Approach Objectives	Key Technical Elements	Potential Applications	Data Needs/ Comments
Identifying and Prioritizing Environmentally Sensitive or Impaired Areas:					
Gold Medal Trout Fisheries	CDOW	• Designation of waters with high quality habitat and the potential for trophy trout fishing.		• Identify/prioritize sensitive areas.	• Readily available maps for quick reference.
Threatened and Endangered (T&E) Species Critical Habitat	Federal and State authorities	• Designation of waters critical to the survival of T&E species.		• Identify/prioritize sensitive areas.	• Readily available maps for quick reference.
USEPA 303(d) list for water quality impairment	USEPA	• Designation of impaired surface waters with respect to water quality parameters.		• Identify/prioritize sensitive areas.	• 303(d) listings based on water quality rather than water quantity. • For some parameters, dewatering can increase water quality concerns and affect beneficial use. • 303(d) list mapping readily available.
National and State Forests, Parks, and Wildlife areas	Federal and State authorities			• Identify/prioritize sensitive areas.	• Readily available maps for quick reference.
Colorado Data Sharing Network	Colorado Water Quality Monitoring Council in partnership with CWN and USEPA Region 8	• Gather water quality, habitat, and biological information from across the state into a central database.	• Go from basin to basin to get data from small generators. • Will include link to U.S. Geological Survey (USGS) data. • Database will include all data in STORET. • Database will include easy querying tools. • Database will have a map component with data retrieval. • A directory of data users and generators will be included. • Requires minimum metadata requirements.	• Could be central locator for statewide environmental information. • Allow for data gap and overlap assessments to be conducted.	• Much data still needs to be input in system. • Colorado basin already trained but remaining basins are still being visited.

Table 4-2 Summary of Approaches to Maintaining Environmental Integrity in Statewide Water Supply Management

Approach Name	Organization	Approach Objectives	Key Technical Elements	Potential Applications	Data Needs/ Comments
Identifying and Prioritizing Environmentally Sensitive or Impaired Areas:					
River Watch	CWN in partnership with CDOW		• Largest gatherer of stream water quality baseline data. • Collects habitat and macroinvertebrate data. • Volunteer monitoring program. • Utilizes intense certification training and QA/QC for volunteers.	• Data could be used to create a coarse statewide characterization of Colorado's watersheds.	• Volunteer data. • Statewide scope. • Station sampling usually monthly for several years.
Index of Biologic Integrity (IBI)	James Karr, University of Washington	• Assess biological integrity and evaluate consequences of human impacts using selected metrics, the value of which are converted to metric scores and then an index of biological integrity is calculated.	• Needs a minimally disturbed area to define the biological condition. • Biological attributes that change based on human influence need to be clearly defined and converted into an index.	• Identify/prioritize sensitive areas.	• Can require a significant field effort to collect data.
Quantification – Environmental Flows and Impacts on or from Supply Alternatives:					
R2CROSS	CWCB	• Establish minimum ISF criteria to meet environmental needs.	• Hydraulic survey at a single representative riffle cross-section. • Assumes riffles are the limiting habitat type during low-flow. • Reach-specific biological and water quality data collection to define hydraulic (depth, velocity, bankfull %) minimum criteria. • R2CROSS model to generate hydraulics for a range of flow regimes (or something like HEC-RAS).	• Guide water supply alternatives analysis.	• Not all streams of interest have established criteria. • Level of protection afforded by the method has been debated. • Doesn't account for variability in hydrology, just minimum flow for habitat. • Relatively easy to apply to a large number of streams. • Does require site-specific data collection.
UpCo Study Flow Criteria		• Establish minimum, maximum, and optimum ISF criteria to meet environmental and recreational needs.	• Interviews with local commercial fishermen. • Interviews with CDOW. • PHABSIM simulations.	• Guide water supply alternatives analysis.	• Criteria proposed for selected streams in Grand and Summit Counties. • Also includes a few general guidelines for ISF maintenance.

Table 4-2 Summary of Approaches to Maintaining Environmental Integrity in Statewide Water Supply Management

Approach Name	Organization	Approach Objectives	Key Technical Elements	Potential Applications	Data Needs/ Comments
Quantification – Environmental Flows and Impacts on or from Supply Alternatives:					
Threatened and Endangered Species Critical Habitat Flow Recommendations	U.S. Fish and Wildlife Service (USFWS)	• ISF recommendations to support T&E species.	• For Colorado and Gunnison Rivers. • Peak and baseflow recommendations based on historical flow analysis.	• Guide water supply alternatives analysis.	• Recommended flows are readily available.
Ecologically Sustainable Water Management	The Nature Conservancy (TNC)	• Maintain ecological integrity in waterways while meeting water demands.	• RVA (Range of Variability Approach). • statistical analyses of historical stream flows. • Defining and meeting metrics (33) associated with "natural" streamflows. • Assessing human impacts to river hydrology (modeling).	• Guiding reservoir operations. • Guiding river flow management.	• Approach relies heavily on historical data availability and being able to define "natural conditions."
Tennant Method	Tennant (1976)	• Establish minimum ISF criteria to meet environmental needs.	• Based on the assumption that aquatic habitat conditions are directly tied to the proportion of mean annual flow in a reach. • Generally a seasonal analysis. • Minimum flow set based on proportion of mean annual flow (proportions set in original methodology).	• Guide water supply alternatives analysis.	• Originally developed for Rocky Mountain region. • Requires historical gauged unregulated flows. • Easy to apply but less site-specific and probably less defensible.
Wetted Perimeter		• Establish minimum ISF criteria to meet environmental needs.	• Based on establishing a relationship between wetted perimeter and flow for representative riffles. • Site-specific cross-section surveying. • ISFs set based on breakpoint in wetted perimeter vs. flow curve.	• Guide water supply alternatives analysis.	• Requires site-specific data collection. • Similar to R2CROSS in underlying assumptions and rationale. • Best-suited to alluvial channels. • Not well-suited to disturbed or modified channels.
Covington and Hubert: Trout Reponse to Restoration of Stream Flows	USGS	• Assess the impacts of flow reductions or restoration on trout.	• Relies heavily on other published empirical models to establish relationship between flows, habitat, and trout. • Aerial photos and topographic maps, rather than intensive field surveys, to characterize habitat. • Historical flow data to characterize natural flows.	• Analyze potential relative impacts on trout from a specific water supply alternative.	• Estimated biomass.

Table 4-2 Summary of Approaches to Maintaining Environmental Integrity in Statewide Water Supply Management

Approach Name	Organization	Approach Objectives	Key Technical Elements	Potential Applications	Data Needs/ Comments
Quantification – Environmental Flows and Impacts on or from Supply Alternatives:					
Physical Habitat Simulation System (PHABSIM)	USGS	• Analyze effects of altered flow regimes on aquatic life habitat. • Establish ISF criteria (not necessarily just minimum flow).	• Brings hydrology, hydraulics, and biology together as an aquatic habitat model (flow -> hydraulics -> habitat). • Estimates changes in physical habitat (e.g. weighted usable area) as a function of flow. • Often part of applying the ISF Incremental Methodology (IFIM). • Analysis is dependent on selection of target species and habitat suitability curves (HSC) for that species. • HSC's may require data collection and certainly require consensus building prior to PHABSIM simulation. • HSC's may be taken from literature or other studies if appropriate and agreed upon.	• Guide water supply alternatives analysis.	• Likely a significant effort to apply the model but the only one of the options that tries to directly quantify habitat impacts and is species-specific.
Distinguishing the Relative Influence of Habitat on Aquatic Biota	Water Environment Research Foundation (WERF)	• Developed a statistical methodology to determine significance of chemical, habitat, flow, and their biological effects.	• Provides protocol to discriminate between physical and chemical limitations on stream biota. • Identifies key stressor and response variables.	• Guide environmental project applications.	• Relies on chemical, physical, hydrological, and biological information. • Can require a significant effort. • Provides sampling plan.

There are several other data sources and methods available for determining environmental and recreation needs including the Southern Rockies Ecosystem Project, CNHP's High Priority Conservation Area Program, USGS Basin Retrospectives, and CDOW recovery and conservation plans.

CWCB Flow Water Rights and Stream Protection

In Colorado, at the state level, there are two important methods that have been and can be used to address environment and recreation water needs once priorities have been set and water quantification is complete. This section provides an overview of the CWCB's ISF Program and Recreational In-Channel Diversion (RICD) rules.

CWCB Instream Flow Program

The 1973 General Assembly enacted Senate Bill 97, which created the Colorado Instream Flow and Natural Lake Level Program ("ISF Program") to be administered exclusively by the CWCB. For the first time in the history of Colorado water law, the General Assembly recognized a beneficial use of water that did not require diversion from a stream.

This statute was challenged as statutorily vague and unconstitutional, among other things, but the Colorado Supreme Court upheld its validity. Thus, the CWCB is responsible for the appropriation and protection of ISF and natural lake level water rights to preserve the natural environment to a reasonable degree and the acquisition of water rights to preserve and improve the natural environment to a reasonable degree. To date, the CWCB has appropriated and adjudicated approximately 1,500 water rights in approximately 8,500 miles of streams and 476 natural lakes.

In 1997, the CWCB adopted new procedures for the appropriation of ISF water rights that incorporate the provisions of Senate Bill 96-64. Formal changes to the CWCB's Rules and Regulations followed in 1999, and again in 2004. Under state law, the CWCB is vested with the exclusive authority to appropriate water rights to preserve the natural environment. However, any entity may request that the CWCB consider initiating an appropriation. Prior to initiating an appropriation, the CWCB requests recommendations, through its annual work plan process, from stakeholders such as the CDOW, the Division of Parks and Outdoor Recreation, the DOA, the U.S. Department of the Interior (DOI), Trout Unlimited, Colorado Water Trust, and TNC.

Did You Know?

The CWCB ISF Program can protect minimum stream flows via the new appropriations program

- AND -

Can preserve and improve the natural environment through acquisition and donation of more senior water rights? Any entity can make recommendations to CWCB for new ISF appropriations.

In addition to new appropriations, state law also authorizes the CWCB to acquire existing water rights on a voluntary basis to preserve or improve the natural environment. The CWCB can acquire water, water rights, and interests in water by purchase, bequest, lease, exchange, or other contractual agreement. To date, the CWCB has permanently acquired over 390 cfs and 3,600 acre-feet (AF) of water rights to preserve the natural environment. In 2003, the CWCB was authorized to accept temporary loans of water rights to preserve the natural environment to a reasonable degree in times of drought emergencies[2], and in 2005, the General Assembly amended that statute to allow a water right owner to loan water to the CWCB for ISF purposes, for up to 120 days, where the CWCB holds a decree for a water right on the benefiting stream. Such loans may not occur for more than 3 years in any 10-year period.

For more information see: http://cwcb.state.co.us/Streamandlake/.

[2] Section 37-83-105, C.R.S.

Recreational In-Channel Diversion Rules

In 1999, several municipalities filed for a water right for recreational purposes. The water court approved the application and it was affirmed by the Supreme Court in a 3-3 decision.

In 2001, in response the General Assembly passed SB 216. This bill provided that local governmental entities could apply for water rights for RICDs, but limited these types of water rights to the "minimum stream flow" "for a reasonable recreational experience in and on the water." Section 37-92-102, C.R.S. requires applicants for RICD water rights to provide a copy of their application to the CWCB. Under SB 216, the CWCB was required to review an application for a RICD and submit findings and recommendations to a water court within 90 days of the expiration of the Statement of Opposition period. SB 216 further required that CWCB and the water courts determine whether a decree for an RICD water right would:

- Promote maximum utilization of water resources in Colorado.
- Impair the development of Colorado's compact entitlements.
- Be located in appropriate stream reach.
- Be located in a place that has adequate access.
- Injure CWCB held ISF water rights.
- Meet other factors that are set forth in rules adopted by the CWCB.

A number of entities applied for water rights under this statutory provision, including the City of Pueblo, the Upper Gunnison River Water Conservancy District, the Town of Longmont, the City of Steamboat Springs, the Town of Silverthorne, Chaffee County, the Town of Avon, the City of Durango, and the Town of Carbondale. So far, only one application has made its way to the Colorado Supreme Court, which provided some guidance about how to interpret the phrases: "minimum stream flow" for a "reasonable recreation experience." In 2005, the General Assembly attempted to provide some additional guidance through SB 05-62, which would have limited RICDs to a maximum of 350 cfs. Although SB 62 passed out of the Senate, the bill failed in the House. Then, in 2006, the General Assembly passed SB 37, which was signed on May 11, 2006. SB 37 revised statute 37-92-102(6)(a), (6)(b), and (6)(c), The statute now, among other things:

1. Requires the CWCB to make a Findings of Fact on three factors—maximum utilization, compact entitlements, and injury to ISF water rights.
2. Provides that the CWCB must deliberate in a pubic meeting rather than holding a hearing.
3. Defines control structures, "reasonable recreation experience" and "recreational in-channel diversion."
4. Establishes a "*de minimis*" provision.
5. Provides that an owner of a RICD water right may not call for the water that has been lawfully stored by another appropriator.
6. Establishes a number of requirements for the water court with regards to RICDs.
7. Provides that these amendments apply after the affective date of the act.

Figure 4-29 depicts both pending and decreed RICDs. For more information see: http://cwcb.state.co.us/ WaterSupply/RICD.htm.

4.3.4 Summary of Findings of Technical Subcommittee

The TRT assembled several environmental and recreational attributes that can be used by the Water for the 21st Century Act BRTs in completing their nonconsumptive needs assessments. In addition, tools were presented that can assist the BRTs in both prioritizing and quantifying environment and recreation needs. Finally, the CWCB ISF Program and RICDs were described so that stakeholders have a better understanding of how those processes work so that when the nonconsumptive needs assessment process is complete, interaction with those programs can be further achieved.

4.4 Financial Subcommittee

4.4.1 Focus of Subcommittee

In addition to gaining an understanding of the environmental and recreational economy, the financial subcommittee answered the following question:

> *What are the sources of funding and payment for projects that enhance environment and recreation needs?*

In assessing financing options, it is important to emphasize that there are opportunities to address environmental and recreational needs for:

- Those projects that are solely focused on protection, improvement, or rehabilitation of important environmental or recreational resource areas.
- Evaluation and assessment of environmental and recreational needs in relationship to water projects and/or other beneficial uses.

Moreover, the following points were raised at subcommittee meetings:

- Funding sources for water development projects should focus on projects that provide opportunities for competing interests to work cooperatively to achieve multiple project goals.
- Environment and recreation funding should target both multi-purpose projects as well as stand alone environment and recreation projects.
- Funding may come from the federal, state, or local level and may include existing, commonly used, sources; existing sources that have not been traditionally used for these types of projects as well as new funding mechanisms.

This section first discusses the environment and recreation economy and then identifies existing federal and state level funding sources that could be used for recreation or environment programs. It also explores several possibilities for new types of funding mechanisms.

4.4.2 Data Evaluation

Colorado Environment and Recreation Economy

Section 2 of the 2004 SWSI Report summarized the Colorado recreation economy and information on other economic sectors and their role in Colorado's overall economy. Although recreation economic data was not used by the Finance Committee for any decisionmaking purposes, it provided an overview of the importance of recreation to Colorado's economy and the necessity of maintaining recreational activities as an integral part of the state economy.

Since the publication of the SWSI Report, three other data reports have become available to provide additional economic information regarding the importance of Colorado's recreation industry: "Commercial River Use in Colorado" (Colorado River Outfitters Association 2006), "The Active Outdoor Recreation Economy" (Outdoor Industry Foundation 2006), and "The Economic Impacts of Hunting, Fishing and Wildlife Watching in Colorado" (Pickton and Sikorowski 2004).

Colorado was the third fastest growing state during the 1990s and this high growth rate is projected to continue. One of the important factors for this growth rate is the quality of life in Colorado. In addition to the attractive climate, the natural environment of the Rocky Mountains and plains and the wide array of recreation opportunities attract new residents and businesses. Recreation opportunities include skiing and snowboarding, golf, hunting, bicycling, camping, hiking, backpacking, reservoir-based recreation, stream and lake fishing, wildlife viewing, rafting and kayaking, boating, and water skiing. Many of these recreation activities are water-based (fishing, boating, rafting, kayaking, and water skiing) or rely on water to support the activity (turf watering for golf and snowmaking for skiing and snowboarding).

In addition to the recreation opportunities for residents, recreation and the natural environment support tourism, a major economic driver, in many parts of the state. In many headwaters counties, recreation and tourism are the largest industries. As population growth continues, there will be increasing and competing demands for water. The new residents and businesses will require water for their domestic uses, residential landscaping, urban recreation, and the associated municipal, commercial, and industrial uses that accompany population growth. These same residents will also seek water-based and other types of recreation in Colorado's natural environment.

The Outdoor Industry Foundation (2006) estimates that the outdoor economy contributes $730 billion annually to the U.S. economy. Estimates for the State of Colorado were not published but the Rocky Mountain Census Division 8 (Arizona, Colorado, Idaho, New Mexico, Utah, Nevada, and Wyoming) estimates that the total contribution to the nation's total outdoor economic activity is $61.5 billion or 9 percent of the national total. The percent population in Division 8 compared to the national population is approximately 6 percent. The breakdown of individual activities for Census Division 8 is presented in Figure 4-30. The top economic producing activities are camping, snow sports, and trail related outdoor activities.

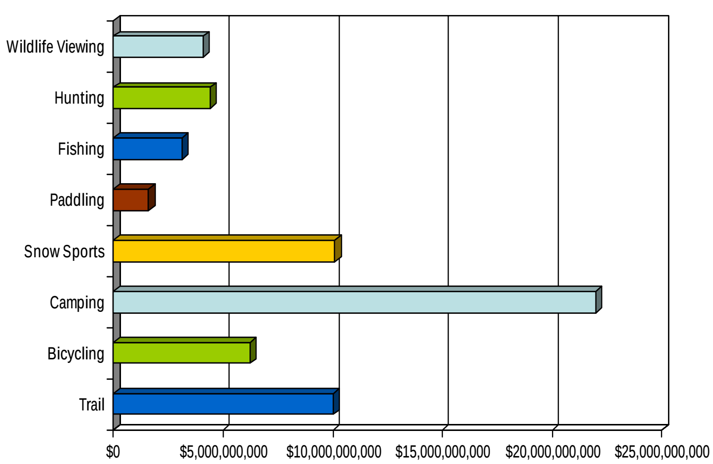


Figure 4-30
Contribution to Rocky Mountain Census District 8 by Annual Economic Activity by Type

The Colorado River Outfitters Association's study on commercial river use in Colorado shows the growth in the industry of the last 15 years. The economic activity associated with commercial rafting in Colorado is shown in Figure 4-31. In 2005, the industry set a new economic impact record of $135 million dollars. The drop of activity in 2002 is attributed to the drought that occurred during that year (Colorado River Outfitters Association 2006).

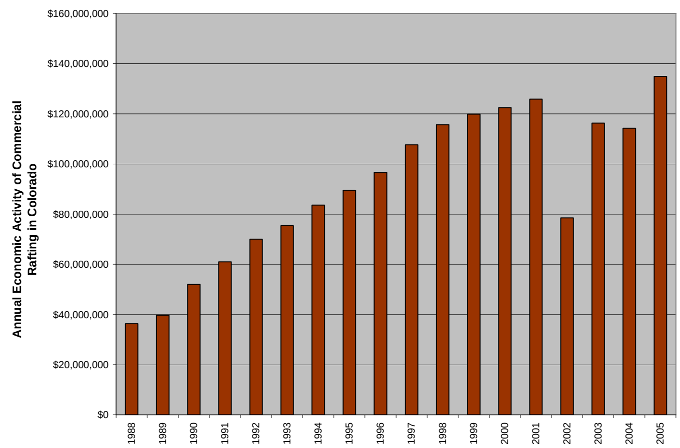


Figure 4-31
Annual Economic Activity of Commercial Rafting in Colorado

The report by Pickton and Sikorowski (2004) for CDOW investigated the economic impacts of hunting, fishing, and wildlife watching statewide. Data from 2002 show that hunters and anglers spent an estimated $797 million and a total of 10.1 million hunting and fishing activity days (Pickton and Sikorowski 2004). An additional $49 million was spent by CDOW on operations that support these types of recreation activities. It should be noted that the TRT did not peer review the methodologies that were used to generate the financial data summarized in this section.

Existing Funding Sources

There are several ways that funding can be acquired for environment and recreation 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. The subsections below discuss potential federal, state, and other funding sources.

Federal Funding Sources

Table 4-3 shows existing Federal funding sources appropriate for meeting the goals of environment and recreation needs.

The federal funding programs identified are not dedicated entirely to recreation or environment water development, but these purposes are eligible for development under each program to varying degrees. For instance, under the Continuing Authorities Program administered by the U.S. Army Corps of Engineers (USACE), there is a clear eligibility requirement consistent with environment and recreation water development (Sections 206 – Aquatic Ecosystem Restoration and 1135 – Project Modifications for Improvement of the Environment). Grant monies must be matched by local resources and funding must be authorized and approved by Congress; a significant challenge. The Rural Community Assistance Corporation (RCAC) loan program also has an environmental eligibility criterion; however, a dependable source of repayment must be identified to receive this loan. The DOA, the U.S. Economic Development Administration, and USEPA all have programs in which environment or recreation project attributes represent legitimate purposes, although none of these programs are actually focused directly on recreation or the environment.

Environment and Recreation Needs can be Addressed by…

- Developing and funding projects aimed at protecting or improving the natural environment.
- Working with new water development projects to incorporate and address multiple needs where applicable and appropriate.
- Working with existing water projects in a manner that does not reduce project yield or cause a financial impact to the project operator.

In sum, federal funding for environment and recreation water development is possible through a number of eligible programs, but obtaining such monies is tenuous at best. As of 2006, Federal funding for water development of any type is highly uncertain. Even so, these opportunities should not be ignored since combining environment and recreation water purposes with other water development purposes may lead to sufficient public support to gain federal funding from one or more of these programs.

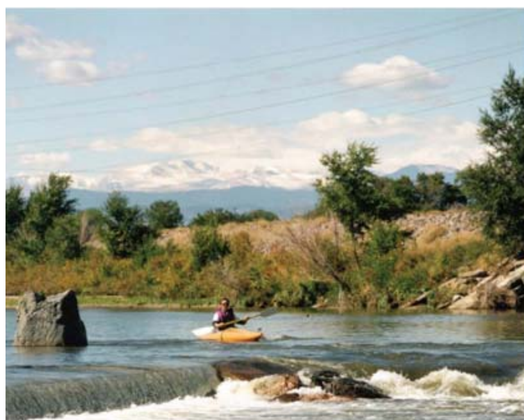


Table 4-3 Existing Federal Programs for Environment and Recreation Water Development

Agency	Program	Purpose	Application Process	Funding Type	Recent Award	Eligibility/Comments	Website
USACE	Continuing Authorities Program	Develop solutions to water resource issues including aquatic ecosystem restoration and improvements to the environment from modification of Federal water resource projects.	Various.	Grant (35% - 50%)	$27 million	Authority and funding from Congress.	http://www.spk.usace.army.mil/organizations/cespk-pd/pdcap.html
RCAC	RCAC Loan	Rural area focus on safe and decent housing, drinking water, wastewater, and community facilities.	Submit a loan application to the RCAC specific to the proposed project.	Loan	$7 million	Nonprofit organizations, municipalities, and tribal governments.	http://www.rcac.org/doc.aspx?82
U.S. Department of Agriculture (USDA)	Rural Development - Water and Environment Programs	Focus is water development for rural areas and towns of less than 10,000.	Various application processes.	Grant/Loan	Not Available	Various eligibility requirements.	http://www.usda.gov/rus/water/ http://www.usda.gov/rus/water/program.htm
USDA	Natural Resource Conservation Service (NRCS) – Wetland Reserve Program (WRP)	Focus is on restoring, protecting, and enhancing wetlands and associated uplands on private land.	1. Submit an application to the local NRCS office. 2. The local NRCS office reviews the application for eligibility and then ranks all applications based on area ranking criteria. 3. Funds are allocated to applicants based on project rank.	Grant or Conservation Easement	$2.77 million total allocation for Colorado	Landowners (must own land for previous 12 months) whose land is restorable and suitable to wildlife benefits.	http://www.nrcs.usda.gov/PROGRAMS/wrp/
USDA	NRCS – Wildlife Habitat Improvement Program (WHIP)	Focus is on creating high quality wildlife habitats for species of National, State, Tribal, or local significance.	See WRP process.	Grant	$0.5 million total allocation for Colorado	Lands that are privately owned or tribal lands; adjusted gross income of land owners from the three preceding years does not exceed $2.5 million.	http://www.nrcs.usda.gov/programs/whip/
USDA	NRCS – Environmental Quality Incentives Program (EQIP)	Focuses on soil, air, water, and other natural resource concerns.	See WRP process.	Grant (Cost-share up to 75% total project cost)	$40 million total allocation for Colorado	Agricultural producers whose adjusted gross income from the three preceding years does not exceed $2.5 million.	http://www.nrcs.usda.gov/PROGRAMS/eqip/

Table 4-3 Existing Federal Programs for Environment and Recreation Water Development

Agency	Program	Purpose	Application Process	Funding Type	Recent Award	Eligibility/Comments	Website
U.S. Economic Development Administration (EDA)	Public Works and Economic Development Program	Infrastructure in low income areas.	1. Applicant will meet with the Regional EDA office to determine eligibility of project. 2. If deemed eligible a request for proposal will be requested from the applicant. 3. If project is deemed viable a pre-application meeting will be requested. 4. After the pre-application meeting a request for formal application may be issued. 5. The applicant submits a formal application. 6. The EDA reviews the application and makes a determination. 7. The EDA notifies the applicant of its determination.	Grant	$1.5 million	State, city, county, or other political subdivision of a State, including a special purpose unit of a State or local government engaged in economic or infrastructure development activities, or a consortium of such political subdivision, an institution of higher education or a consortium of institutions of higher education, an Economic Development District organization, a private or public nonprofit organization or association, including a faith-based non-profit organization, acting in cooperation with officials of a political subdivision of a State, or an Indian Tribe, or a consortium of Indian Tribes.	http://www.eda.gov/AboutEDA/Programs.xml
USEPA	Targeted Watershed Grant Program	Focus is water quality improvement along with habitat improvements.	1. Seek nomination from State Governor or Tribal leader. 2. Once nominated submit proposal to USEPA in response to RFP. 3. USEPA regional watershed experts will review and score all eligible applications. 4. The regional administrator will submit 4 recommended projects to the national panel. 5. The national panel will review 40 semi-finalists and submit its recommendation to the Selection official for final determinations. 6. Selected applicants are required to submit a complete application upon notification.	Grant	Not Available	States, local governments, public and private nonprofit institutions/organizations, federally recognized Indian tribal governments, U.S. territories or possessions, and interstate agencies are eligible to apply.	http://www.USEPA.gov/twg/

Table 4-3 Existing Federal Programs for Environment and Recreation Water Development

Agency	Program	Purpose	Application Process	Funding Type	Recent Award	Eligibility/Comments	Website
USEPA	Wetland Program Development Grants	Focus is water quality improvement along with habitat improvements.	1. Submit proposal to USEPA in response to RFP. 2. USEPA will review proposals. 3. Applicants will be notified of USEPA's decision.			States, Tribes, local government agencies, interstate agencies, and intertribal consortia are eligible.	http://www.USEPA.gov/owow/wetlands/grantguidelines/
U.S. Bureau of Reclamation (USBR)	2025 Grants	Focus is on projects that reduce conflicts through water conservation, efficiency, and markets.	1. Submit proposal to USBR in response to RFP. 2. USBR reviews proposal and makes determination. 3. Applicant is notified of USBR's determination.	Grant (50%)	Not Available	Irrigation and water districts, municipal governments, tribes, and states.	http://www.doi.gov/water2025/grant.html
U.S. Fish and Wildlife Service	Partners for Fish and Wildlife	Focus is on restoring habitat on private lands including wetlands and riparian areas.	Contact Partners for Fish and Wildlife coordinator for more information.	Grant	Not Available	Individuals and groups who privately own land.	http://ecos.fws.gov/partners/viewContent.do?viewPage=home
National Fish and Wildlife Foundation (NFWF)	General Matching Grant Program and Special Grant Programs	Focus in on projects that restore native populations of sensitive or species.	1. Submit a preproposal (only applicable for certain special grants). 2. If a preproposal application is required and successful the NFWF will request a full proposal from the applicant. 3. NFWF staff review and NFWF Board of Directors make final determinations on proposals. 4. Applicant is notified of final determination.	Grant	Not Available	Various eligible projects and applicants.	http://www.nfwf.org/AM/Template.cfm?Section=Grants

Source: Interviews with program officials and selected websites, 2006

State Funding Sources

In addition to federal funding programs, a variety of state level funding sources are also available. Table 4-4 shows existing state level funding sources available for meeting the goals of environment and recreation water needs. There are a host of state programs available for environment and recreation water development led by the various programs of the CWCB. Several of these programs specifically call out eligibility requirements related to environment and recreation water development. However, these grants are typically not large or common. The most widely used program available to water developers—the construction loan program—can also have an environment or recreation purpose. However, these loans require a dependable source of repayment that can be a challenge for recreation or environment development. The Colorado Resource and Power Development Authority also has a number of loan programs that focus on environmental improvement, largely related to water pollution. These programs are mostly revolving fund programs that require loan repayment and are typically sponsored through public entities. Among the other available state programs, Great Outdoors Colorado (GOCO) has a specific focus on recreation and the environment. These grants, through one of three programs, typically entail other funding partners and public entities.

Although recreation and water development projects are eligible to receive funding from a number of state programs, significant challenges remain in accessing these funds. First, public entities and other partners are often required to secure the funding. Secondly, loan repayment sources must be identified, which is a considerable challenge for environment and recreation water developments. Third, competition for public money is keen and identified constituencies for environment and recreation water development are more difficult to identify than more traditional water resource development purposes.

Many of the challenges for state funding of environment and recreation development are the same challenges that all other water development purposes face; especially agricultural water projects and rural water development.

Other Funding Sources

Although the focus of this section has been on federal and state funding sources, there are also a number of non-government organizations (NGOs) that may provide funds for environment and recreation water projects. Ducks Unlimited, High Country Wetlands, and Platte River Initiative programs are good examples. Although these funding sources are not detailed in this report, they should be included in future funding inquiries.

Potential New Funding Sources

The Financial subcommittee examined several potential new funding sources. A more detailed discussion of these funding sources, such as impact fees, recreation service fees, sales taxes, and trust funds can be found below.

Table 4-4 Existing State Programs for Environment and Recreation Water Development

Agency	Program	Purpose	Application Process	Funding Type	Recent Award	Eligibility/Comments	Website/Reference
CWCB	Fish and Wildlife Mitigation Fund	Fund mitigation of impacts on fish and wildlife resources from water diversions, deliveries, or storage facilities.	1. Application is submitted to CWCB staff for review. 2. CWCB staff make a recommendation to the CWCB Board. 3. CWCB Board will make a final determination. 4. CWCB notifies applicant of final determination.	Grants (Up to 25% of total project cost; maximum $250,000)	Elkhead Reservoir $1,048,000	• Used for the appropriation or acquisition of water rights to preserve or improve the natural environment to mitigate impact of an existing water facility. • Used to complete river restoration feasibility studies and construction projects. • Eligible applicants include operators of existing water diversions, delivery or existing storage projects and the CWCB.	http://www.cwcb.state.co.us/Flood/pdfDocs/FWLRFProgramGuidance.pdf
CWCB	Construction Loans	Provide low-interest loans to agricultural, municipal, and commercial borrowers for the development of raw water resource projects.	1. Conduct a loan feasibility study and submit the study along with the loan application to the CWCB. 2. CWCB staff will review the application and provide a recommendation to the Board. 3. Board staff will evaluate the application for approval. 4. CWCB notifies applicant of decision.	Mostly Loan	Up to 90% of project costs	• Overall project can have recreation and/or environment component.	http://cwcb.state.co.us/Finance/waterProjectLoanProgram.htm
CWCB	Severance Tax Trust Fund Operational Account	Water resources planning studies and associated demonstration projects, within mineral impacted areas of the state.	1. Application submitted to CWCB. 2. CWCB evaluates application. 3. CWCB notifies applicant of decision.	Grant	Annually	• Requests Reviewed Annually by CWCB.	http://cwcb.state.co.us/Finance/sevTaxOperationalAccount.htm
CWCB	SB 179 - Water Supply Reserve Account	Fund water activities approved by the Basin roundtables.	1. Application submitted to CWCB. 2. CWCB evaluates application. 3. CWCB notifies applicant of decision.	Grant	Bimonthly	• Approval by Interbasin Compact Roundtables and non-consumptive water needs are one of the eligible activities.	http://cwcb.state.co.us/IWMD/statutes.htm

Table 4-4 Existing State Programs for Environment and Recreation Water Development

Agency	Program	Purpose	Application Process	Funding Type	Recent Award	Eligibility/Comments	Website/Reference
CWCB	HB 1400 - Implementation of the Water for the 21st Century Act	Technical support to Interbasin Compact Roundtables	Task Orders from Basin Roundtables submitted to state project manager	Operations CWCB	Approximately $700,000 annually	• Funds available to complete Basin Roundtable Needs Assessments.	http://cwcb.state.co.us/ IWMD/statutes.htm and ibcc.state.co.us
CWCB/CDPHE	Colorado Watershed Protection Fund	Colorado Individual Income Tax Refund checkoff program to give taxpayers the opportunity to voluntarily contribute to Watershed Protection. Grants are locally based water projects and planning.	1. Application submitted to CWCB 2. CWCB staff, CDPHE, Water Quality Control Commission (WQCC) staff, and Colorado Watershed Assembly review, rank, and identify funding proposals to be forwarded to the Board and WQCC. 3. The Board and WCCC may select two respective designees each responsible for making final grant award decisions, in consultation with the Colorado Watershed Assembly representative.	Grant	Annually ~$100,000	• Collaborative locally-based watershed protection. Must provide 20 percent in-kind or cash match.	http://cwcb.state.co.us/ flood/river restoration.htm

Table 4-4 Existing State Programs for Environment and Recreation Water Development

Agency	Program	Purpose	Application Process	Funding Type	Recent Award	Eligibility/Comments	Website/Reference
CDPHE/ USEPA	319 Program	Focus on nonpoint source pollution to impaired Colorado water bodies.	1. Submit draft proposal to nonpoint source (NPS) coordinator. 2. Review of draft proposals is conducted by technical committees, watershed coordinators, and USEPA. 3. Feedback is given to project sponsors about project eligibility. 4. Final proposals are submitted to NPS coordinator. 5. Project is reviewed by Project Review Committee. 6. Proposals are submitted to NPS Council and USEPA for final review. 7. NPS Council rank projects and provide recommendations to Water Quality Control Division (WQCD). 8. WQCD presents recommended project list to the Water Quality Control Commission for approval.	Grant	$1.8 million	• Program funds BMP construction and also Watershed Management Plans.	http://www.epa.gov/ OWOW/NPS/cwact.html http://www.cdphe.state.co. us/wq/nps/index.html

Table 4-4 Existing State Programs for Environment and Recreation Water Development

Agency	Program	Purpose	Application Process	Funding Type	Recent Award	Eligibility/Comments	Website/Reference
Colorado Water Resources and Power Development Authority (CWRPDA)	Drinking Water Revolving Fund	Provides low interest loans to government agencies for the construction of water projects for public health and compliance purposes.	1. The borrower's project included in the adopted annual intended use plan (IUP) eligible project list. 2. The IUP and eligible project list included in a Joint Resolution approved by General Assembly and signed by Governor. 3. The borrow submits an application to the Water Quality Control Division (WQCD) once the project is on the eligible project list. 4. Application is forwarded to Division of Local Government (DLG) who then conducts a review along with CWRPDA and WQCD. 5. CWRDPA Project Finance Committee and the Board of Directors review the borrower's credit report. 6. Board of Directors approve application.	Loan	$13 million	• Drinking water infrastructure.	http://www.cwrpda.com/DWRFsubmenu.htm
CWRPDA	Water Pollution Control Revolving Fund	Provides loans to government entities for construction of water quality projects.	See Drinking Water Revolving Fund process.	Loan	$24 million	• Wastewater infrastructure; non-point source abatement.	http://www.cwrpda.com/WPCRFsubmenu.htm

Table 4-4 Existing State Programs for Environment and Recreation Water Development

Agency	Program	Purpose	Application Process	Funding Type	Recent Award	Eligibility/Comments	Website/Reference
CWRPD	Small Water Resource Projects	Finance water supply projects costing $10 million or less.	1. Submit application directly to CWRDPA (if the project involves raw water collection or storage application is forwarded to CWCB for informational purposes). 2. Application reviewed by CWRDPA staff and Financial Guaranty Insurance Company (FGIC). 3. CWRDPA Project Finance Committee and the Board of Directors review the borrower's credit report. 4. Board of Directors approve application.	Loan	$10 million	• All water supply systems components.	http://www.cwrpda.com/SWRPsubmenu.htm
Department of Local Affairs	Energy and Mineral Impact Assistance Program	Assist communities with implementing improvement projects and local government planning.	1. Submit application to the Department of Local Affairs. 2. Applications reviewed by department and state advisory committees. 3. Grant/loan awards announced.	Grant/Loans	$500,000/$1 million	• Municipalities, counties, school districts, and most special districts that have been affected by development, processing, or energy conversion of fuels and minerals.	http://www.dola.state.co.us/dlg/fa/eiaf/index.html
Department of Local Affairs	Conservation Trust Fund	Implementation of projects that benefit state and local parks, recreation facilities, open space, environmental education, and wildlife habitat.	Funds dispersed quarterly on a per capita basis.	Grant	Not Available	• Municipalities, counties, school districts, and most special districts that intend to acquire, develop, or maintain new conservation sites or implement capital improvements or maintenance for recreational purposes on any public site.	http://www.dola.state.co.us/dlg/fa/ctf/index.html
State of Colorado	Colorado Conservation Easement Tax Credit	Protecting lands through conservation easements.	State income tax credit.	Tax Credit	Up to $260,000	• Colorado resident individuals, C Corporations, trusts, estates, and members of pass-through entities.	http://www.revenue.state.co.us/fyi/html/income39.html

Table 4-4 Existing State Programs for Environment and Recreation Water Development

Agency	Program	Purpose	Application Process	Funding Type	Recent Award	Eligibility/Comments	Website/Reference
CDOW	Habitat Stamp	Acquiring or preserving wildlife habitat.	Funding recommendations made by a citizen committee to the Wildlife Commission.	Grant	Not Available		http://wildlife.state.co.us/ShopCDOW/AppsAndLicenses/HabitatStamp/
CDOW	Fishing is Fun (FIF) Program	Improve fishing opportunities for anglers.	1. File an application with CDOW. 2. Various reviews by CDOW staff. 3. Presentation and Q&A session by applicants to FIF Review Panel meeting. 4. Review Panel recommendations forwarded to CDOW top management for final decision.	Grant	Not Available	• Local governments, park and recreation departments, water districts, individuals, conservation groups, and organizations with projects that either improve angler access, improve habitat, improve fishing sites, or improve motorboat access.	http://wildlife.state.co.us/Fishing/ResourcesTips/FishingIsFunProgram/
Colorado Department of Natural Resources	Species Conservation Trust Fund	Fund programs designed to conserve native threatened and endangered species.		Annual Appropriation	$3.485 million	• Programs that address conservation of threatened and endangered species in the state.	Colorado Revised Statutes Title 24 Article 33 Section 24-33-111
Various Counties	County Open Space Sales Tax	Open space protection.	Various.	Sales Tax	Not Available	• Focus is on acquiring land for open space.	See county websites
Water Quality Control Comm., Other	Watershed protection fund	Protect lands and waterways in Colorado's watersheds.	1. Applications Available March 1. 2. Deadline April 30. 3. Applications reviewed and approved July 31. 4. Grants Awarded September 30.	Grants	$15,000 Design and $50,000 Projects	• Requires 20% match.	http://www.cdhpe.state.co.us/op/wqcc/SpecialTopics/CWPF/colowtshdprot.html
Great Outdoors Colorado (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.	1. File an application with GOCO. 2. GOCO reviews applications. 3. Grants awarded.	Grant	$13.2 million	• Parks, outdoor recreation, environmental education; regional or state significance.	http://www.goco.org/GrantPrograms/Legacy/tabid/125/Default.aspx
GOCO	Local government	Implement projects that provide places to play, gather, and compete.	See Legacy Initiative process.	Grant	Not Available	• Similar emphasis for local governments.	http://www.goco.org/GrantPrograms/LocalGovt/tabid/120/Default.aspx

Table 4-4 Existing State Programs for Environment and Recreation Water Development

Agency	Program	Purpose	Application Process	Funding Type	Recent Award	Eligibility/Comments	Website/Reference
GOCO	Open space	Open space protection.	See Legacy Initiative process.	Grant	Not Available	• River corridors, habitat, broad objectives.	http://www.goco.org/GrantPrograms/OpenSpace/tabid/119/Default.aspx
Colorado Water Trust	Colorado Water Trust	Acquisition of water rights or interests in water rights for conservation benefits.	None.	Direct acquisitions and donations	Not Available	• Existing water users, willing participants.	http://www.coloradowatertrust.org

Source: Interviews with program managers and selected websites, 2006.

The following criteria were used to evaluate the various funding sources described below in order to identify advantages and drawbacks. The criteria were also used to assess which funding source might work best for specific programs or goals or in other specific circumstances. These criteria should also be used to evaluate new mechanisms for funding beyond what are addressed here.

- Source of Funds: Where would the funding come from or how would funding be generated for the program? Potential funding sources could include public or private water developers, governmental entities, out-of-state visitors, or other Colorado beneficiaries.
- Administration of Mechanism: How would funds be collected? Distributed? What agency or group would be in charge of overseeing the administration of the program? How easy or difficult would it be to implement the program?
- Basis of Quantification: How are program fees or rates set? What is the justification for the projected financial requirements?
- Positives: What is the justification for recommending the program? What are the strong points of the program? What are the advantages over other types of funding programs?
- Negatives: What are the expected objections to the program from opponents? What aspects of the program might be arguable or contentious and why?

Impact Fees

Impact fees are monies collected from new development, typically for each new single family dwelling equivalent, to offset costs that local government incurs as a result of that new development. Table 4-5 applies the evaluation criteria discussed above to a program funded by impact fees.

Table 4-5 Evaluation of Impact Fees as a Potential Funding Source

Criteria	Observations
Sources of Funds	Percentage of state or county retail sales from in-state and out-of-state purchasers
Administration of Mechanism	Colorado Department of Revenue collects and distributes; need public agency to receive dollars
Basis of Quantification	Project and justify dollar requirements; estimate percentage required from total sales
Positives	Includes visitors; small percentage; easier to justify than property tax
Negatives	Competition for sales tax dollars; precedent

Source: Harvey Economics, 2006.

The use of impact fees for funding recreation or environment water development is likely to be limited. Impact fees could be justified in circumstances where development specifically threatened resources or where past development had curtailed recreation or environment values. The administration of such impact fees would need to take place through public jurisdictions, such as municipalities, which are responsible for planning zoning and approving land developments. Those entities must be convinced that impact fees are justified before any consideration of this mechanism would occur. The advantages of this mechanism would be the direct tie of environment and recreation to new development. There is an opportunity for wider application than simply partnering with traditional water development through the permitting process. Difficulties associated with the use of impact fees include developing an acceptable means to quantify what the fee should be and convincing local planning agencies and developers that the recommended fee is appropriate. This is an extremely difficult proposition in most circumstances.

Recreation Service Fees

Recreation service fees are fees paid by those people that actively engage in recreational activities. Recreation service fees could be charged for the use of water based recreation, specifically related to new water development, or more broadly applied to other recreational activities in the region or even throughout Colorado. Table 4-6 applies the evaluation criteria discussed above to programs funded through recreation service fees.

Table 4-6 Evaluation of Recreation Districts as a Funding Source

Criteria	Observations
Sources of Funds	Levies on property value in areas of benefit.
Administration of Mechanism	Collected by local governments.
Basis of Quantification	Project dollar needs, tie to beneficiaries and property assessments.
Positives	Property values benefit from recreation/ environment.
Negatives	Election required; tax payer resistance; leaves out visitors.

Source: Harvey Economics, 2006.

There are a host of ways recreational users could pay this fee, but existing permit systems or the internet would lower administrative costs. Quantification of the fee is also relatively straight forward: project funding needs would be compared with participation levels and competitive recreational fees elsewhere. The recreational service fee alternative is likely to have more support than other programs since Colorado residents are very familiar with user fees, i.e., seat tax, national park fees, fishing licenses, etc.

The main drawback for this alternative is the limit of service fees due to competing recreational alternatives. Unless recreational fees are applied broadly, recreationists and tourists will be unwilling to pay very much for most water based recreational activities. A broader based recreational service fee is likely to incur resistance from existing programs that have their own service fees and have been able to establish their own funding programs. Even so, this alternative is promising in conjunction with other funding alternatives.

Sales Taxes

A specific portion of state or local sales taxes collected could be earmarked specifically for funding environment and recreation needs programs. This tax would most likely be an additional new sales tax, although, in theory it could be a percentage of the existing tax rate. Table 4-7 applies the evaluation criteria to the sales tax funding approach.

Table 4-7 Evaluation of Sales Tax as a Funding Source

Criteria	Observations
Sources of Funds	Percentage of state or county retail sales from in-state and out-of-state purchasers.
Administration of Mechanism	Colorado Department of Revenue collects and distributes; need public agency to receive dollars.
Basis of Quantification	Project and justify dollar requirements; estimate percentage required from total sales.
Positives	Includes visitors; small percentage; easier to justify than property tax.
Negatives	Competition for sales tax dollars; precedent.

Source: Harvey Economics, 2006.

Trust Funds

Like special districts, trust funds are a common form of legal entity that could easily be designated to fund environmental and recreational projects. Monies could be accepted from almost any source and expenditures could be limited such that the trust expended only the earnings off the principal or corpus of the trust for any purposes designated by the trustees. One advantage of this mechanism would be its flexibility in terms of both receiving funds and expending funds in an opportunistic manner. The chief disadvantage of this mechanism is that there are already a number of related trust funds and entities that might create confusion and limit support for the new entity. However, if a trust fund was carefully defined such that it was distinct from and worked cooperatively with other trust funds and agencies, such as TNC, GOCO, or various land trusts, then this mechanism might be favorable. In order to be successful, specific and significant funding sources must be found to launch the trust.

Table 4-8 applies the evaluation criteria to trust funds as a funding source.

Table 4-8 Evaluation of Trust Funds as a Funding Source

Criteria	Observations
Sources of Funds	State or Federal Government, water developers, local government, or other entities
Administration of Mechanism	Create a fund, spend earnings, operate as revolving fund
Basis of Quantification	Set minimum goals, seek maximum funds, set priorities
Positives	Responds to broad benefits, singular effort to establish
Negatives	Limited public funds, case for urgency, GOCO or others already doing this?

Source: Harvey Economics, 2006.

Other Funding Sources

Other potential sources of funding for environment and recreation flows include increased transportation fees, such as landing fees and rental car fees; increased overnight fees, such as those for hotels and campsites; and taxes on special products, including sporting goods, beer, and cigarettes. In each instance, these would be add-ons to existing taxes, fees, or levies. There would likely be resistance to such increases, though it may vary depending on the commodity taxed. One source of resistance would be that some of those paying the fees through taxes do not benefit from the spending purpose.

4.4.3 Summary of Findings

Each of the funding sources or programs has its own advantages and disadvantages. Existing federal and state funding programs already exist ostensibly to fund environment and recreation water development, but there may be a considerable amount of competition for those funds.

Federal funding programs are particularly problematic and uncertain. Although environment and recreation water development is eligible for funding through a number of State of Colorado programs, the larger programs still require loan repayment and the source of loan repayment presents special challenges. In particular, environment and recreation water beneficiaries are not easily identified and the willingness or ability of those beneficiaries to financially support environment and recreation needs is unknown. Other challenges in funding environment and recreation needs relate to the formation of agencies or organizations to receive and disperse money; the accountability of those agencies and organizations; and the basic resistance to increases in fees, taxes, or levies of any sort, especially in a competitive funding environment in the public sector in 2006.

Nevertheless, potential new funding mechanisms have been identified and evaluated in this report. Each mechanism offers certain promise although the challenges will be considerable. In pursuing any of these new funding alternatives, Taxpayer Bill of Rights (TABOR) limitations may be overcome through the creation of new enterprise funds to receive and disperse the monies. The creation of such enterprise funds is a common technique in the State of Colorado. Regardless of which new funding technique is adopted, it will be important for the organizing entity to convince taxpayers of the overall merit of the recreation or environment water development. It is suggested that the following issues be addressed by such organizers:

- Nature of benefits: Provide a clear and exact description of the benefits of the program.
- Beneficiaries: What groups of people or what agencies will benefit from the program? What geographic area will benefit? Which political jurisdictions will benefit from the program?
- Magnitude of the benefits: Expected number of visitor days and expenditures; local versus non-local benefits; attraction to the region and effects on quality of life; preservation of future opportunities.

State and local support will be crucial to successfully enacting new types of funding programs.

4.5 Legal/Water Rights/ Institutional/Political Subcommittee

4.5.1 Focus of Subcommittee

The legal/water rights/institutional/political roundtable formed a subcommittee to address the following questions:

1. What are the potential impacts on senior and junior water rights holders if an environment or recreation enhancement project is developed? What are the impacts on future uses of water?

2. Can incentives be developed for entities to donate their water rights for instream or recreational uses?

   — What are other legal changes that need to occur to protect water-related environment and recreational uses?

   — What incentives can be developed to encourage entities to donate their water rights?

3. How can an acceptable balance be achieved between competition for the same sources of water with existing uses such as agricultural and M&I?

4. Can a prioritization scheme be developed where there is consideration of environment and recreation needs, M&I needs, and agricultural needs?

The first question is addressed in Section 4.5.2 - Water Rights and Environment/Recreation Project Development. Questions 2-4 were not addressed specifically; however, this subgroup concluded that there are extensive legal mechanisms that provide for the protection of environment and recreation needs. Depending on the individual viewpoint at the extremes, these legal and political mechanisms are either:

- The foundation/tools to ensure environment and recreation needs are met
- The cause of delay, cost escalation, and litigation that impede water resource development

It is hoped that by examining these tools and evaluating other potential funding and implementation strategies, a more collaborative approach between the extremes can be fostered and pursued.

There are regulatory tools available at the federal, state, and local level that may benefit environment and recreation needs. Descriptions of each of these tools are provided below, and, where possible, a website has been provided for additional information. These tools are implemented at a variety of levels and are described here to provide a baseline of understanding of the amount of protection for environment and recreation resources.

The questions that were not directly addressed during this process (Questions 2, 3, and 4) are addressed in the conclusions and recommendations sections – Sections 4.7 and 4.8.

4.5.2 Water Rights and Environment/ Recreation Project Development

Table 4-9 provides a comparison of the type of water rights and other mechanisms that provide environmental and recreational flows. The table describes local, state, and federal mechanisms for establishing water rights for the environment and recreation as well as describing how multipurpose projects or structural improvements could provide environmental and recreational flows. The TRT chose not to discuss the impacts on senior and junior water rights holders if an environment or recreation project is developed. These issues will ultimately need to be discussed.

Table 4-9 Comparison of Types of Water Rights and Other Mechanisms that Provide Environmental and Recreational Flows

		CWCB Program					
	RICDs	CWCB ISF and Natural Lake Level Water Rights (New Appropriations)	Dedication of Existing Water Right to CWCB for ISFs	Voluntary Flow Agreements	Federal Permitting Conditions	Multipurpose Projects	Structural Improvements
Entity	Local governmental entities. Private, State, and Federal entities are prohibited from appropriating these types of water rights.	CWCB is the only entity authorized to obtain a decree for ISF or natural lake level water rights.	CWCB can acquire by donation, purchase, lease, or other contractual agreement from any person or entity.	Can be between any water users, subject to each party's legal authority and to applicable water court decrees.	Can be imposed by federal agencies such as the Forest Service, Bureau of Reclamation, USACE, National Park Service, Bureau of Land Management, or other agency.	Any type of water user, in conjunction with CWCB if providing ISFs, or with a local governmental entity if providing flows for RICDs.	Any type of water user, in conjunction with CWCB if providing ISFs, or with a local governmental entity if providing flows for RICDs.
Flow Amounts	Minimum stream flow for a reasonable recreation experience.	Minimum amount to preserve the natural environment to a reasonable degree.	Minimum amount to preserve or improve the natural environment to a reasonable degree.	Amounts determined by mutual agreement.	Variable – these sometimes mimic CWCB ISF decreed amounts.	Agreed upon and proposed by project sponsors and partners and confirmed by water court.	Variable - but may be limited by size of pumpback pipelines, pumping costs, or other logistical constraints.
For What Purposes	To provide stream flows for a reasonable recreation experience.	To preserve the natural environment to a reasonable degree.	To preserve or improve the natural environment to a reasonable degree.	Determined by mutual agreement.	Recreation/environment/ other uses associated with the original federal authorization legislation.	Recreation/ environment.	Recreation/ environment/ water quality.
Season	Can be year round or seasonal (usually summer).	Can be year round or seasonal.	Can be year round or seasonal.	Determined by mutual agreement.	Can be year round or seasonal. These sometimes mimic CWCB ISF decreed amounts.	Agreed upon and proposed by project sponsors and partners and confirmed by water court.	May be limited during the winter season because of icing/freezing pipelines or other frozen infrastructure.
Times of Day	Usually limited to daylight hours.	24 hours a day.	24 hours a day.	24 hours a day.	Typically 24 hours a day. May be limited by operational schedules.	Agreed upon and proposed by project sponsors and partners.	Variable.

Table 4-9 Comparison of Types of Water Rights and Other Mechanisms that Provide Environmental and Recreational Flows

		CWCB Program					
	RICDs	CWCB ISF and Natural Lake Level Water Rights (New Appropriations)	Dedication of Existing Water Right to CWCB for ISFs	Voluntary Flow Agreements	Federal Permitting Conditions	Multipurpose Projects	Structural Improvements
Limits	Limited to the minimum flow to provide for a reasonable recreation experience.	Limited to the minimum flow to provide reasonable preservation of the natural environment.	CWCB may not (1) acquire water by eminent domain; (2) accept donations of water rights that either would require removal of existing infrastructure without approval of owner of infrastructure or that were acquired by condemnation; or (3) use money from the Construction Fund to acquire water or water rights.	Limitations determined by mutual agreement or imposed by law.	Can only be imposed when a new permit is needed, or when a current permit is up for renewal. These types of federal imposition of bypass flows have been, and could continue to be the subject of litigation.	Limitations determined by mutual agreement or imposed by law.	Costs associated with the pipeline, costs associated with pumping, costs associated with the storage vessel.
Affects on Compact Entitlements	Shall not impair the ability of Colorado to fully develop and place to consumptive beneficial use its compact entitlements.	Shall not deprive the people of the State of Colorado of the beneficial use of those waters available by law and interstate compact.	Shall not deprive the people of the State of Colorado of the beneficial use of those waters available by law and interstate compact.	Potential to impact Colorado's compact entitlements.	Potential to impact Colorado's compact entitlements.	In accordance with law governing ISFs or RICDs.	Should not affect Colorado's Compact entitlements.

4.5.3 Available Tools and Mechanisms

Federal Tools

Endangered Species Act

The Endangered Species Act (ESA) provides protection for fish, wildlife, and plant species that are listed as threatened or endangered in the U.S. or elsewhere. The ESA gives procedures that federal agencies must follow when taking actions that may jeopardize a listed species. Federal agencies typically "consult" with the Fish and Wildlife Service and the National Marines Fishery Service to ensure that listed species and their habitats are not harmed. If negative impacts are expected, plans such as a Recovery Plan or Habitat Conservation Plan (HCP) are required. In Colorado, recovery plans have been created to protect endangered species on a programmatic basis, on the Colorado and Platte Rivers.

For more information see: http://www.fws.gov/endangered/

Federal Reserved Water Rights

Federal Reserve Water Rights are implied and express water rights that are created when land is taken out of the public domain for national parks, national wildlife refuges, national forests, etc. These rights were judicially created by the U.S. Supreme Court in 1907 in Winters vs. U.S., which concluded that the U.S. could not deprive Native Americans of water reserved for them through the creation of tribal reservations (known as the "Winters" Doctrine). In Colorado, reserved water rights are finalized throughout the state with exception of the Division 7 Forest Service and the Black Canyon of the Gunnison National reserved rights.

For more information see: www.blm.gov/nstc/WaterLaws/fedreservedwater.html.

Section 404 Dredge and Fill Permits

Section 404 of the CWA instituted a permit program to regulate discharge of dredge and fill material in wetlands and in "waters of the U.S." USACE is responsible for issuing permits and assessing the potential impact to the environment including water quality. USACE may require terms and conditions on the permit to mitigate any potential impacts as per 404(B)(1) guidelines.

For more information see: http://www.usace.army.mil/cw/cecwo/reg/oceover.html.

Nonpoint Source (NPS) Management Program

Section 319 NPS Grant Program was created by Section 319 of the CWA to curb NPS pollution. USEPA administers funding to state and tribal agencies. The money is then used to assess nonpoint pollution and to develop and implement NPS management programs. In Colorado, the grant program funds voluntary NPS pollution projects that are intended to enhance water quality and potentially provide environment and recreation benefits.

For more information see: http://www.epa.gov/OWOW/NPS/cwact.html.

Salinity Control Program

The salinity control program is a program in which the BOR, DOA, and the Bureau of Land Management (BLM) are working together to cost-effectively reduce salinity in the Colorado River Basin. For example, in western Colorado, earthen canals have been replaced with pipes to reduce seepage and salt loading to the Colorado River. There may be funds available for projects that help improve water quality by reducing salinity levels.

For more information see: http://www.usbr.gov/dataweb/html/crwq.html.

Federal Facilities

Federal water facilities, such as those operated by BLM and USACE, may provide multiple benefits, including water supply, flood control, power development, and environment and recreation benefits. Reservoirs often provide flatwater recreation and habitat opportunities as well as beneficial environmental and recreational downstream flows.

For more information see: http://www.usbr.gov/dataweb/, https://www.nwo.usace.army.mil/, http://www.spa.usace.army.mil/, and http://www.spk.usace.army.mil/

Federal Energy Regulatory Commission (FERC) Licenses

Under the Federal Power Act, FERC issues licenses for non-federal hydroelectric projects requiring compliance with state and local requirements. Many hydroelectric projects currently need to renew their licenses. This triggers a review process in which water quality and other environment and recreation benefits/impacts may be reviewed and addressed.

For more information see: http://www.ferc.gov/ and http://www.ferc.gov/docs-filing/elibrary.asp

National Environmental Policy Act (NEPA) Reviews

NEPA requires federal agencies to prepare an Environmental Impact Statement (EIS), evaluating environmental impacts of a proposed action(s) and to consider alternatives that may avoid or reduce impacts. Potential environment and recreation impacts as a result of changes in flows are identified and either avoided or mitigated.

For more information see: http://www.epa.gov/compliance/nepa/eisdata.html

Forest Management Plans

In accordance with the National Forest Management Act of 1976, national forests are required to develop a comprehensive management plan. These plans include management, protection, use goals and guidelines, and monitoring plans. Periodically, these plans are revised to adapt to changing conditions and management strategies.

For more information see: http://www.fs.fed.us/emc/nfma/index.htm and each individual National Forest website.

USGS Data Gathering on Water Quality and Quantity

The USGS collects water quality and flow data through the National Water-Quality Assessment Program (NAWQA) and the National Streamflow Information Program (NISP), respectively. The USGS operates and maintains approximately 7,000 stream gages that collect long-term stream flow data through the NISP. In Colorado, the NAWQA program collects water quality data from the South Platte, Upper Colorado River, and Rio Grand Valley Basins.

For more information see: http://water.usgs.gov/nawqa/ and http://water.usgs.gov/nsip/

Wild and Scenic River Designation (WSR)

Passed in 1968, the WSR serves to preserve selected rivers that possess not just "wild and scenic" qualities but also "outstanding remarkable scenic, recreational, geologic, fish and wildlife, historic and cultural or other similar values." Congressional intent was to complement water development activities on some rivers with preservation of free flowing river conditions on other rivers. Currently, the Cache La Poudre is the only WSR in Colorado. The BLM, National Park Service, and U.S. Fish and Wildlife Service are the primary agencies charged with designating a river as a WSR.

For more information see: http://www.rivers.gov/

CWCB Programs

CWCB Instream Flow Program

The 1973 General Assembly enacted SB 97, which created the Colorado ISF and Natural Lake Level Program ("ISF Program") to be administered exclusively by the CWCB. The CWCB is solely responsible for the appropriation and protection of ISF and natural lake level water rights to preserve the natural environment to a reasonable degree and the acquisition of water rights to preserve and improve the natural environment to a reasonable degree. To date, the CWCB has appropriated and adjudicated approximately 1,500 water rights in approximately 8,500 miles of streams and 476 natural lakes. In addition to new appropriations, state law also authorizes the CWCB to acquire existing water rights on a voluntary basis to preserve or improve the natural environment.

For more information see: http://cwcb.state.co.us/Streamandlake/.

Recreational In-Channel Diversion Rules

In 1999, several municipalities filed for a water right for recreational purposes. The water court approved the application and it was affirmed by the Supreme Court in a 3-3 decision.

In 2001, in response the General Assembly passed SB 216. This bill provided that local governmental entities could apply for water rights for RICDs, but limited these types of water rights to the "minimum stream flow" "for a reasonable recreational experience in and on the water." Section 37-92-102, C.R.S. requires applicants for RICD water rights to provide a copy of their application to the CWCB. Under SB 216, the CWCB was required to review an application for an RICD and submit findings and recommendations to a water court within 90 days of the expiration of the Statement of Opposition period.

For more information see: http://cwcb.state.co.us/WaterSupply/RICD.htm

Other State and State-Administered Federal Programs

401 Certification

The state has to certify that the construction and operation of any project requiring a federal approval (404, FERC license, federal discharge permit) will meet all applicable state water quality requirements. The statute sets forth Best Management Practices (BMPs) that may be imposed to help ensure compliance with state water quality standards. The state can also include conditions on the 401 certification to ensure compliance with state water quality standards.

For more detailed information see: http://www.cdphe.state.co.us/wq/PermitsUnit/index.html

National Pollution Discharge Elimination System Permits

The NPDES, under the CWA, requires discharge permits for municipal and industrial wastewater and stormwater. The Water Quality Control Division issues permits for the majority of discharges in Colorado. Permits may include conditions to protect water quality. USEPA issues permit for federal facilities and on American Indian reservations. Permits are renewed every 5 years.

For more information see: http://www.cdphe.state.co.us/wq/PermitsUnit/index.html and http://cfpub.epa.gov/npdes/

State Classifications and Standards

The Colorado Water Control Commission decides on an appropriate level of water quality for stream reaches by first assessing how the water is used and identifying the desired future beneficial uses. Colorado surface waters may be classified for the following uses: recreation, aquatic life, agriculture, water supply, and wetlands. Numerical and narrative water quality standards are assigned to stream reaches to protect the classified uses.

For more information see: http://www.cdphe.state.co.us/op/wqcc/index.html

Exchange and Substitution Statutes

Colorado Water Law requires that if an upstream user takes water that a senior downstream user would otherwise receive, the water must be replaced at the time, location, quantity, and of suitable water quality that the downstream user experienced prior to the exchange or substitution. This protects senior downstream users and can indirectly help maintain water quality for downstream environment and recreation purposes.

For more information see: http://water.state.co.us/wateradmin/wateradmin.asp

319 Projects

Section 319 of the CWA established the 319 NPS Management Program under which states, territories, and Indian tribes receive federal grant money for NPS implementation projects. The states are responsible for submitting their funding plans to USEPA, in which USEPA awards funding as long as the state's plans are within the grant eligibility requirements and procedures.

For an example project see: http://www.epa.gov/nps/Success319/state/co_mos.htm

HB 1132 Regulations
HB 1132, passed in 2007 and signed on March 12, was enacted to address water quality protection in water court for change of use applications for large water transfers. Specifically, for a change of type of use of water rights that transfers more than 1,000 AF of water per year, the water judge is allowed to include a term or condition that addresses decreases in water quality caused by the change.

For the exact bill text see: http://www.leg.state.co.us/Clics/Clics2007A/csl.nsf/fsbillcont3/B7940B3E87651B5A87257251007A063B?Open&file=1132_enr.pdf

HB 1012 Regulations
HB 1012, passed in 2007 and signed on March 14, was enacted to amend C.R.S. 37-83-105(2) to state that any loaned water right used by the Board for ISF purposes will not negatively impact historic CU analysis. Additionally HB 1012 under C.R.S. 37-92-103 revises the definition of "abandonment of a water right" to state that the loan of water to the CWCB for ISF use shall not be used to determine abandonment.

For the exact bill text see: http://www.leg.state.co.us/Clics/Clics2007A/csl.nsf/fsbillcont3/85F8683D5A1CD69887257251007B8552?Open&file=1012_enr.pdf

Local Tools

HB 1041 Regulations
HB 1041, codified at Section 24-65.1-101 et. seq., C.R.S., was passed in the 1970s to address impacts associated with growth in Colorado. HB 1041 gave local governments a voice in the development of projects that benefit one community but cause impacts in another community. Specifically, HB 1041 Regulations allow consideration and mitigation of impacts associated with water projects. Typically, HB 1041 regulations require the project proponent to obtain a permit to construct the project. The local government may require terms and conditions in the permit to mitigate environmental, social, and economic impacts associated with the project.

Local Land Use Regulations
Counties and municipalities have other land use tools available to protect water quality and even require mitigation of water projects. For example, municipalities may adopt a watershed ordinance to protect the watershed above its water supply intake. Special use permit regulations can also be structured to require mitigation of a project.

Conservation Easement
A conservation easement is a legal agreement between a landowner and a qualified land organization that restricts the amount and type of development that can occur on the property. This may prevent the landowner from selling or transferring water rights associated with the property. In Colorado, land owners are eligible for a state tax credit and conservation easements have been used to preserve open space and keep land in agriculture in perpetuity.

Recreational In-Channel Diversions Statute and Regulations
These regulations provide authority for local governments to seek RICDs. See Section 4.3.3 for more detail.

Stream Restoration Projects
As competition for water resources increases, local communities are looking for stream restoration projects that utilize less water. These projects often provide habitat enhancement to stream reaches that experience low flow conditions without requiring increased flows. Grants are often available for these projects.

Voluntary Flow Management Programs
These are programs in which reservoir operations are modified to provide recreational flows for downstream users. Dillon Reservoir has been operating voluntarily to optimize downstream flows for boaters for specific periods of time to benefit recreation and the environment.

Water System Re-optimization
The operation of major water systems can be optimized to enable a better balance between meeting consumptive and nonconsumptive needs.

Numerous tools are available to determine if re-operation of the system will provide additional benefits to both consumptive and nonconsumptive water users.

Multi-stakeholder and Market Based Tools

Multi-Party Voluntary Flow Management Programs

Multi-party programs in which river flows are managed to provide recreational flows for downstream users. For example, the Arkansas River Recreation Management Plan includes the BLM, Colorado Department of Natural Resources' (DNR's) Division of Parks and Outdoor Recreation, U.S. Forest Service, and Colorado's Natural Resources Division of Wildlife. The objective of this plan is to emphasize the Arkansas River Headwaters Recreation Area's natural resources, sustainability, and public land health, while respecting private property and embracing education, recreation, and commercial activities. In some situations, these plans may be of use when RICDs or instream-flow water rights may not be exercised due to water rights constraints.

Water Court Decree Stipulations

In order to obtain a water right in Colorado, an application must be filed with the appropriate water court division. All applications are filed in the "resume" and local newspaper. Any person may submit a statement of opposition within 45 days. The water referee reviews the application and statement(s) of opposition and provides recommendations. Protests to the referee's recommendations may be filed, initiating a water court hearing. Following the hearing, the water judge decides whether the water right is granted or denied. This process enables water right holders to protect their water rights and apply for new rights.

Decrees for Piscatorial Use

In order to obtain a decreed water right, the applicant must show that the water is being put to beneficial use. Piscatorial use is considered a beneficial use, usually in the context of a storage water right. Water rights for piscatorial uses have been granted at a number of locations, including Taylor Reservoir where the concept of using releases from storage to protect ISFs was first developed when the Upper Gunnison Conservancy filed for enough water for a second filling of the reservoir. Other examples with decrees for piscatorial use include Elkhead and Wolford Reservoirs.

Temporary Water Transfers

Water rights may be donated to the CWCB for ISF use. The donation of senior water rights is especially beneficial to the ISF Program. Water rights may also be donated on a temporary basis, providing additional flows to decreed ISF rights for a period of time. Special lease agreements between the CWCB and other governmental agencies, including the BLM and the Colorado Division of Parks have occurred where leased water supplemented ISF water rights.

Water Sales

Water rights may be sold and purchased for conservation and environment benefits. They must be donated to the CWCB or utilized for a recognized beneficial use. The mission of the Colorado Water Trust is to acquire and provide assistance to others in acquiring water rights for conservation. In addition to this nonprofit organization, a variety of other governmental agencies and non-profits such as the CWCB, TNC, and the Colorado Coalition of Land Trusts strive to acquire water for conservation purposes.

Subordination Agreements

A subordination agreement is a legal agreement by which a senior water right holder allows a junior right holder to be satisfied out of priority. Subordination agreements may be developed to allow senior water right holders to subordinate their water rights to a junior ISF water right, providing environmental benefits. The SEO will generally not approve selective subordinations, but will administer a subordination that is authorized by a water court decree.

4.5.4 Summary of Findings

The TRT compared different types of water rights and other mechanisms that provide environmental and recreational flows that can be used in implementation of projects recommended by the BRTs. In addition, the TRT provided a summary of legal mechanism that provide for protection of environment and recreation needs. As the roundtables complete their needs assessments, the legal/water rights/institutional/ political questions asked by the TRT will need to be considered again when implementing the recommendations of the BRTs' needs assessments.

4.6 Overview of Select Environmental and Recreational Projects

During the course of the TRT process, several examples of successfully implemented environment and recreation projects were discussed. These examples follow within this section. In addition, several other proposed environment and recreation projects have been proposed by several entities and are provided as examples of types of environment and recreation projects.

The following case studies were developed by members of the Environment and Recreation TRT shown below. The purpose of the case studies was to highlight multi-purpose projects around the state that could be used by others as examples of what elements these types of projects could contain, and to represent success stories that other projects could emulate.

Case Studies:	
Elkhead Reservoir	Blue River/Moser Donation
• Taylor Hawes	• Taylor Hawes
Arkansas Agreement	Grand Valley Canal
• John Gertis and Rob White	• Tom Iseman
Ruedi Reservoir	Tarryall River/Reservoir
• Michelle Garrison	• Lynda James
Animas River Stakeholder Group/ Carbon Lake	Wolford Agreement
• Peter Butler	• Taylor Hawes

4.6.1 Elkhead Reservoir

The reservoir enlargement project involved raising the dam height by 25 feet, thereby increasing water storage from 13,800 to 24,888 AF.

Wetland Mitigation

Higher water levels will submerge existing wetlands. Wetlands mitigation sites were created along the County Road 78 detour, on the west ends, at the upstream end, on an island near the middle of the reservoir, and in Muddy Gulch. Waterfowl nesting on the island will be isolated from terrestrial predators. All mitigation areas will be planted with wetland brush and related plants when the reservoir refills in the spring of 2007.

Recreational Facilities

About $1 million in funding for the project from Colorado State Parks, and the GOCO Trust Fund (lottery funds) are available for recreational facilities. An extended and widened boat ramp will be constructed on the west side; the primary campground will be relocated to the boat ramp area; the East Beach will be rebuilt above the new reservoir levels; and the east end of the detour will likely be incorporated into a boat ramp for fishing boat use

The Partners

The enlargement of Elkhead Reservoir is a cooperative effort among the River District, the Upper Colorado River Endangered Species Recovery Program, the City of Craig, the Colorado DNR, CWCB, and the Craig Station power plant.

Upon completion, surplus water will be available for maintaining streamflows in the Yampa River for endangered fish such as the Colorado pikeminnow and for growing human needs.

Elkhead Reservoir Facts

- Current capacity: 13,800 AF
- New capacity: 24,888 AF
- Cost: $30 million ($500,000 CWCB Grant for Feasibility and $11,110,000 CWCB Construction Loan Fund)

- Old dam elevation: 6,378 feet
- New dam elevation: 6,403 feet

4.6.2 Arkansas River Flow Agreement

The Colorado Division of Parks and Outdoor Recreation also collects one-quarter of one percent of gross from commercial boating outfitters operating within the Arkansas Headwaters Recreation Area (AHRA) to assist in the funding of water purchases. This .25 percent generates approximately $30,000 in revenue each year for Colorado State Parks. In return Colorado State Parks sets aside approximately $100,000 each year to purchase supplemental water for the Voluntary Flow Program (if needed in addition to the Voluntary Flow Program water supplied by the BOR to maintain flows of 700 cfs from July 1 - August 15).

There is continued cooperation between the BOR and the Southeastern Colorado Water Conservancy District (SECWCD) in the implementation of an annual flow program for fisheries and rafting in the Upper Arkansas River Basin, consistent with the operation of the Frying Pan-Arkansas Project.

These recommendations for May 2005 to May 2006 are intended to provide an annual flow regime that helps the state maintain the brown trout fishery, meet the demand for boating recreation, and support the region's tourism industry while allowing the managers of the AHRA to meet their obligation to manage recreation and natural resources within the area's boundaries. Implementation of these flow management recommendations will be subordinate to the rights of water owners and water users, and must not impair their associated diversions, storage, or exchanges of water. All flows recommended here should be measured at the Wellsville gauge.

Specifically, with respect to the 2005-2006 flow program recommendations included:

1. The highest priority is the maintenance of a minimum year-round flow of at least 250 cfs to protect the fishery.
2. Winter incubation flows (mid November through April) should be maintained at a level of not more than 5 inches below river height during the spawning period (October 15 to November 15). The optimum flow range is from 250 to 400 cfs, depending on spawning flows:

Minimum Incubation Flow Nov.16 – Apr. 30		Spawning Flow Oct. 15-Nov. 15
250 cfs	if	300-500 cfs
325 cfs	if	500-600 cfs
400 cfs	if	600-700 cfs

Source: Arkansas River Needs Assessment. July 2000.

3. To the extent possible, between April 1 and May 15, BOR should maintain flows within the range of 250 to 400 cfs in order to provide conditions favorable to egg hatching and fry emergence.
4. Deliveries in excess of 10,000 AF should be subject to review and consideration, prior to such deliveries, by the BOR, the SECWCD, and DNR.
5. Subject to water and storage availability, BOR should augment flows during the July 1 to August 15 period at 700 cfs through releases from the Fryingpan-Arkansas Project. The 700 cfs level is a target; when augmentation occurs, every effort should be made to ensure that flows are as close to 700 cfs as possible. The Division of Parks and Outdoor Recreation, using funds collected from commercial outfitters, shall be responsible for replacing evaporative losses caused by summer augmentation.
6. BOR should avoid dramatic fluctuations on the river as much as possible throughout the year. When it is necessary to alter flow rates, BOR should limit the daily change to 10 to 15 percent.
7. It may be possible to improve feeding conditions for brown trout by reducing flows between Labor Day and October 15 in years when flows would otherwise be higher than those recommended by the CDOW. If potential benefits warrant the effort, AHRA managers, the

CDOW, BOR, and the Division II Engineer should work with water users to seek opportunities for reducing flows after Labor Day.

4.6.3 Ruedi Reservoir

Ruedi Reservoir is located on the Fryingpan River about 15 miles east of Basalt, Colorado. It was constructed from 1964-1968 as part of the federal Fryingpan-Arkansas water diversion and delivery project. Ruedi Dam is about 285 feet high and the reservoir stores up to 102,000 AF of water. Surface area of the reservoir is about 997 acres.

The Fryingpan-Arkansas Project

The Fryingpan-Arkansas Project is a multi-purpose transmountain, transbasin water diversion and delivery project built and operated by the BOR to provide supplemental water supplies to southeastern Colorado. It makes possible an average annual diversion of 69,200 AF of water from the Fryingpan River and other tributaries of the Roaring Fork River on Colorado's western slope, to the Arkansas River Basin on the eastern side of the Continental Divide.

Diversions to the Arkansas River are made upstream of Ruedi Reservoir out of the Fryingpan and Hunter Creek basins. Ruedi's role on the project is to provide storage for replacement and regulation of approximately 100,000 AF of water for western slope use.

Ruedi and the Western Slope

The "active conservation pool" or water available for use in Ruedi is divided into two sections. Water in the replacement portion of the reservoir is released to protect senior western Colorado water rights. When the Frying Pan-Arkansas project is diverting water at the same time senior water rights downstream are short (or "calling"), water is released from Ruedi Dam to allow the project to continue diverting while making downstream rights "whole" at the same time. Additional protection for local fisheries and recreation is also provided by the project's operating principles, which include limits on the diversions to southeastern Colorado, minimum bypass requirements at most project diversion points, and minimum flows below Ruedi.

Water in the regulatory portion of the reservoir is available to be leased to Western Colorado water users and to provide for environment and recreation purposes. To date BOR has contracted 13,964 AF of water and has pending requests for an additional 5,071 AF. These contracts provide water for western Colorado irrigators, domestic users, municipalities, and industries.

Recreation, Fish, and Wildlife

Twenty thousand AF of the regulatory capacity has been set aside to preserve recreational opportunities on the reservoir. Sailing, boating, fishing, camping, and other related recreational opportunities are available at Ruedi Reservoir. The U.S. Forest Service (USFS) manages recreation at the reservoir and operates one campground there.

Development of Ruedi Reservoir has increased available fishing in the area. There is a gold medal trout fishery downstream of the dam. The BOR coordinates regularly with local entities to manage operational releases from the dam to better maintain fishing accessible flows in the lower Fryingpan River.

The BOR also continues to work with and support the work of its various partners along the Fryingpan River. For example, the Roaring Fork Conservancy, Ruedi Water and Power Authority, and the Colorado River Water Conservation District have initiated the Ruedi Futures study to better quantify the recreation, economic, and ecologic values of the lower Fryingpan River Valley, including the Town of Basalt. To view reports of past studies, please visit: http://www.roaringfork.org/sitepages/pid136.php.

Since the mid-1990s, operations of Ruedi Reservoir are also used to benefit the Upper Colorado River Basin Endangered Fish Recovery Program. As mitigation to allow leasing of water from Ruedi to western Colorado users, BOR committed to several different release schedules to augment late summer flows in a 15-mile reach of designated "critical habitat" of the Colorado River between Cameo and

Grand Junction, Colorado. Those commitments include the water release of:

- 5,000 AF annually.
- 10,825 AF annually through 2012.
- 5,000 AF when available, approximately every 4 out of 5 years.

In years where there is above average snowpack, Ruedi Reservoir also participates in a voluntary springtime Coordinated Reservoir Operations (CROs). CROs coordinate the bypass of snow melt inflow into several upper basin reservoirs while at the same time achieving reservoir fill objectives. By passing the snow melt through the reservoirs on downstream, reservoir operators help enhance the natural river peak of the Colorado River in the 15 Mile Reach, recreating conditions to aid recovery of the four endangered fish.

4.6.4 Carbon Lakes Ditch Removal

Over the past 12 years the Animas River Stakeholders Group (ARSG) has worked to improve water quality and aquatic habitat in the Animas River Watershed. ARSG is a coalition of government agencies (local, state, and federal), mining interests, environmental groups, and interested citizens that meet approximately 10 times a year in Silverton.

Characterization

Through exhaustive water quality sampling and modeling including sampling over 175 draining mines and 200 mine waste piles, ARSG has estimated metal loading from mining sources versus non-mining sources and recommended site specific water quality standards leading to the development of 29 TMDLs. Studies show that one of the biggest loading areas is the region east of the summit of Red Mountain Pass.

Project Setting

Above the highway on the east side of Red Mountain Pass, a transbasin water diversion used to capture water and carry it from the Animas Watershed to the Uncompahgre Watershed. The ditch passed over workings of a mine that is one of the biggest metal loaders in the Animas Basin. In addition, over the years the ditch has suffered a number of blowouts, eroding the fragile alpine environment.

Actions Taken

In 2001, ARSG secured a 319 non-point source grant ($50,000) to purchase the water rights to the diversion. Later, with funding ($12,400) from the USFS and ($5,000) from the Southwestern Water Conservation District (SWCD), the ditch was reclaimed and re-vegetated. SWCD took control of the water rights and donated them to the CWCB ISF program, contributing over $9,000 for legal services in the process.

The purchased water will help maintain a cutthroat fishery in a small tributary of the Animas and increases dilution to reduce metal concentrations in the mainstem. Most importantly, the water flowing into the mine has been diminished. Because of liability concerns and economic costs, it is far preferable to limit the water reaching the mine workings than to treat the contaminated discharge leaving the portal. Of the 50 or so remediation projects undertaken in the watershed, this is one of the most innovative and successful.

4.6.5 Moser – Colorado Water Trust Transaction

The Colorado Water Trust ("Trust"), a non-profit corporation, bought the Peabody #1 Ditch and Peabody #1 Ditch, Lund Enlargement & Extension water rights in Summit County on a tributary to the Blue River from the Mosers ("Moser Rights") in May 2005. The CWCB, by means of an acquisition agreement dated December 2004 and amended May 2005 (the "Acquisition Agreement"), acquired the rights from the Trust.

CWCB filed an application in water court to change the use of the Moser Rights to allow the rights to be used for ISF purposes exclusively by the CWCB, pursuant to C.R.S. § 37-92-102(3), to preserve and improve the natural environment for the reach of Boulder Creek and the Blue River lying between the headgate of the Peabody #1 Ditch on Boulder Creek and Green Mountain Reservoir on the Blue River.

This change will reserve the CU portion of the Moser rights, making the CU portion of the rights available to the Trust or its assignees for subsequent use downstream from the ISF reach. Water obtained via this change of use will be in addition to any water to which the Board would otherwise be entitled pursuant to its existing decreed ISF rights on Boulder Creek and the Blue River.

The Trust has contracted to sell the consumptive use of the Moser rights to the Colorado River Water Conservation District ("River District"). They propose to change the use from irrigation to all beneficial uses, including but not limited to municipal, commercial, industrial, domestic, irrigation, agricultural, livestock, hydro-power production, evaporation, piscatorial, and recreational (including in-reservoir and in-river fish habitat and river flow maintenance and enhancement uses and uses in furtherance of the Upper Colorado River Basin Fishes Recovery Program consistent with Wolford Mountain Reservoir decrees).

4.6.6 Tarryall Creek Restoration

Tarryall Creek stream, wetland, and riparian habitats have been degraded by various land use practices. The endeavor to restore Tarryall Creek is a collaborative effort between local, state, and federal governments and local landowners. Partners in the restoration project include, among others, the Park County Land and Water Trust Fund, Park County Commissioners, USFS, Teller-Park Natural Resources Conservation District, Centennial Water and Sanitation, Aurora Utility Department, and the CDOW Wetlands Initiative. There are three elements to the Tarryall Creek Restoration Project:

1. After the Tarryall Reservoir dam was repaired and prior to filling the reservoir, Denver Water Board (DWB) created a minimum pool necessary to reduce sedimentation downstream of the reservoir. Once the reservoir filled, the water was paid back to DWB. This was very important to keep sedimentation out of the creek to prevent the destruction of any completed stream restoration work.
2. The creek was restored using various geomorphic and engineering techniques.
3. A fishing program was implemented.

Vision for the Restoration of Tarryall Creek

- To restore and maintain a stable, healthy, functioning stream and riparian ecosystem that allows for continued agricultural use, recreational opportunities, and a productive fishery.
- Stream Restoration is part of an overall approach to improve and protect the Tarryall Valley.

Tarryall Creek Restoration Goals

- Stream stability
- Riparian habitat
- Fish habitat
- Water quality
- Agriculture
- Recreational opportunity
- Aesthetics/beauty

4.6.7 Wolford Mountain Reservoir

Wolford Mountain Reservoir, located on the Muddy Creek in Grand County, Colorado, features cooperation among Colorado's water users.

The reservoir, owned and operated by the Colorado River District, benefits both Western Colorado and the Eastern Slope. The West Slope gains a 66,000 AF reservoir and, in exchange for financial support, Denver Water can use up to 40 percent of Wolford's water. The project is financed by Denver Water, CWCB, and NCWCD.

Western Colorado

The future economic health of towns, cities, recreation, industry, and agriculture all depend on a secure source of water. Wolford Mountain Reservoir provides this source. For adjacent Kremmling and surrounding communities, the reservoir enhances tourism by adding camping, fishing and boating opportunities.

Recreation

Wolford Mountain Reservoir recreational facilities include:

- Lake and stream fishing
- Boat ramps
- Boat rentals
- Picnic areas
- 48-unit overnight camping spots with RV hookups
- Hiking and mountain biking
- Wildlife viewing
- State-of-the-art fish cleaning station
- Facilities for the physically challenged

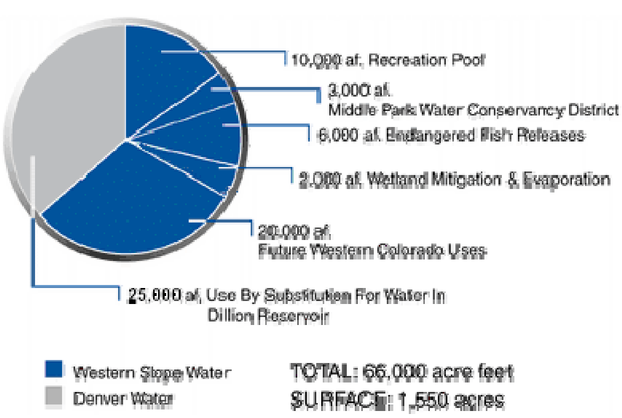
The Colorado River District and the CDOW have steadily stocked Wolford Mountain Reservoir since its opening with trout and kokanee salmon. The District and the CDOW have also established a fishery downstream of the dam on Muddy Creek.

Supporting Wildlife

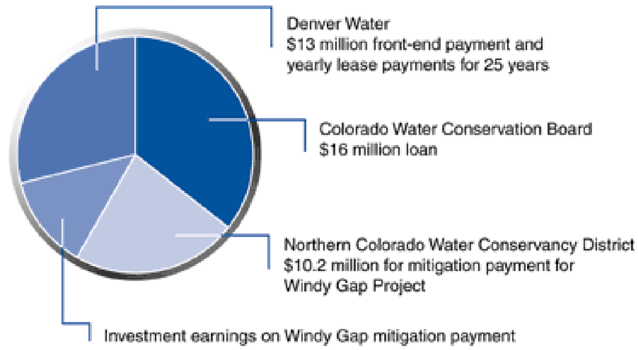
The Colorado River District committed 6,000 AF of Wolford Mountain Reservoir water as mitigation to assist recovery efforts of Colorado's endangered fish species that include the Colorado pikeminnow, the humpback chub, the razorback sucker and the bonytail.

Wolford Mountain Reservoir is a popular winter range for elk and deer. Habitat improvements on Wolford Mountain east of the reservoir reduce big game movement across U.S. Highway 40 and the reservoir.

Water Use



Financing



4.6.8 Inventory of Projects Identified by the Environment and Recreation TRT

Discussions during the Environment and Recreation TRT meetings generated the following list of environment and recreation projects that should be considered to address environment and recreation needs.

- San Miguel River – CCC Ditch
- Alamosa River – Natural Resource Damage Funding for ISF
- Republican/Arickaree – aquifer sustainability, compact compliance, and plains fish protection
- Roaring Fork River – water rights acquisitions for ISF
- Dolores River – Dolores River Dialogue
- Yampa River – Diversion structure consolidation
- Colorado Headwaters Initiative Partnership – Colorado River – Riparian vegetation restoration
- Halligan-Seaman
- South Platte – Chatfield Reallocation
- Cochetopa Creek
- Purgatoire River
- Hat Creek – ISF donation

These projects are in various stages of completion and may be seeking future funding opportunities.

Additionally, Table 4-10 is the CDOW project list included in the SWSI Report (2004). This list is included here in consolidated form so that interested parties are aware of CDOW's ideas for future projects. Table 4-11 is a list of projects initiated by local watershed groups.

Table 4-10 Colorado Division of Wildlife Projects included in SWSI Report

Basin (Sub-catchment)	Project	Description	CDOW Priority	State of Implementation
Gunnison River (Cochetopa Creek)	Cochetopa Creek/ Archuleta Ck - Coleman Easement	Relieve perennial bottleneck (Dry-up) below Smith-Ford Headgate #2 on Cochetopa Creek. Address riparian habitat degradation and improving flow conditions on Cochetopa, Archuleta, Los Pinos, and Pauline Creeks.	HI	Tentative discussions between water right/ranch owner, Regional and Area manager(s), other interested parties have occurred; no resolution to date (Tier II).
Gunnison River	Aspinall Unit Operations EIS	Division of Wildlife and CWCB participation in operations discussions for the Aspinall Unit EIS process.	HI	Process ongoing (Tier I).
Gunnison River Basin	Aquatic Wildlife Management Plan	Provide management guidance and strategies in order to conserve and protect aquatic resources in the basin. Collaborative iterative (5-year) process w/ various intra-basin task force partners.	HI	Preliminary Draft – expected completion and approval in late 2004 (Tier I).
Colorado River	Shoshone Sediment Release	Improve timing and coordination of sediment releases from Shoshone diversion in order to maintain water quality during spring and fall spawns.	HI	Agreement w/ Excel (Shoshone operators) to revise release timing; permit revision may be required (Tier I).
Colorado River	Windy Gap Bypass Channel	Northern Colorado Water Conservancy District (NCWCD) bypass channel - discussions to improve access upstream and aquatic conditions downstream of Windy Gap reservoir; mitigate reservoir effects on Upper Co River fishery.	HI	Ongoing discussions w/ NCWCD, other interests (Tier I).
Colorado River (Abrams Creek)	Cutthroat habitat restoration	Water exchange w/Division of Parks and Outdoor Recreation and others to expand Co River cutthroat habitat in Abrams Creek.	HI	Analyses of water rights and discussions w/ other interests ongoing (Tier II).
Colorado River (Eagle River)	Gypsum State Wildlife Area Instream Habitat Improvement	Improve instream habitat conditions in the Eagle River on the west end of the Gypsum Ponds State Wildlife Area.	MED-HI	Initial planning and data collection; no final plan to date. Bank stabilization ongoing. (Tier I).
Colorado River (Eagle River)	Eagle Mine Superfund Project	Mitigation projects for Eagle Mine impacts.	HI	Ongoing (Tier I) – Round I Projects awarded; Round 2 pending.
Colorado River (Eagle River)	Summer Base-flow project	Low baseflows and high water temperatures increasing stress, disease on aquatic resources in Avon-Dotsero reach of Eagle River.	HI	Problem clearly identified; no substantive discussions or clear mechanism for solving problem identified at this point (Tier II).
Colorado River Basin	Aquatic Wildlife Management Plan	Provide management guidance and strategies in order to conserve and protect aquatic resources in the basin. Collaborative iterative (5-yr) process w/ various intra-basin task force partners.	HI	Plan in Draft – expected completion and approval in late 2004 (Tier I).
Yampa / White-Green Rivers	CO River listed T&E species Recovery Program	Complete Programmatic Biological Opinion (PBO) for T&E fish and critical habitat in the Yampa River.	HI	PBO process w/ U.S. FWS and partners nearing completion (Tier I).
Yampa / White-Green Rivers (White River)	White River/ Lake Avery (aka Big Beaver Reservoir)	Maintain/ improve administrative flexibility below Lake Avery to ensure water released for ISF purposes will be used for such purposes between the reservoir and Meeker.	MED	Successful verbal agreements to maintain instream releases were reached during 2002 (Tier I).
Yampa River	Chuck Lewis SWA Instream Habitat Improvement	Cooperative project to improve instream habitat conditions in the Yampa River at the Chuck Lewis State Wildlife Area.	MED-HI	Ongoing. Preliminary design nearing completion; implementation scheduled for fall 2005 (Tier I).

Table 4-10 Colorado Division of Wildlife Projects included in SWSI Report

Basin (Sub-catchment)	Project	Description	CDOW Priority	State of Implementation
Yampa River	Yampa River SWA stream gauging station	Component of ISF management for Yampa River T&E fish.	HI	Approval by CDOW; construction July 2004 (Tier I).
Yampa River	Yampa River Flow Enhancement	Maintain operational flexibility between major users and suppliers of water to mitigate drought impacts to fishery in Yampa River (i.e., Stagecoach to the Elk River).	MED	Successful re-operation/ exchange in 2002 allowed flow increases through upper reach that minimized effects of high water temperature (Tier I).
Yampa River Basin	Aquatic Wildlife Management Plan	Provide management guidance and strategies in order to conserve and protect aquatic resources in the basin. Collaborative iterative (5-year) process w/ various intra-basin task force partners.	HI	Plan completed; Discussions on 5-yr revisions ongoing (Tier I).
San Juan / Dolores / San Miguel (Dolores River)	Dolores River Below McPhee Reservoir	Combination of improved flow management and channel reconstruction/ rehabilitation to enhance downstream fishery; ancillary benefits to downstream native roundtail chub populations. Increase available Fish Pool water contemplated by Dolores Project Definite Plan Completion Report.	HI	Ongoing discussions b/ BOR, DWCD, Division of Water Resources (DWR) re: administration, opportunities, constraints w/ re-operation of fish pool. Ongoing efforts to enhance fish pool (AF storage in McPhee) (Tier I).
San Juan / Dolores / San Miguel (La Plata River)	La Plata River – Long Hollow Mitigation Flows	Ensure winter and late-season base flows in Long Hollow/ La Plata River to support native fish (roundtail chub).	HI	Discussions w/ project proponents, CWCB re: ISF needs for native fish (Tier II).
San Juan / Dolores / San Miguel (Fall Creek)	Woods Lake Cutthroat Refugio	Isolate Woods Lake and Fall River above the lake as a Colorado River Cutthroat Trout refugia.	MED-HI	Engineering design in place to address spillway/ outlet isolation; design underway for instream improvements above Woods Lake to ensure isolation (Tier I).
Dolores / San Miguel River Basin	Aquatic Wildlife Management Plan	Provide management guidance and strategies in order to conserve and protect aquatic resources in the basin. Collaborative iterative (5-yr) process w/ various intra-basin task force partners.	HI	Early phase of plan development; expected completion and approval in 2006.
San Juan River Basin	Aquatic Wildlife Management Plan	Provide management guidance and strategies in order to conserve and protect aquatic resources in the basin. Collaborative iterative (5-yr) process w/ various intra-basin task force partners.	HI	Plan in Draft – expected completion and approval in 2004 (Tier I).
South Platte River	Tarryall Reservoir Enlargement	Creation of additional storage which could be used in potential exchange agreements with other entities in the S. Platte drainage including Aurora, Denver, and Centennial. Project could work in synergy with Cheeseman and Strontia Springs Reservoirs to enhance sport fishery of Tarryall Creek and S. Platte River, and potentially could be used for wetland development in South Park.	HI	Presented in concept (Tier III).
South Platte River	Montgomery Reservoir Enlargement	Storage of additional Blue River or South Platte River water rights currently owned by Denver or Aurora which could be managed to improve stream flows and enhance the sport fishery in the Middle Fork and mainstem of the S. Platte River.	MED	Presented in concept. No Project authorization to date.
South Platte River	Tamarack Project	Creation of pump back recharge river credits and timed flow augmentation to enhance native, threatened and endangered species habitats in Colorado and Nebraska. Important component of Three State Agreement between Colorado, Wyoming, and Nebraska.	HI	Ongoing implementation (Tier I). Additional phases located on the State Wildlife Area awaiting MOU addressing operation agreement principles amongst entities involved.

Table 4-10 Colorado Division of Wildlife Projects included in SWSI Report

Basin (Sub-catchment)	Project	Description	CDOW Priority	State of Implementation
North Platte River	Lake John Expansion	Provide additional storage in Lake John by raising existing dams 4 feet. Provide additional augmentation water for the North Platte River and meet evapotranspiration losses of the reservoir. Would eliminate problems associate with winterkill of the trophy sport fishery in North Park.	MED	Presented in concept; no project authorization or expansion filing to date (Tier III).
Arkansas River (Beaver Creek)	Rehabilitate Skaguay Reservoir	Increase current storage capacity of 2056 AF up to the historical maximum capacity of 3079 AF. Revisit the potential for hydroelectric power generation to put existing CDOW decreed rights to beneficial use.	HI	High level of interest by local water users including Beaver Park Water Inc., Penrose Water District, City of Victor, City of Cripple Creek and Colorado Springs.
Arkansas River	Acquire additional pond and lake resources for habitat and fisheries	Utilize CDOW water rights to augment gravel pit ponds and stream flows for T&E fish species.	MED	Water For Wildlife acquisition of the Center Farms water rights will provide substantial water supply for future needs.
Arkansas River (Grape Creek)	Re-operate CDOW storage rights in DeWeese Reservoir	Investigate the potential to maximize the 500 AF storage right currently being used as a minimum pool for other beneficial uses such as exchanges with main stem Arkansas River or supplemental flows for habitat and fisheries in Grape Creek below reservoir.	LOW	CDOW has well established relationships with BLM and DeWeese Dye Ditch Co. that would aid in putting this storage space to additional uses.
Rio Grande River	Fully utilize transmountain return flows	Establish criteria and procedures that will prioritize annual surplus of transmountain return flows to full consumptive use.	HI	CDOW has developed the accounting tool necessary for the determination of available transmountain return flows and is using the preliminary data.
Rio Grande River	Continental Reservoir Storage Agreement	Acquire storage and water agreement in Continental Reservoir to protect fisheries resources and provide adequate access for angling from shore and boat.	MED	CDOW is investigating ways to re-establish the pool that previously existed.
Rio Grande River	Rio Grande Reservoir Operations	Winter flows below Rio Grande Reservoir are low after irrigation season. Low reservoir levels stress fish by warm temps and crowding.	MED	CDOW has a recent storage agreement that may offer potential for future exchange opportunities to meet wildlife goals.
Rio Grande River (Conejos)	Platoro Reservoir minimum flow modification.	Increase winter minimum flows below Platoro Reservoir. Consider dam operation changes to prevent extreme daily fluctuations in flow due to ramping.	MED	CDOW has transmountain waters sources that may be suitable for exchange to cover evaporative losses. Potential exists for leasing Joint Use Pool Water sources.
Rio Grande River	Dredging of conservation pools	CDOW has several permanent pools that have lost capacity due to siltation. A program for extended dredging can prolong the life of these reservoirs and preserve the CDOW conservation pool interests.	HI	CDOW has identified silt problems in Big Meadows, Beaver, Road Canyon, Upper and Lower Browns.
Western Slope - CO	Three-Species Conservation Strategy	Five-State Conservation Agreement and Strategy document(s) for long-term conservation and protection of three native fish populations (bluehead sucker, roundtail chub, flannelmouth sucker).	HI	Conservation Agreement between Arizona, Wyoming, Utah, New Mexico, and Colorado to be signed in spring 2004. Strategy document draft due Dec. 2004. La Plata and Mancos River roundtail chub broodstocks at Mumma Native Aquatic facility (Tier I).

Table 4-10 Colorado Division of Wildlife Projects included in SWSI Report

Basin (Sub-catchment)	Project	Description	CDOW Priority	State of Implementation
STATEWIDE	Water Quality	Continue to work through State's water quality rule-making procedures to improve standards and classifications for streams and water bodies. • Continue/ improve monitoring data collection. standardization, analyses, and posting. • Continue advising watershed assemblies on water quality and wildlife issues.	HI	Ongoing Division of Wildlife participation in WQCC hearings and other local processes to ensure non-degradation and cooperation on wildlife issues (Tier I).
STATEWIDE	Dynamic flows	Improve coordination and communication w/ water suppliers so that within operational, institutional, and hydrologic constraints, dynamic releases can be made to simulate natural flow conditions.	MED	No substantive discussions have occurred to date. Successful implementation in other western river systems and Canada (Tier III).
STATEWIDE	Return Flow Mitigation Project	Recognition of connectivity between irrigated agriculture and late-season baseflow and water temperatures. Ensure that changes to agricultural practices (e.g., sprinklers, or type-conversions) do not significantly impair or reduce these benefits.	LO-MED	No discussions. Inventory of affected areas not compiled and anecdotal to date (Tier III).

Source: SWSI Phase I Report, 2004.

Table 4-11 Projects Identified by Local Watershed Groups

Paonia River Park - $1,000,000	Gypsum Ponds Wildlife Area - $3,000,000
Tri-County Gravel Pit Rehabilitation, Hotchkiss - $1,200,000	Eagle Mine Restoration
Midway Restoration Project, North Fork of the Gunnison - $800,000	Pennsylvania Mine Reclamation, Summit County
Stewart Ditch Reconstruction, Paonia - $500,000	Kansas City Mine Remediation, Animas River
Farmer Ditch Reconstruction, Paonia - $500,000	Pride of the West Mine Remediation, Animas River
Relief Ditch Reconstruction, Delta - $250,000	Hayman Fire Restoration, Upper South Platte
Hartland Ditch Reconstruction, Delta - $800,000	Fountain Creek
Yampa River/Hayden Restoration Project - $1,100,000	Selenium Task Force
CCC Ditch, Nucla - $130,000	Standard Mine Remediation, Coal Creek, Gunnison County
Camp Hale Restoration Project, Eagle County - $5,000,000	James Creek Restoration Project, Jamestown
Edwards/Eagle River Restoration - $4,000,000	Cherry Creek Watershed Education Center
Black Gore Creek, Vail Pass	Willow Creek Restoration Project, Creede

Source: Colorado Watershed Assembly, 2006.

4.7 Conclusions

The Environment and Recreation TRT has:

- Assembled significant environment and recreation resource information statewide.
- Outlined examples of existing successful environment and recreation projects and management strategies.
- Identified potential future environment and recreation projects.
- Identified potential funding methods to address non-consumptive needs.
- Identified regulatory and non-regulatory tools to address non-consumptive needs.
- Outlined a procedure to work with the BRTs established under the Water for the 21st Century Act and other stakeholders to more fully address

the key questions and mission of the Environment and Recreation TRT.

The development of the GIS-based environmental and recreational coverages provides an initial identification of potentially important environmental and recreational resources or attributes in each of Colorado's major river basins. The coverages can serve as an initial resource to begin the delineation of non-consumptive water needs across the state.

In addition, in the future, it is envisioned that BRTs can further identify important environmental and recreational attributes for investigation and mapping. The selection process for identifying those attributes has not been determined; it is recommended that they tie back to the vision, goals, and socioeconomic future of the basin.

The coverages can be used by the BRTs to begin prioritizing their recreational and environmental water needs. The examples of successful environmental and recreational components of water projects presented in the Case Studies section can be used by the basin roundtables, water providers, and water agencies as a template for sustainable water development. A suite of funding strategies has been presented that can be used in project development. It was determined by the technical roundtables that there were adequate regulatory and non-regulatory tools to move the environmental and recreational projects forward.

4.8 Recommendations

Figure 4-32 outlines the process that was recommended by the Environment and Recreation TRT that the basin roundtables use to move from initial attribute selection to implementation of a management method or protection strategy for environment and recreation uses.

Since the completion of the TRT process, a nonconsumptive work group comprised of members from the BRTs and the Environment and Recreation TRT was formed to assist the BRTs in completing their nonconsumptive needs assessments. The process that the BRTs and the nonconsumptive needs assessment work group is utilizing to complete the nonconsumptive needs assessments is presented in Figure 4-33. The strategy outlines methods for the roundtables to build upon the SWSI 2 attributes, prioritize areas of environmental and recreational importance, and to quantify needs to protect these areas.

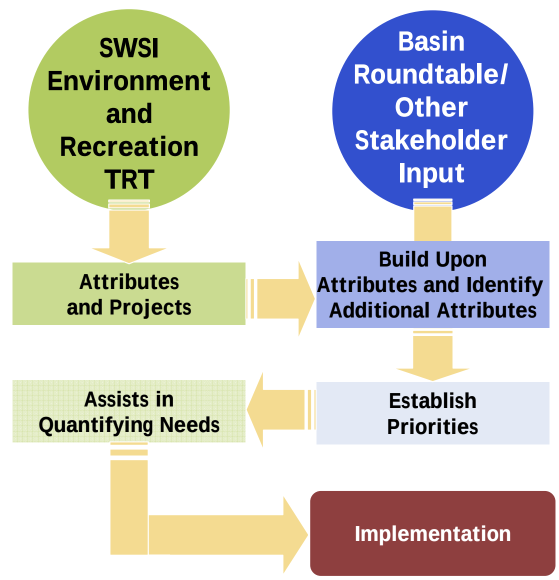


Figure 4-32
Environment and Recreation Prioritization

The selection process for identifying those attributes has not been determined; it is recommended that they tie back to the vision, goals, and socioeconomic future of the basin.

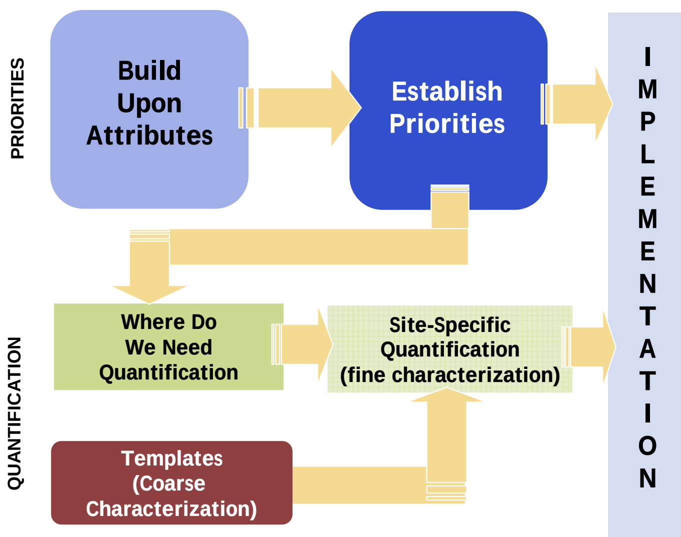


Figure 4-33
Non-consumptive Needs Assessment Overview

Based on discussions with the Environment and Recreation TRT, following are recommendations for consideration as the BRTs complete their nonconsumptive needs assessments:

- The nonconsumptive and consumptive needs assessments should be completed concurrently and coordinated. Once completed, the BRTs should use this information together to understand and evaluate tradeoffs that may occur in addressing water needs across the state.
- Each BRT should identify additional attributes that are reflective of local importance in their basins.
- Further work in identifying the density of fish species should be considered as part of the BRT Needs Assessments
- As part of nonconsumptive needs assessments distinguish between areas that have been sampled but no species were present versus areas that have not been sampled.
- For vegetation coverages further identify where CNHP has identified areas with low or no conservation value.
- The GIS attributes and datasets that have been developed as part of SWSI 2 and will be developed as part of the BRT Nonconsumptive Needs Assessments should be continually maintained by the CWCB in cooperation with CDOW.
- Develop a common technical platform for assessing environment and recreation needs is important. This includes making sure the process undertaken provides consistency and comparability within and between the basins.
- BRTs should continue to examine funding options and alternatives.

4.9 Environment and Recreation Roundtable Membership

Table 4-12 provides the names of members that participated or volunteered to serve on the Environment and Recreation TRT. Members included volunteers identified from the original SWSI BRT e-mail list as well as individuals recommended based on their interest in this issue and/or their professional expertise in the area of environment and recreation issues. Further members were added in order to provide for broad river basin and interest group representation. The CWCB expresses its deep gratitude to the members of the TRT for their assistance and participation.

Table 4-12 Environment and Recreation TRT Membership

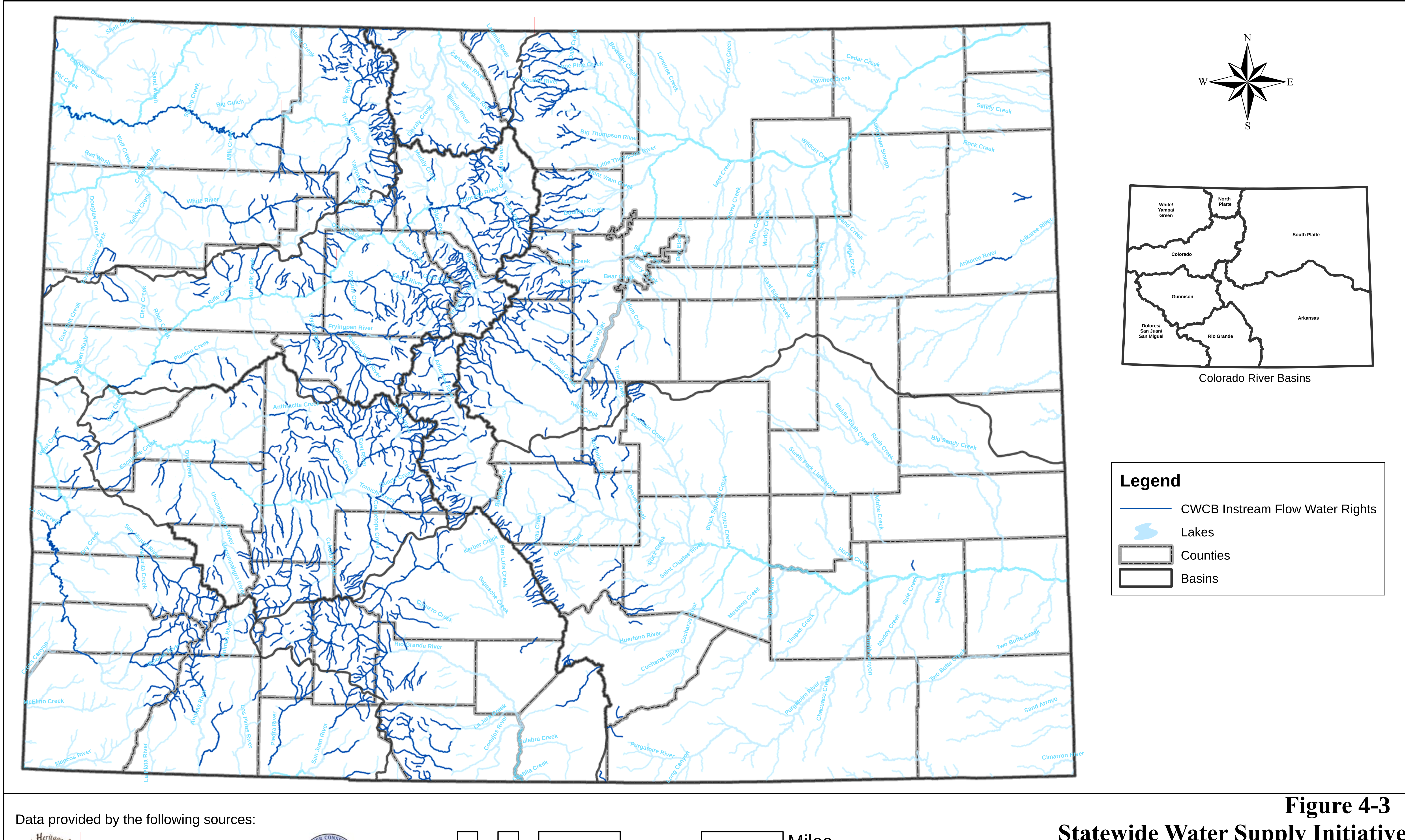
Member	Organization	Interest Category
Jeff Baessler	CWCB Statewide	Technical Advisor
Gary Barber	El Paso County Water Authority Arkansas River Basin	Local Government
Linda Bassi	CWCB Statewide	Technical Advisor
Bill Baum	General Council for Winter Park; Clinton Ditch and Reservoir Company Board Member Colorado River Basin	Recreation and Related Organizations
Janet Bell	Jefferson County South Platte River Basin	Local Government
Barbara Biggs	CWCB Board Member Statewide	Technical Advisor
Caroline Bradford	Eagle River Watershed Council Colorado River Basin	Environmentalists and Related Organizations
Travis Bray	Denver Water South Platte River Basin	Municipal Water Provider
Jim Broderick	Southeastern Colorado Water Conservancy District Arkansas River Basin	Water Conservancy and Conservation Districts
Peter Butler	Animas River Stakeholders Group, Ft. Lewis College Faculty Member, Former Water Quality Control Commission Member Dolores/San Juan/San Miguel River Basin	Environmentalists and Related Organizations
Jack Byers	Colorado Division of Water Resources Statewide	Technical Advisor
Steve Craig	Colorado Trout Unlimited Arkansas River Basin	Environmentalists and Related Organizations
Kristine Crandall	Roaring Fork Conservancy Gunnison River Basin	Environmentalists and Related Organizations
Jeff Crane	North Fork River Improvement Association Gunnison River Basin	Recreation and Related Organizations
T. Wright Dickinson	Rancher Yampa/White/Green River Basin	Agricultural, Ranching, Ditch, and Reservoir Companies
Reed Dils	Former Rafting Company Owner, Co-founder of Arkansas River Outfitters Assoc. Arkansas River Basin	Recreation and Related Organizations
Todd Doherty	CWCB Statewide	Technical Advisor
Greg Gerlich	Colorado Division of Wildlife Statewide	Technical Advisor
Steve Glazer	High Country Citizens Alliance, Sierra Club, Upper Gunnison River WCD Gunnison River Basin	Environmentalists and Related Organizations
Dave Graf	Colorado Division of Wildlife Statewide	Technical Advisor
Rick Hammel	Trout Unlimited Yampa/White/Green River Watershed	Environmentalists and Related Organizations
Steve Harris	Southwestern WCD Dolores/San Juan/San Miguel River Basin	Water Conservancy and Conservation Districts
Taylor Hawes	Colorado River Water Conservation District Colorado River Basin	Water Conservancy and Conservation Districts

Table 4-12 Environment and Recreation TRT Membership

Member	Organization	Interest Category
Hank Hotze	Black Canyon & Gunnison Gorge Expeditions Gunnison River Basin	Recreation and Related Organizations
Tom Iseman	The Nature Conservancy Statewide	Environmentalists and Related Organizations
Lynda James	Park County Land & Water Trust Fund South Platte River Basin	Environmentalists and Related Organizations
Anne Janicki	CWCB Statewide	Technical Advisor
Don Kennedy	Denver Water South Platte River Basin	Municipal Water Provider
Ted Kowalski	CWCB Statewide	Technical Advisor
Dave Little	Denver Water South Platte River Basin	Municipal Water Provider
Dan Merriman	CWCB Statewide	Technical Advisor
SeEtta Moss	Arkansas Valley Audubon Society Arkansas River Basin	Environmentalists and Related Organizations
Ken Neubecker	Trout Unlimited Colorado River Basin	Environmentalists and Related Organizations
Mark Pifher	City of Aurora South Platte River Basin	Municipal Water Providers
Rick Sackbauer	Vail Resorts and Eagle River Water Sanitation District Colorado River Basin	Recreation and Related Organizations
Terry Scanga	Upper Arkansas WCD Arkansas River Basin	Water Conservancy and Conservation Districts
Karen Shirley/ Dennis Steckel	Upper Gunnison River WCD Gunnison River Basin	Water Conservancy and Conservation Districts
Jay Skinner	Colorado Division of Wildlife Statewide	Technical Advisor
Albert Slap	The Nature Conservancy Statewide	Environmentalists and Related Organizations
John Taylor	San Juan Conservancy District, Southwestern Conservation District Dolores/San Juan/San Miguel River Basin	Agricultural, Ranching, Ditch, and Reservoir Companies
Patrick Tooley	Colorado Whitewater Association Statewide	Recreation and Related Organizations
Peter Van De Carr	Backdoor Sports, Friends of the Yampa, Steamboat Springs Parks and Rec Commission Yampa/White/Green River Basin	Recreation and Related Organizations
Kent Vertrees	Blue Sky West Yampa/White/Green River Basin	Recreation and Related Organizations
Chuck Wanner	San Juan Citizens Alliance Dolores/San Juan/San Miguel River Basin	Environmentalists and Related Organizations
Paul Weiss	City of Greeley South Platte River Basin	Municipal Water Providers
Patrick Wells	Colorado Springs Utilities Arkansas River Basin	Municipal Water Providers
Rob White	Arkansas Headwaters State Park Arkansas River Basin	Technical Advisor

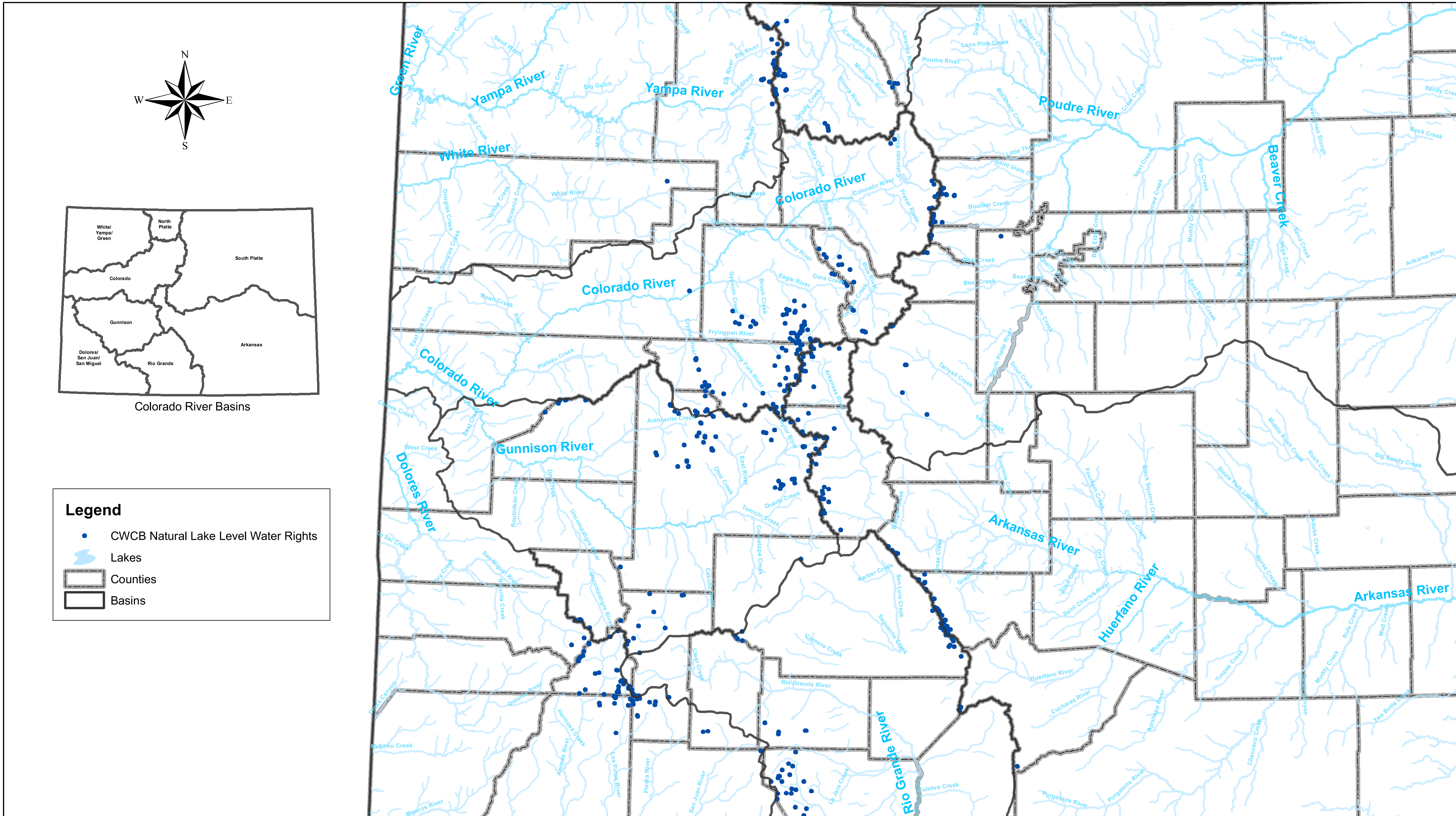
Table 4-12 Environment and Recreation TRT Membership

Member	Organization	Interest Category
John Wiener	University of Colorado Statewide	Technical Advisor
Brad Wind	Northern Colorado WCD South Platte River Basin	Water Conservancy and Conservation Districts
Lane Wyatt	Summit Water Quality Committee Colorado River Basin	Local Government
Rick Wyatt	Jackson County Commissioner North Platte River Basin	Local Government



Data provided by the following sources:

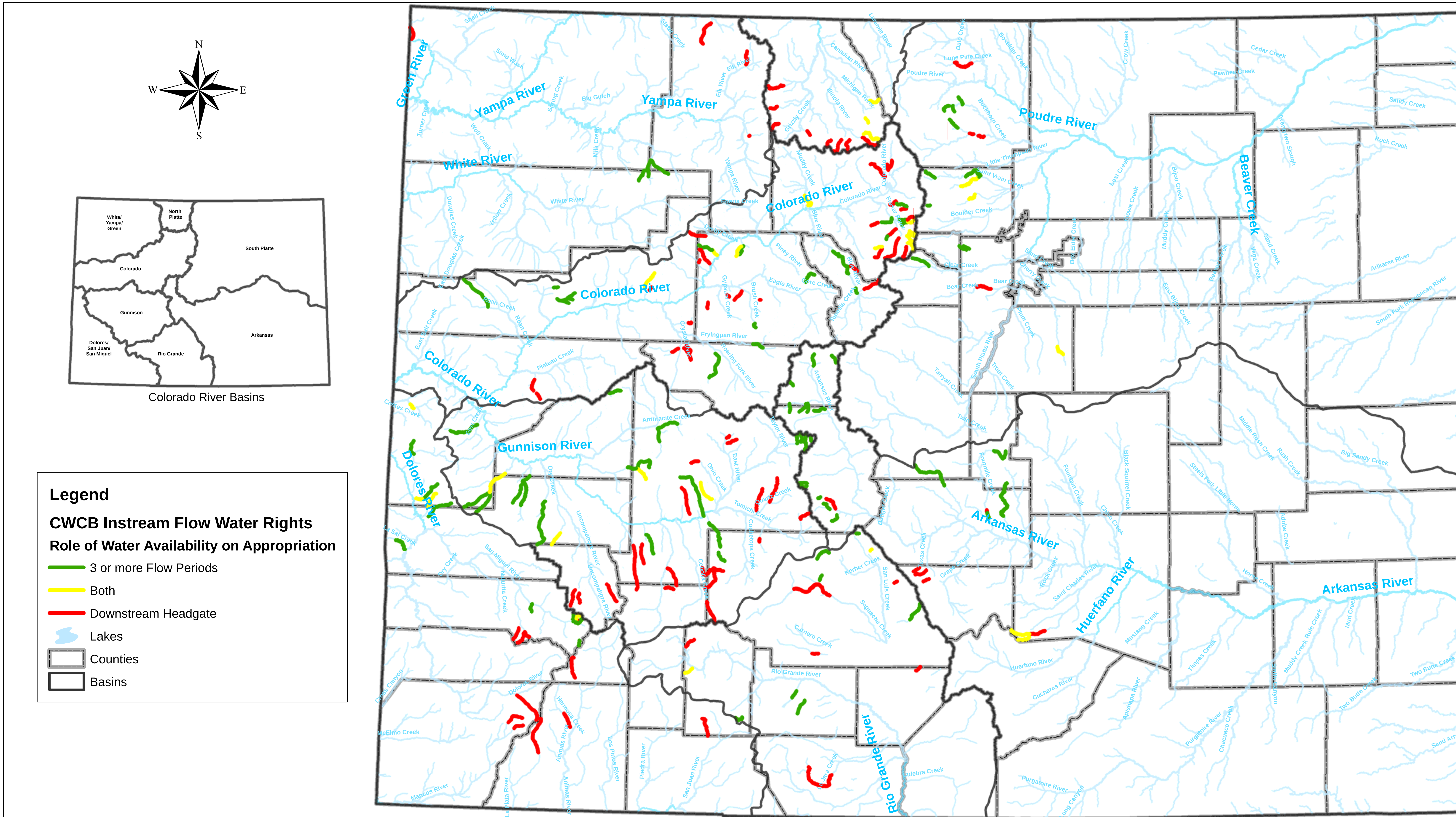
Figure 4-3
Statewide Water Supply Initiative
Environmental and Recreational Coverages
CWCB Instream Flow Water Rights



Data provided by the following sources:

0 15 30 60 90 120 Miles

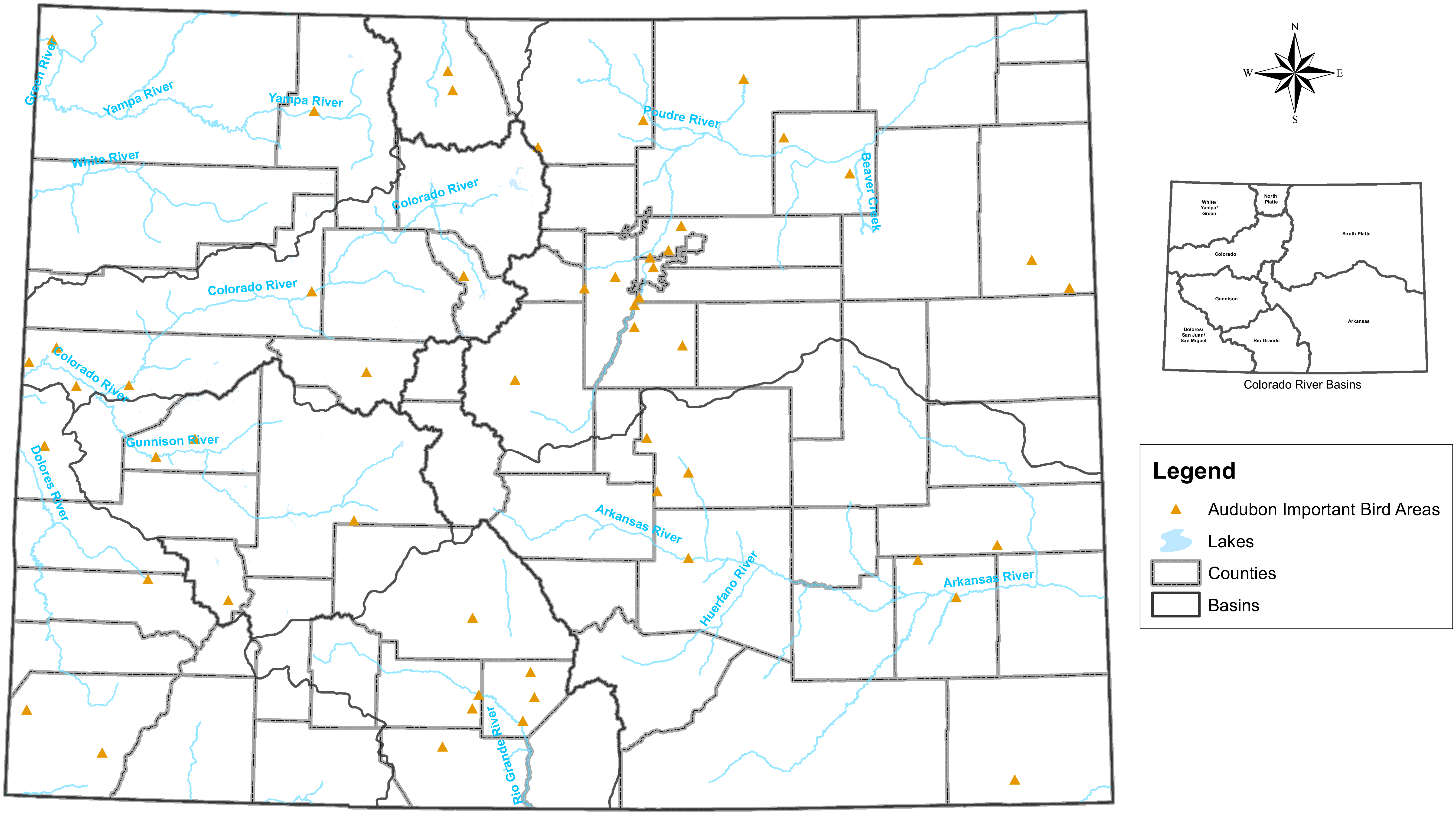
Figure 4-4
Statewide Water Supply Initiative
Environmental and Recreational Coverages
CWCB Natural Lake Level Water Rights



Data provided by the following sources:

0 15 30 60 90 120 Miles

Figure 4-5
Statewide Water Supply Initiative
Environmental and Recreational Coverages
CWCB Instream Flow Water Rights -
Role of Water Availability in Appropriation



Data provided by the following sources:

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Figure 4-6
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Audubon Important Bird Areas

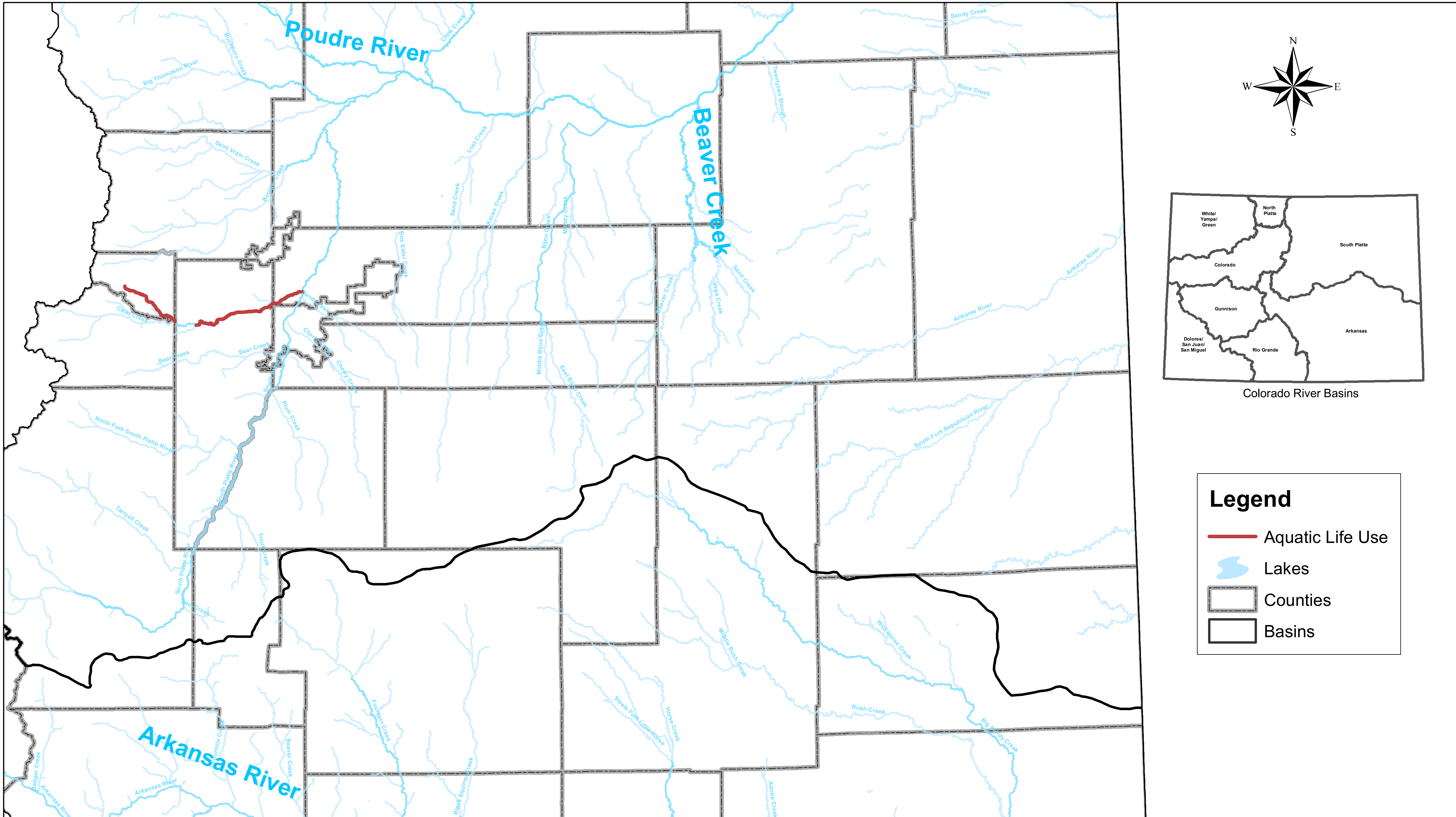

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Figure 4-7
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Water Quality Control Division 303(d) List - Aquatic Life Use

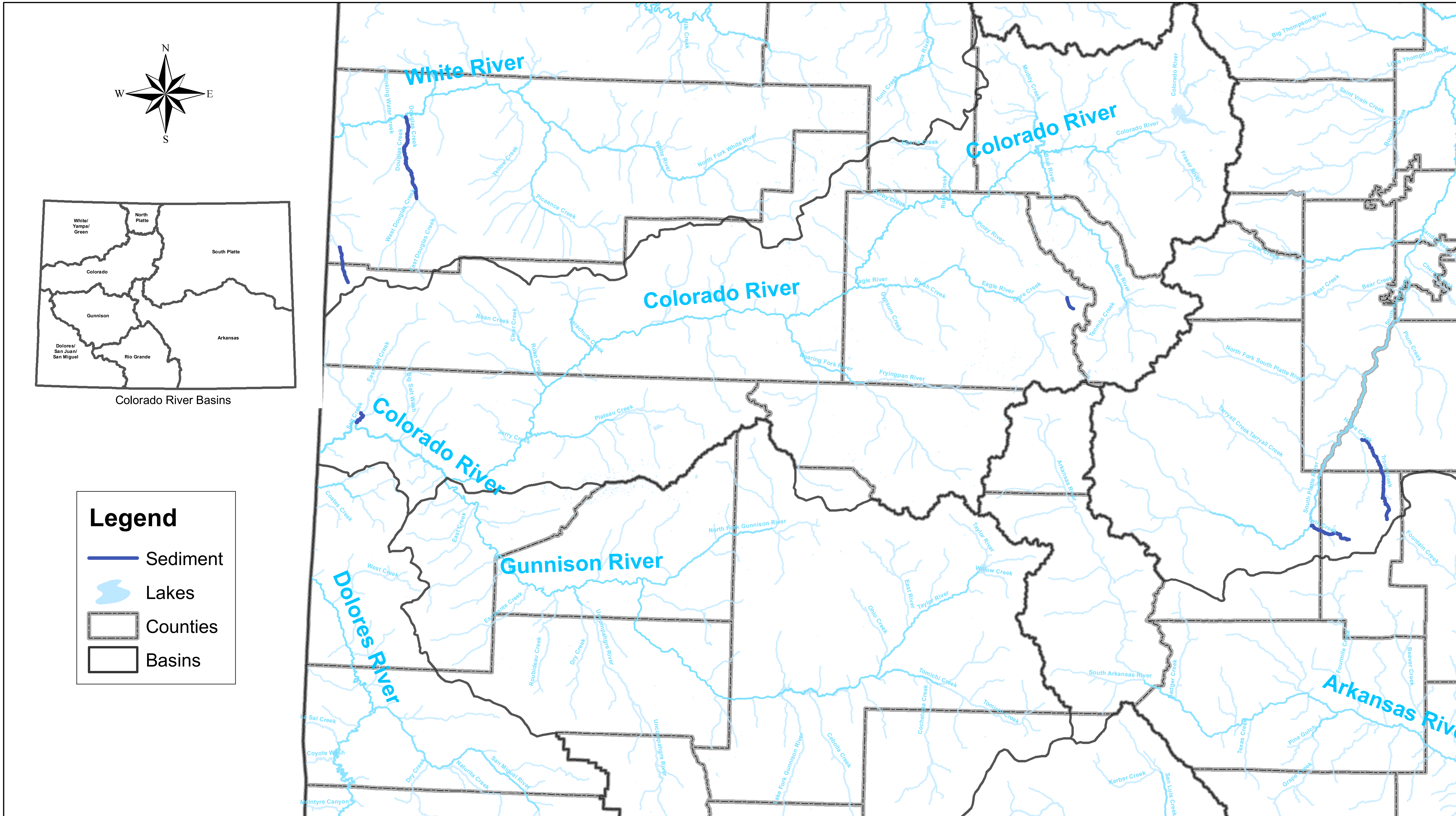

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Figure 4-8
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Water Quality Control Division 303(d) List - Sediment

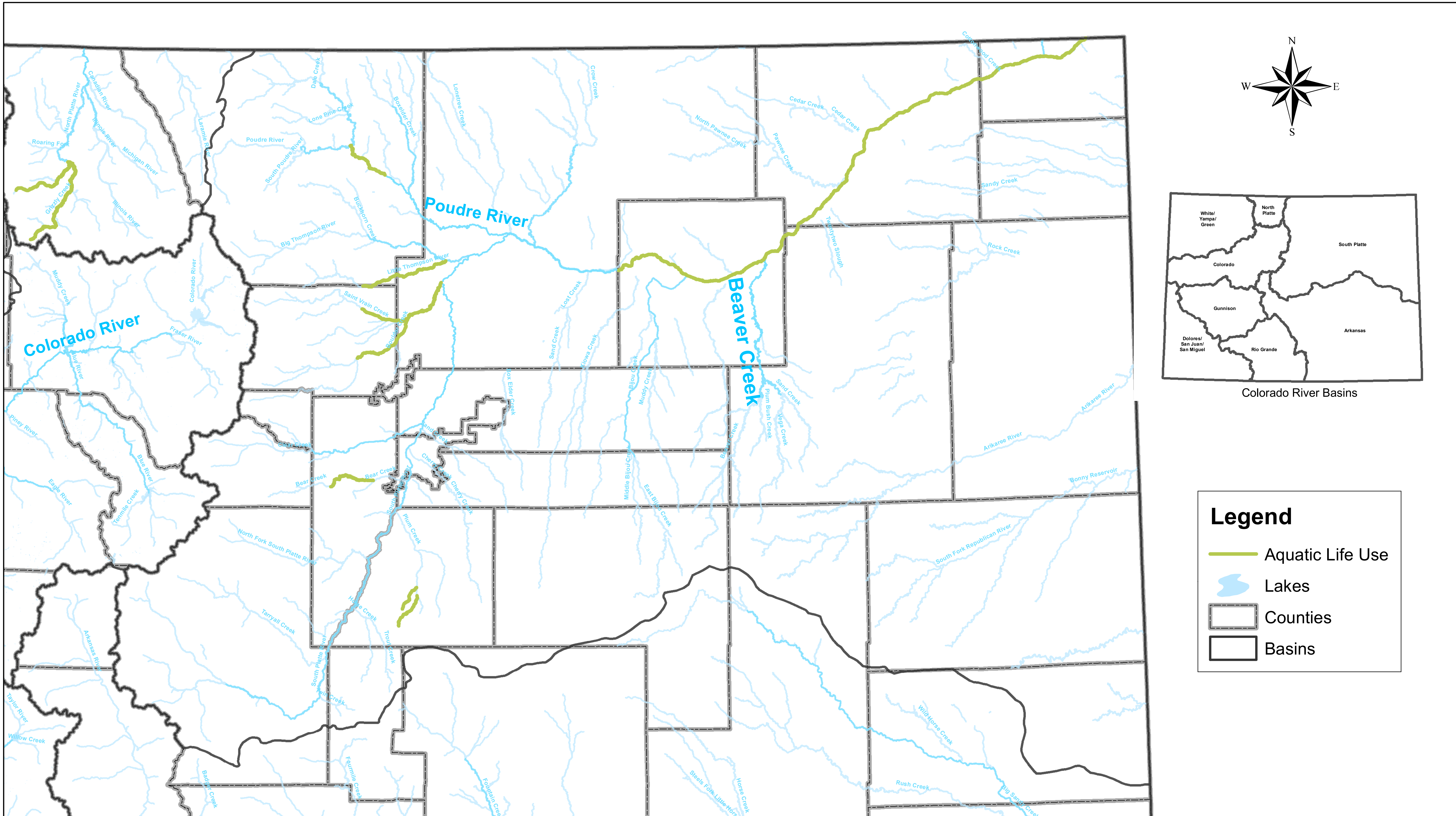

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Figure 4-9

Statewide Water Supply Initiative

Environmental and Recreational Coverages

Water Quality Control Division Monitoring and Evaulation List - Aquatic Life Use

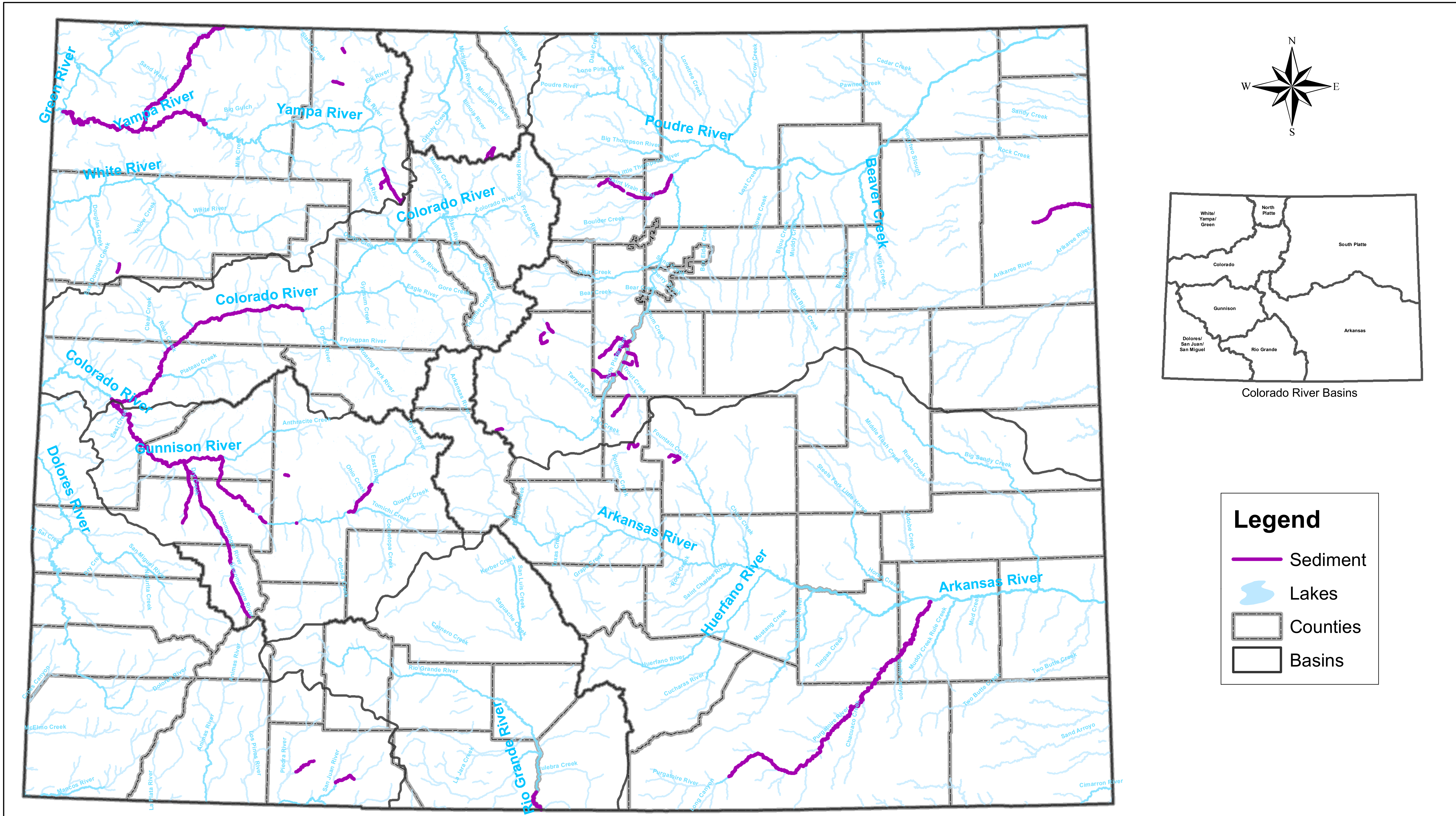

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Figure 4-10
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Water Quality Control Division Monitoring and Evaluation List - Sediment

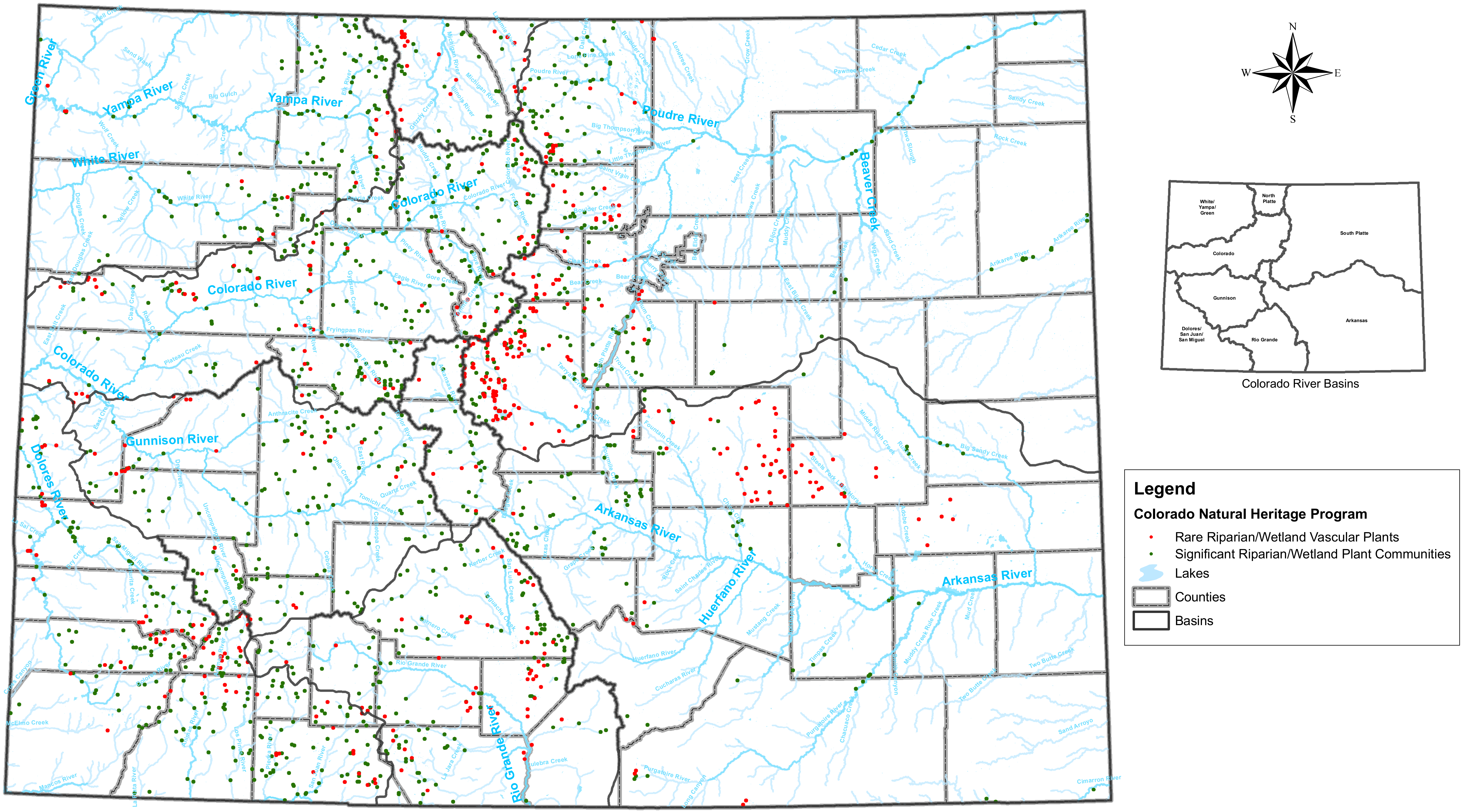

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Figure 4-11

Statewide Water Supply Initiative

Environmental and Recreational Coverages

Colorado Natural Heritage Program - Riparian/Wetland Plants and Plant Communities

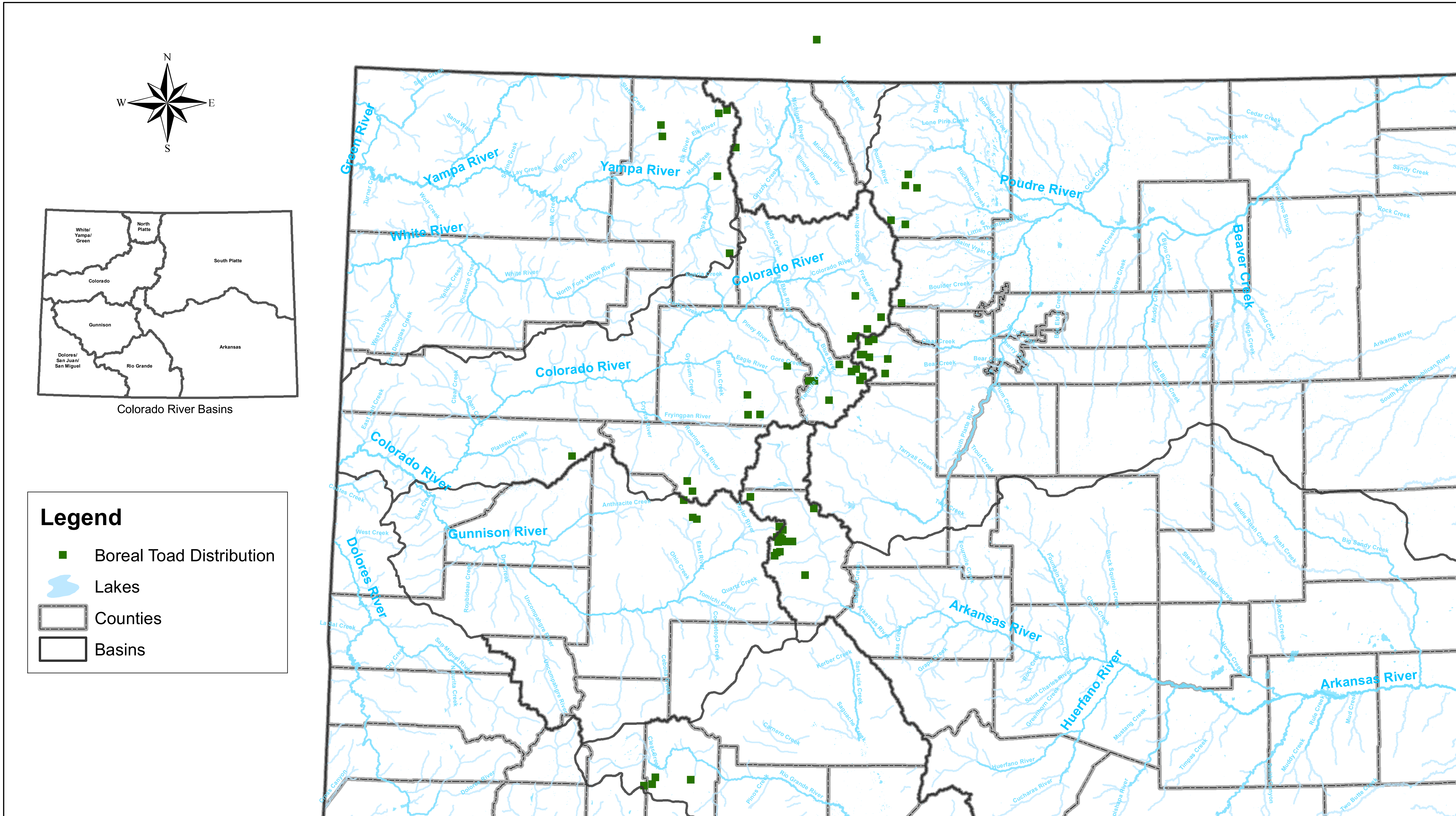

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Figure 4-12
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Boreal Toad Distribution

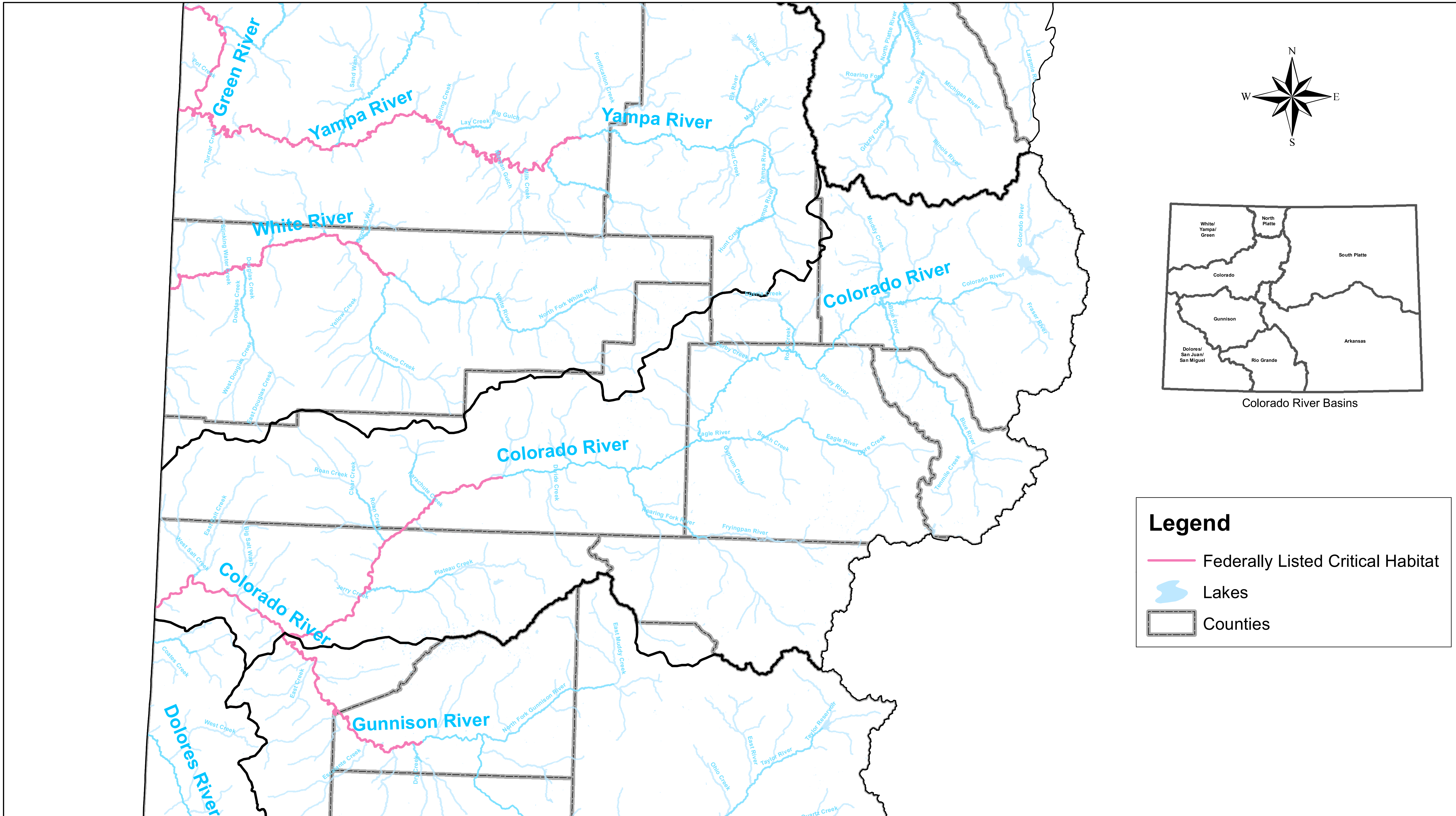

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Figure 4-13
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Federally Listed Critical Habitat

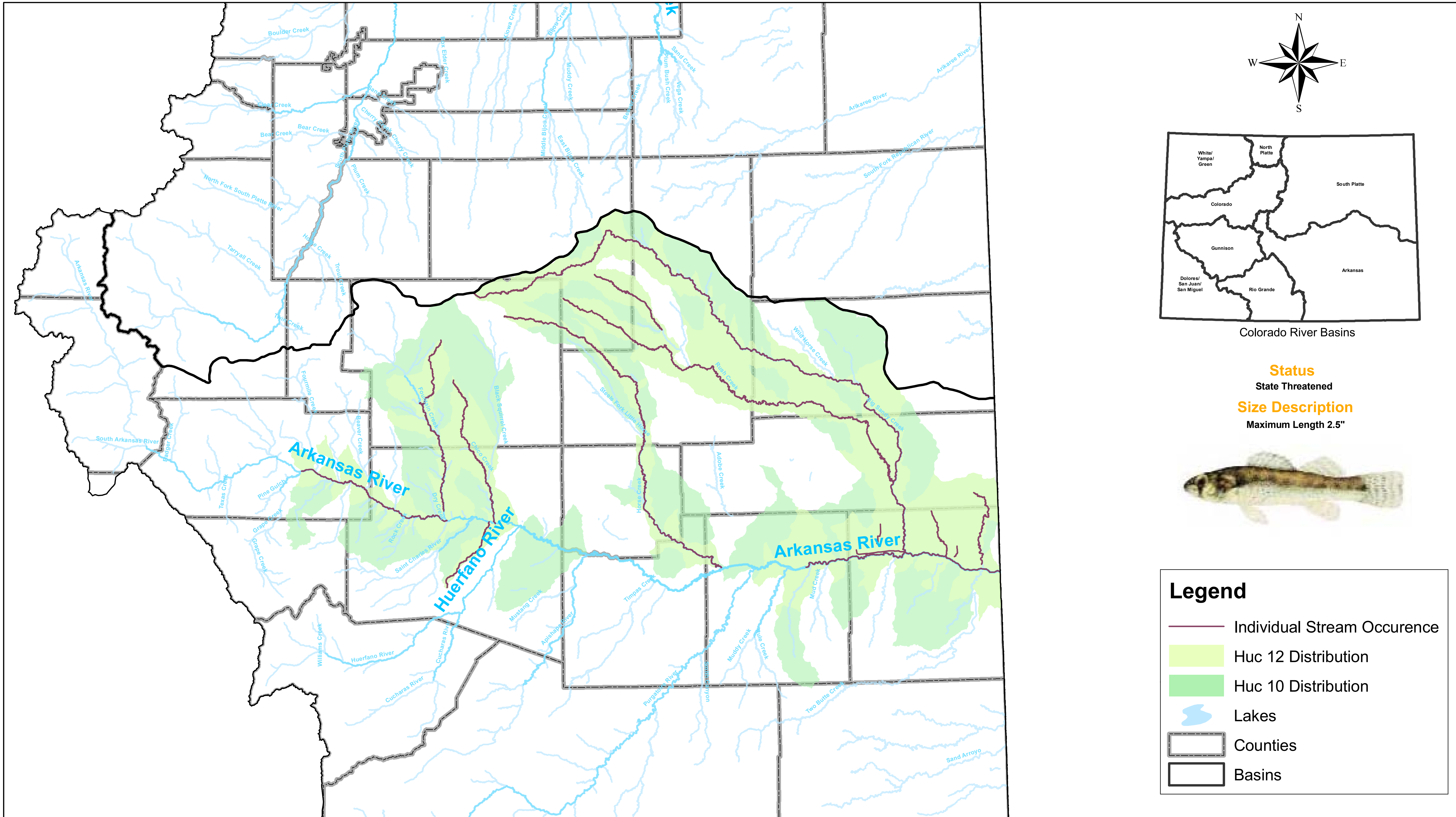

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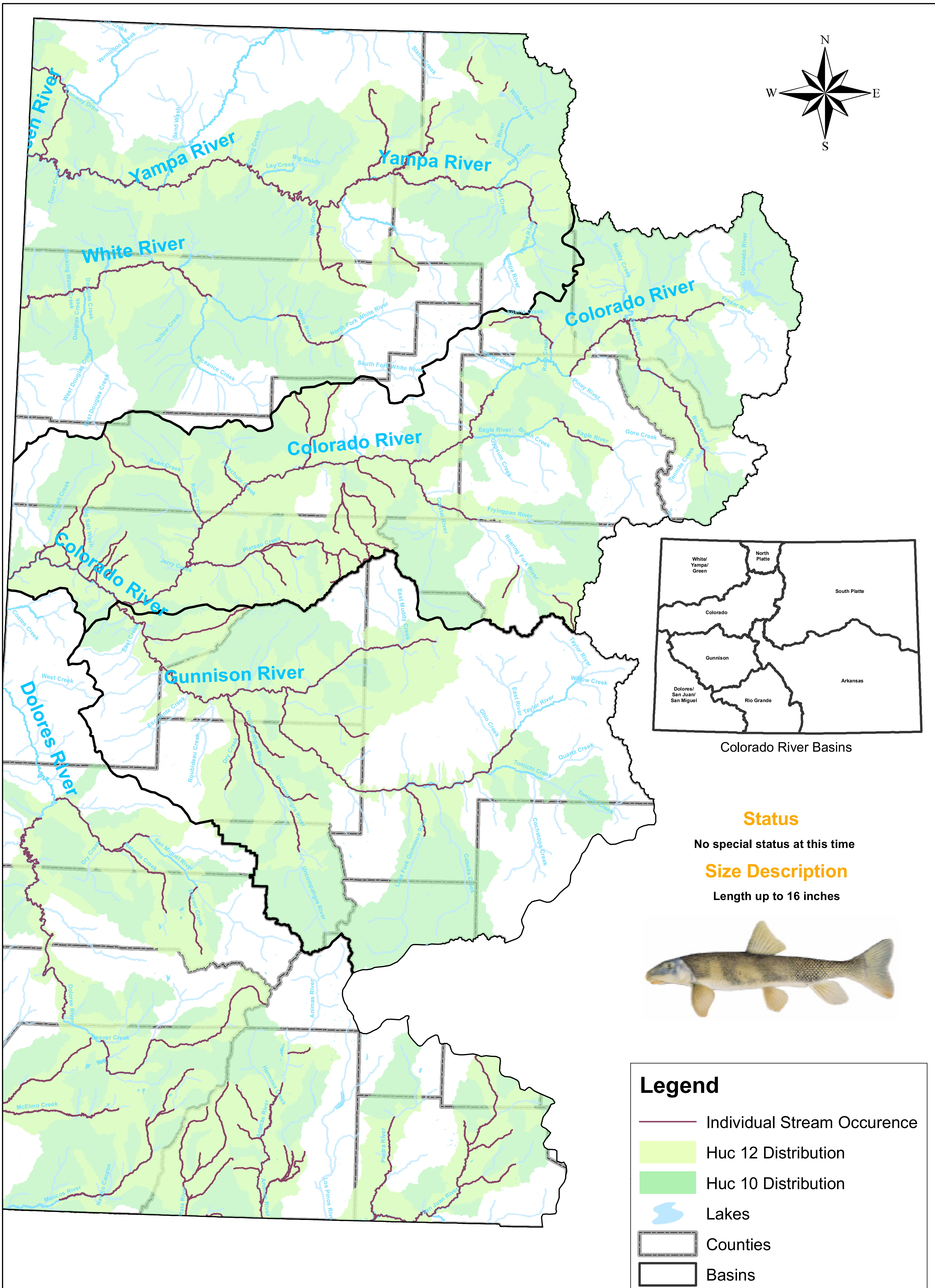
Figure 4-14
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Arkansas Darter Distribution



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Miles
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Figure 4-15
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Bluehead Sucker Distribution

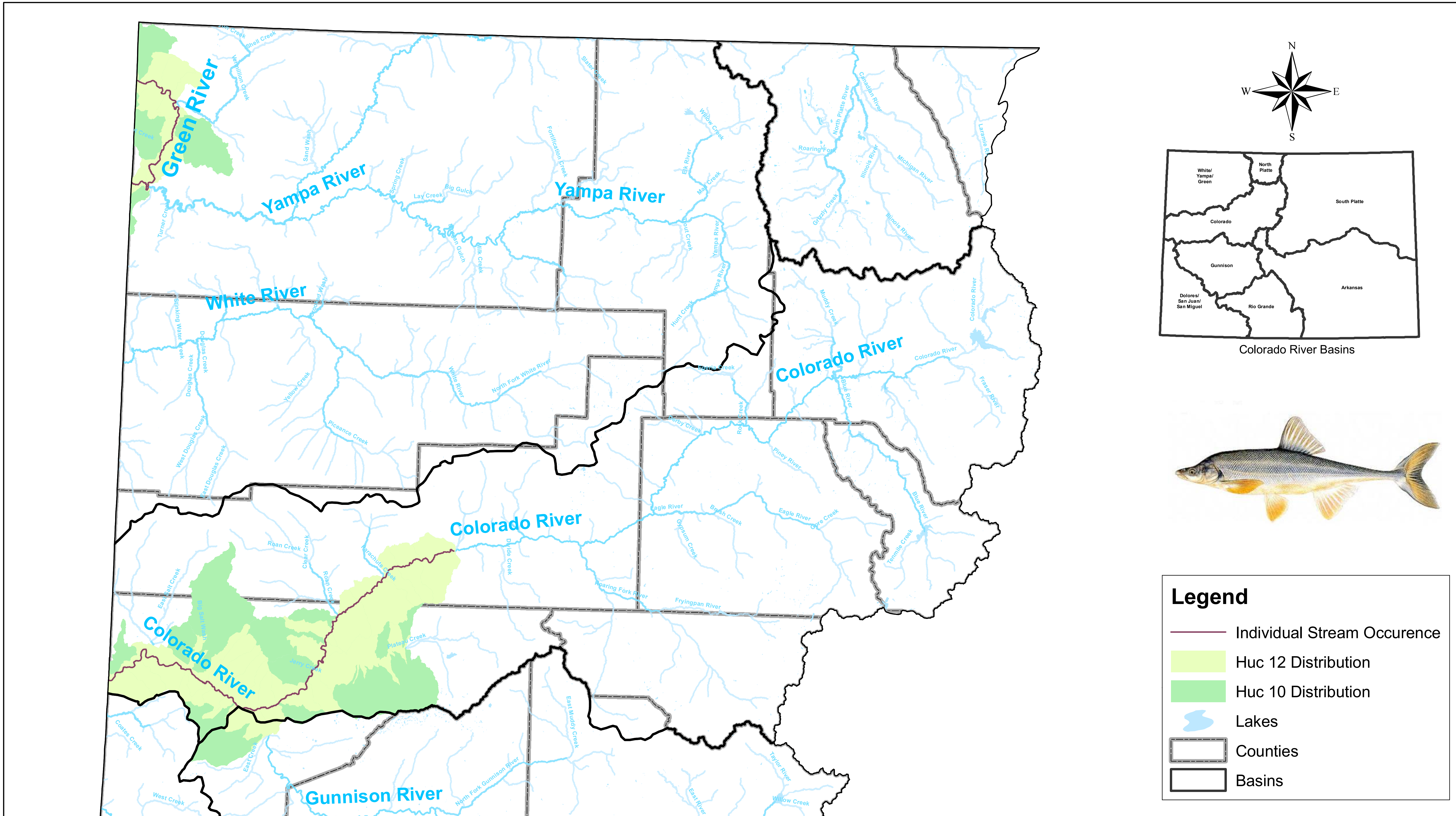

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Figure 4-16
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Bonytail Chub Distribution

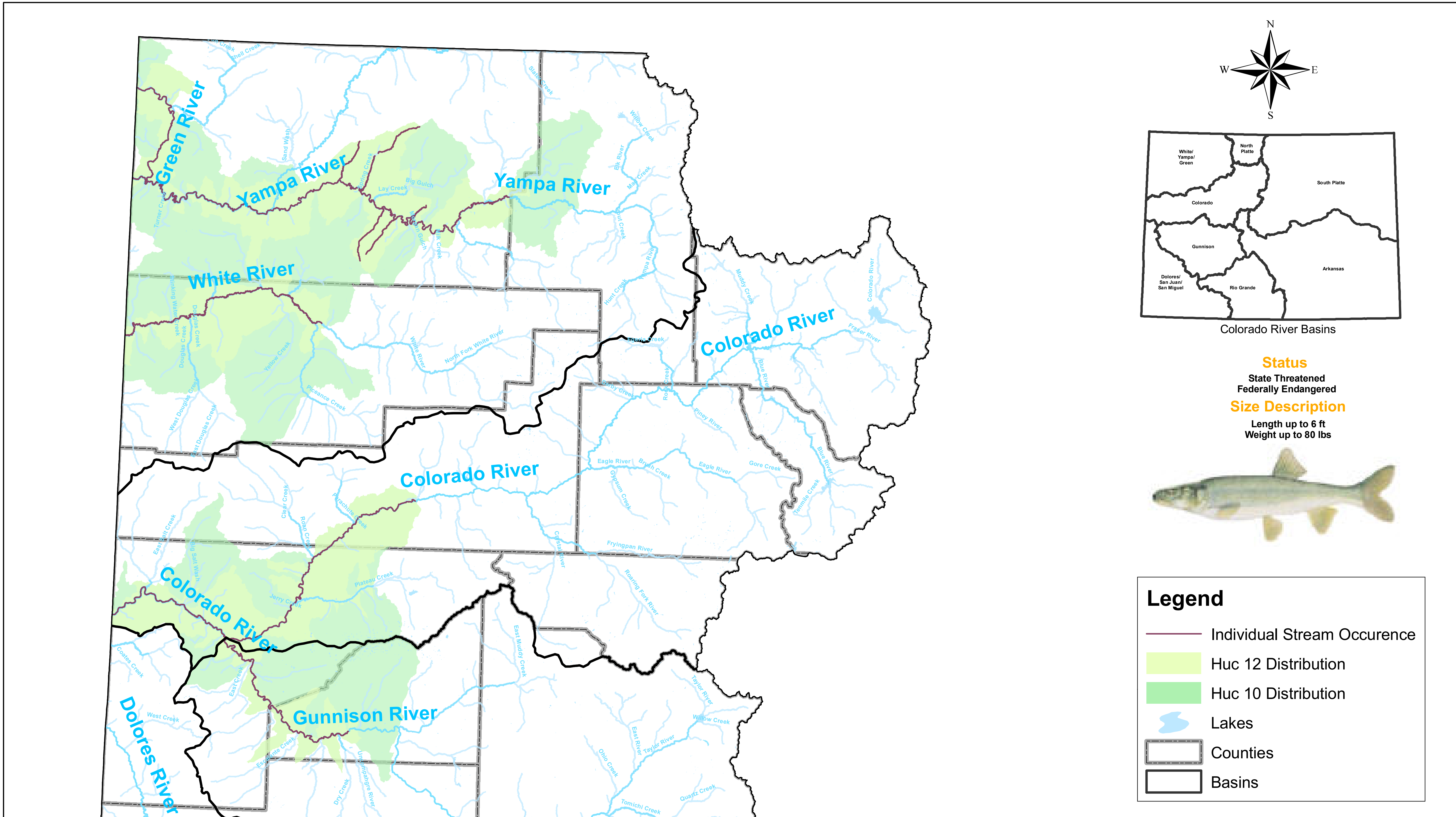

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Figure 4-17
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Colorado Pikeminnow Distribution

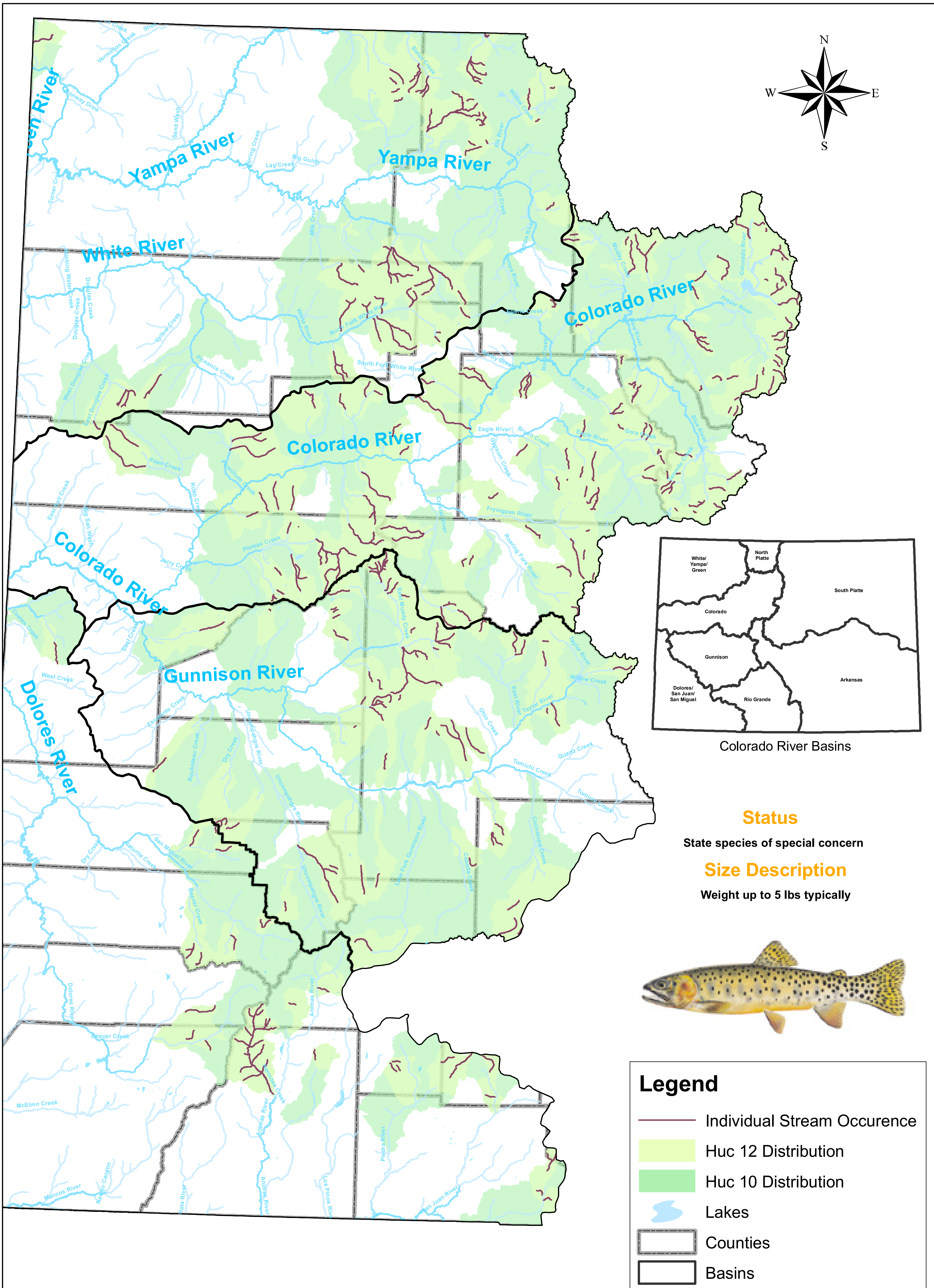

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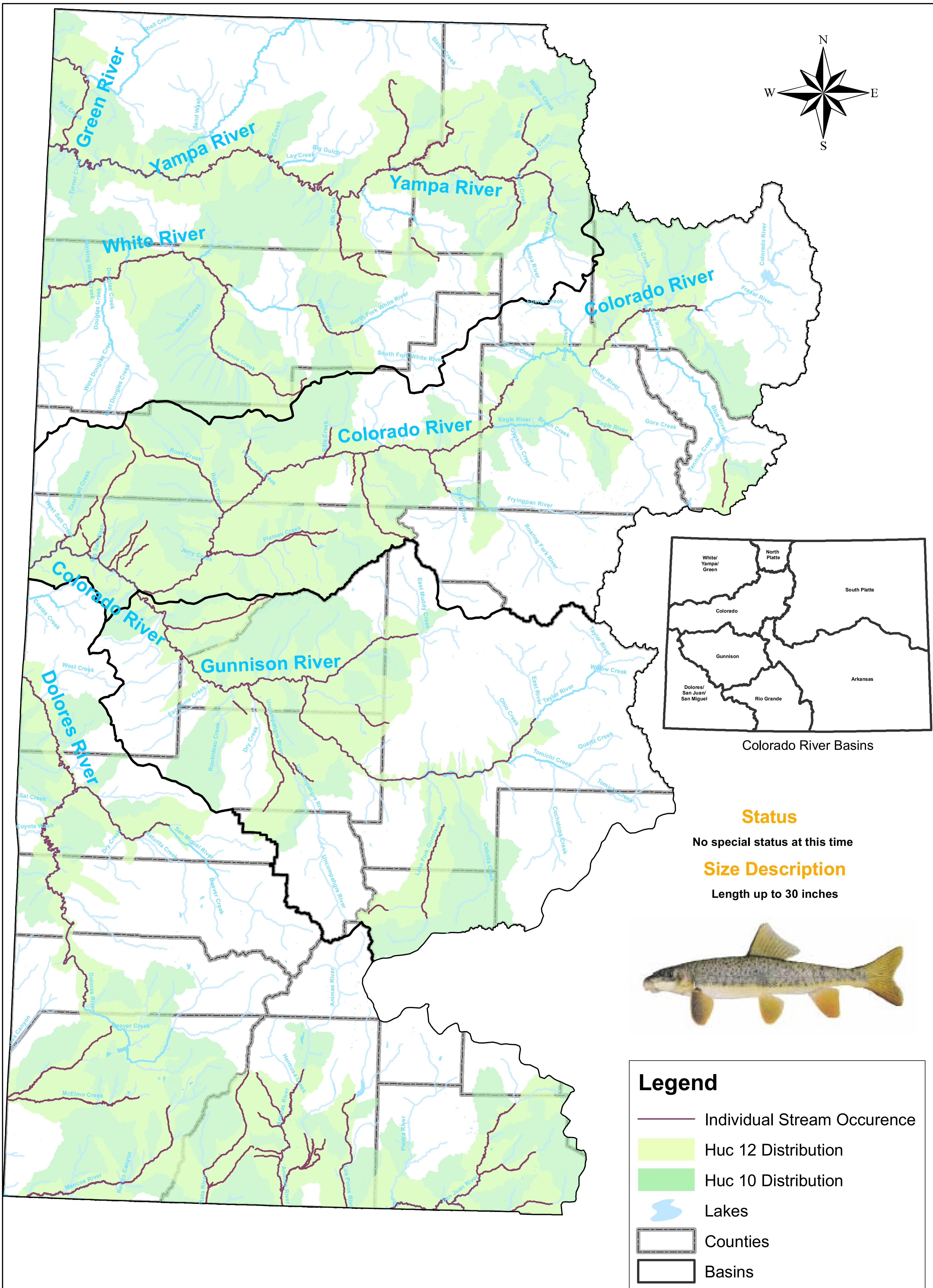
Figure 4-18
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Colorado River Cutthroat Trout Distribution



Data provided by the following sources:

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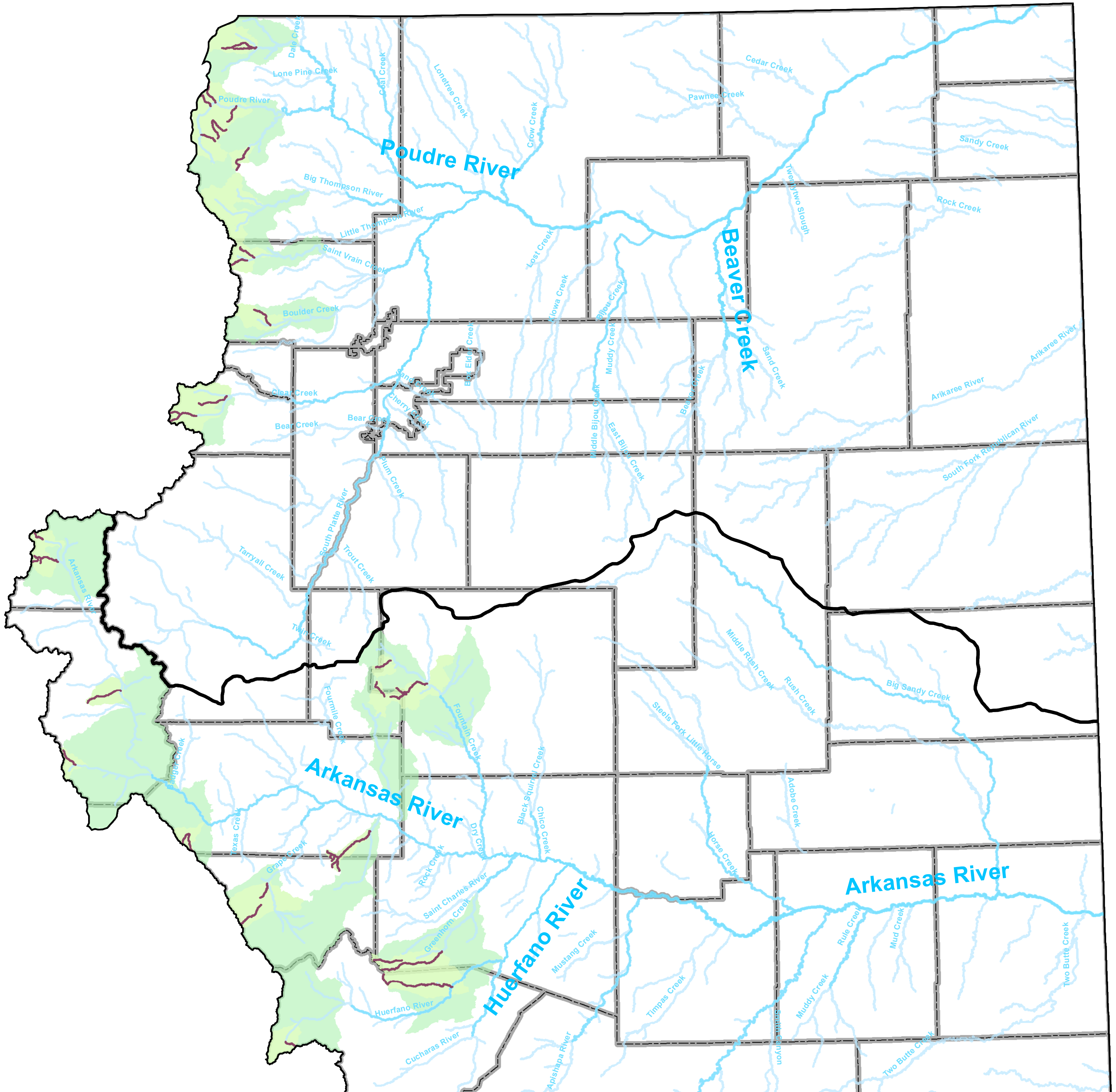
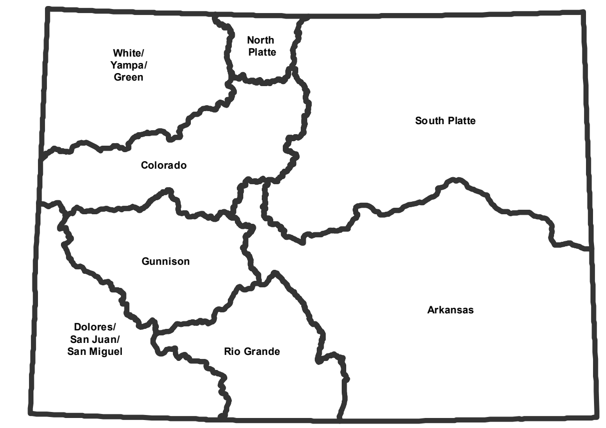
Figure 4-19
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Flannelmouth Sucker Distribution



W E N S



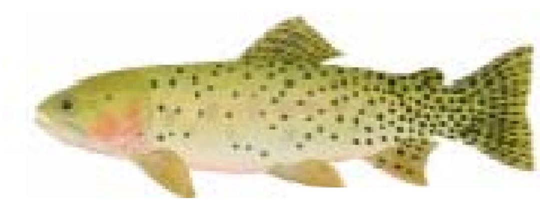
Colorado River Basins

Status

Federal Threatened
State Threatened

Size Description

Length up to 18 inches



Legend

- Individual Stream Occurence
- Huc 12 Distribution
- Huc 10 Distribution
- Lakes
- Counties
- Basins

Data provided by the following sources:

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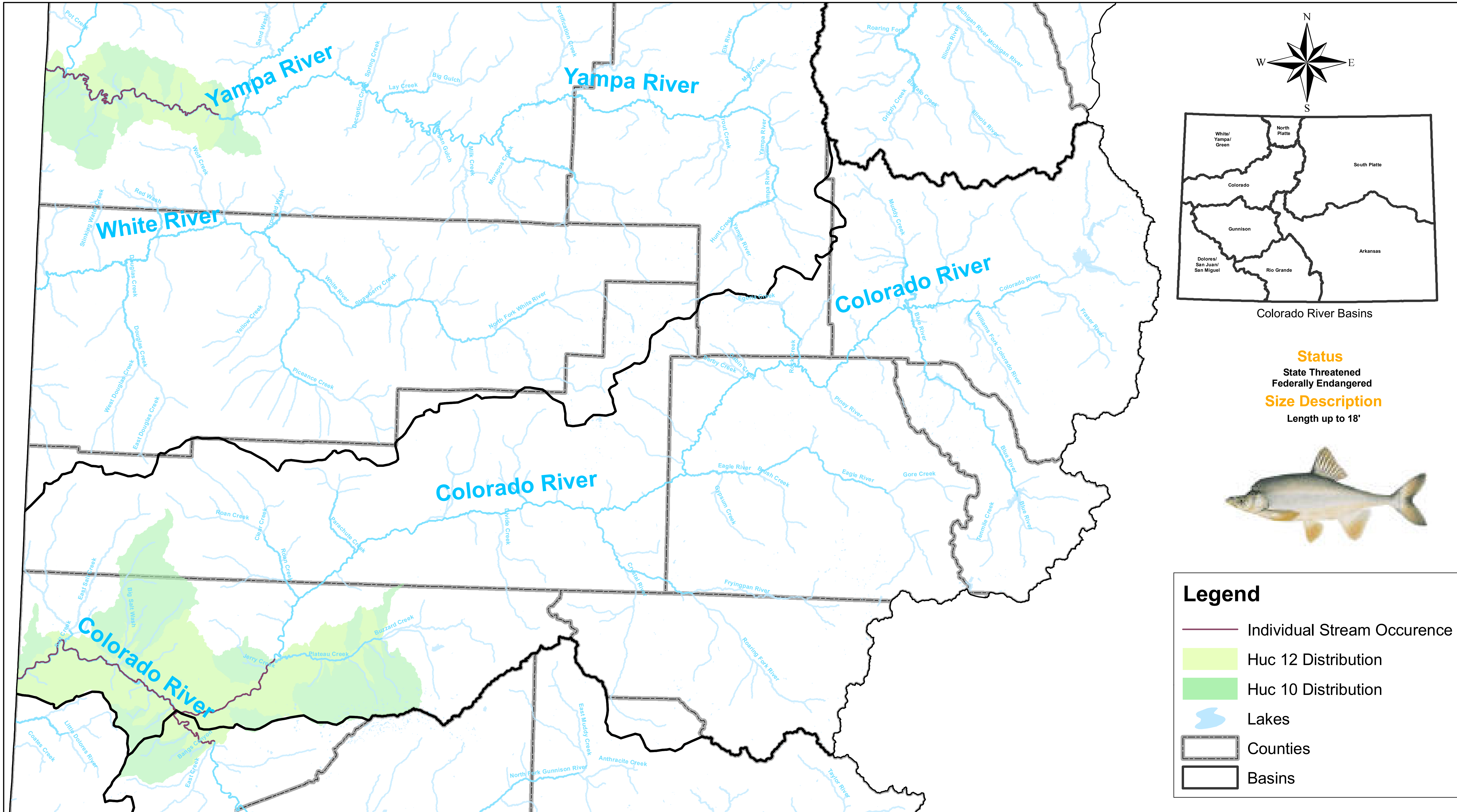
Figure 4-20
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Greenback Cutthroat Trout Distribution



Data provided by the following sources:

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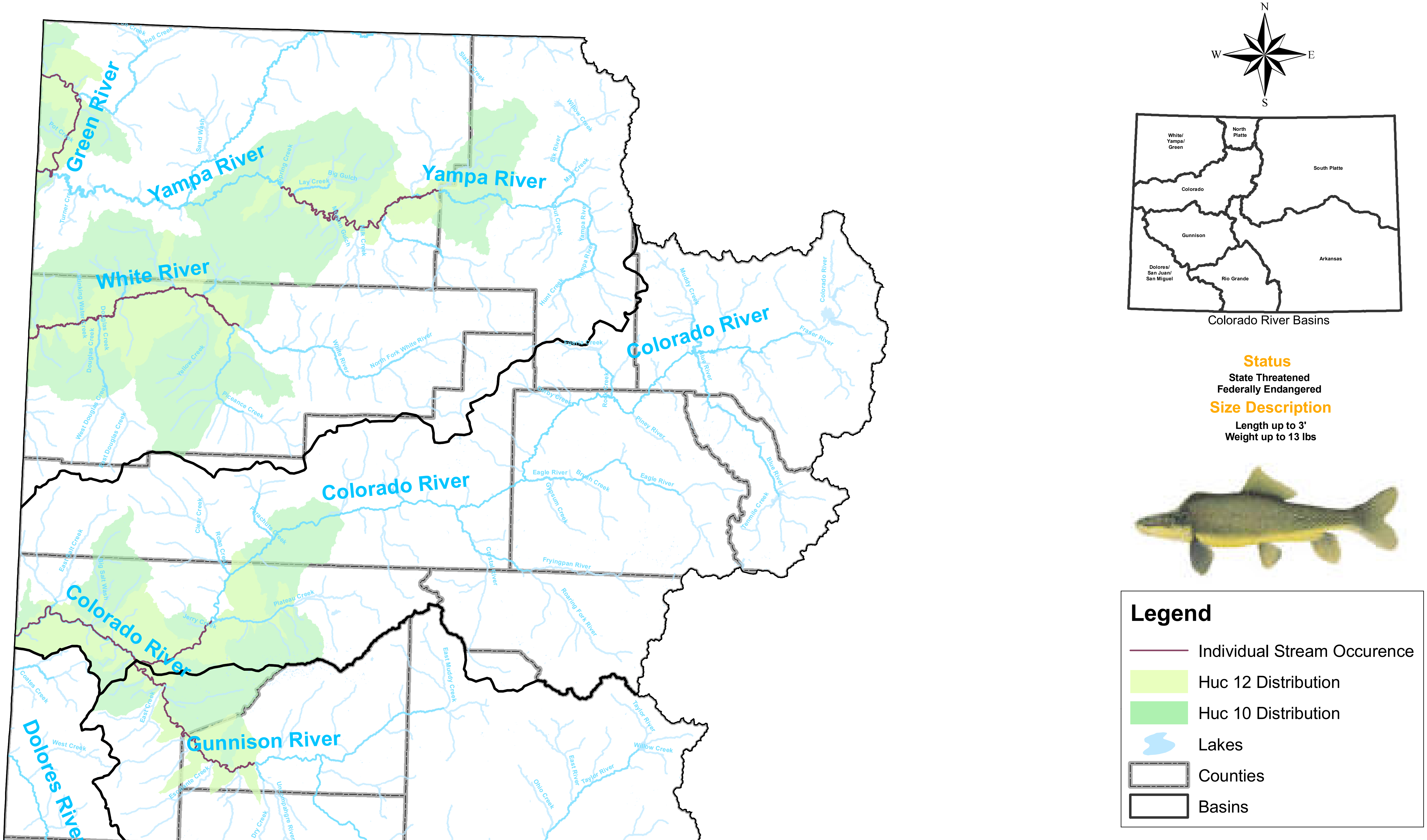
Figure 4-21
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Humpback Chub Distribution



Data provided by the following sources:

Miles
0 5 10 20 30 40

Figure 4-22
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Razorback Sucker Distribution

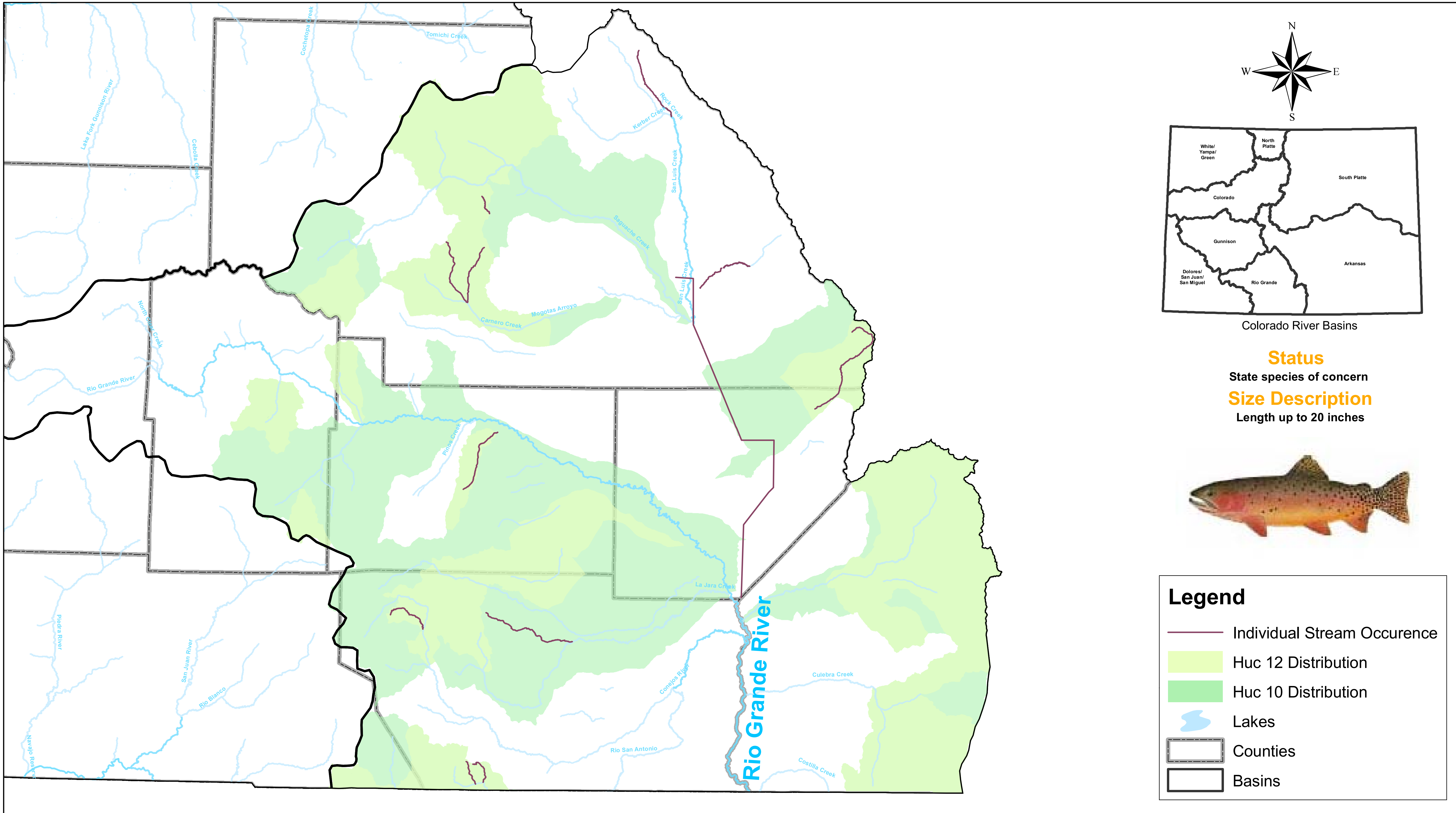


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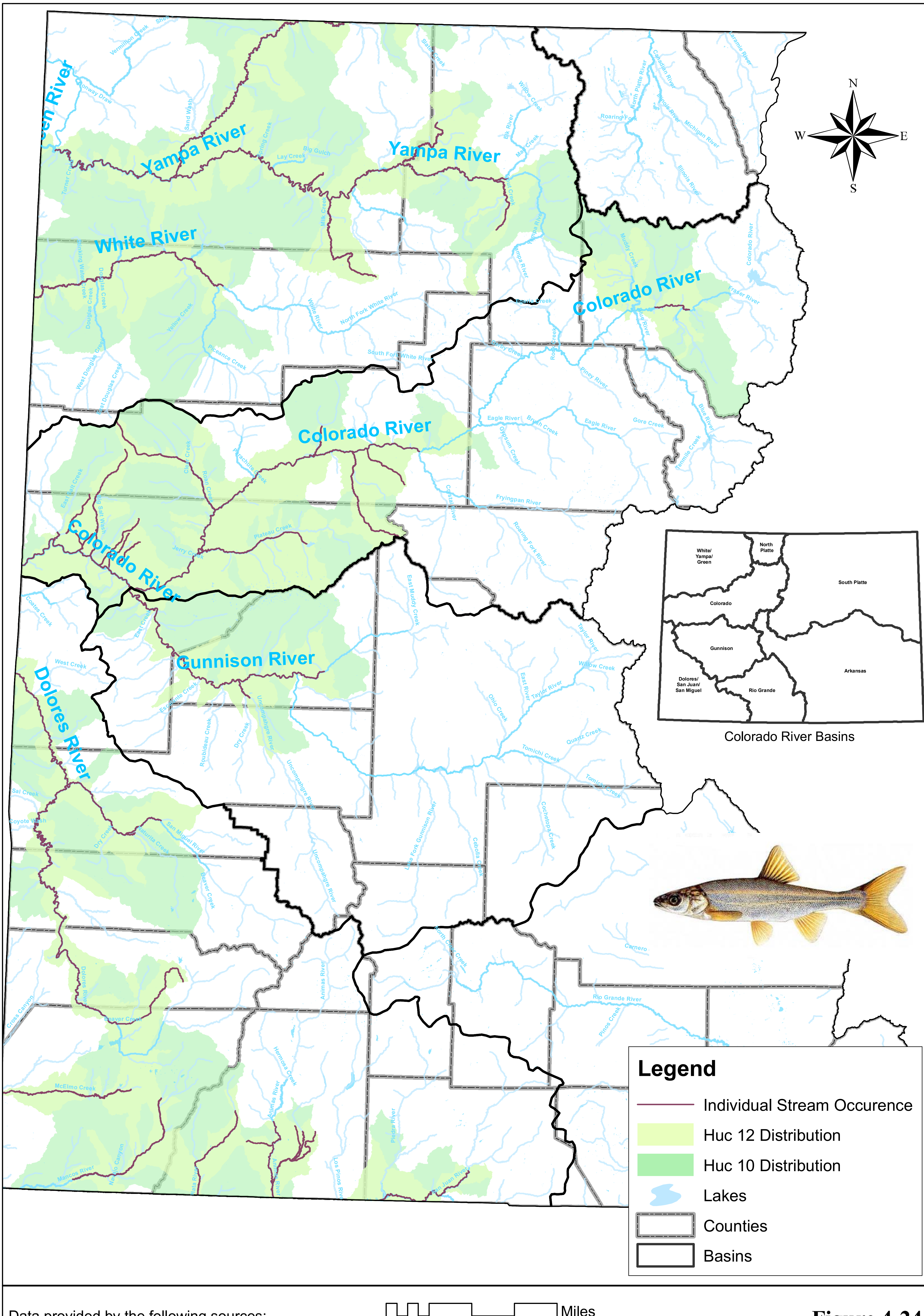
Figure 4-23
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Rio Grande Cutthroat Trout Distribution



Data provided by the following sources:

Figure 4-24
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recorded Roundtail Chub Distribution

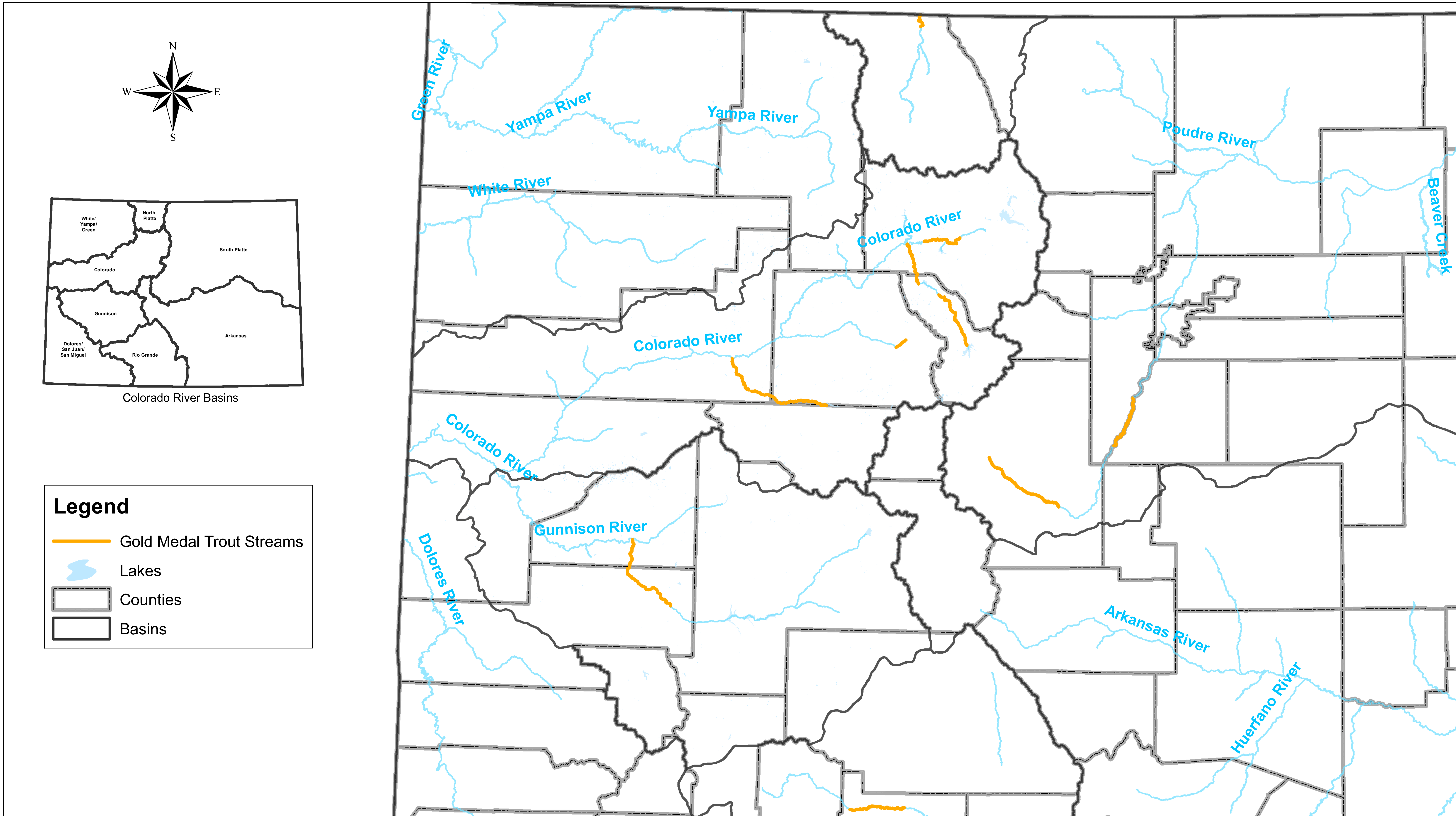


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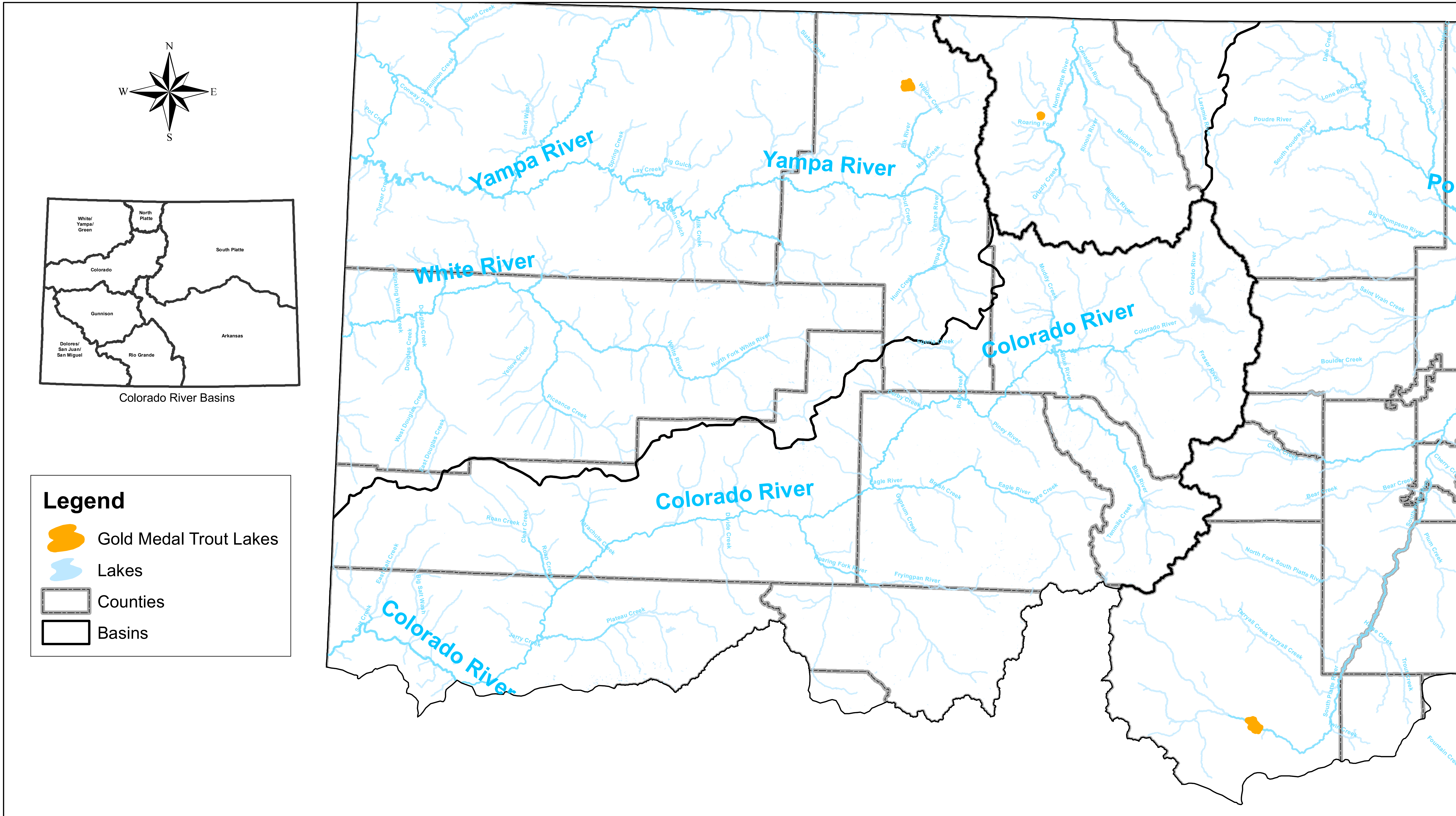
Figure 4-25
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Gold Medal Trout Streams



Data provided by the following sources:

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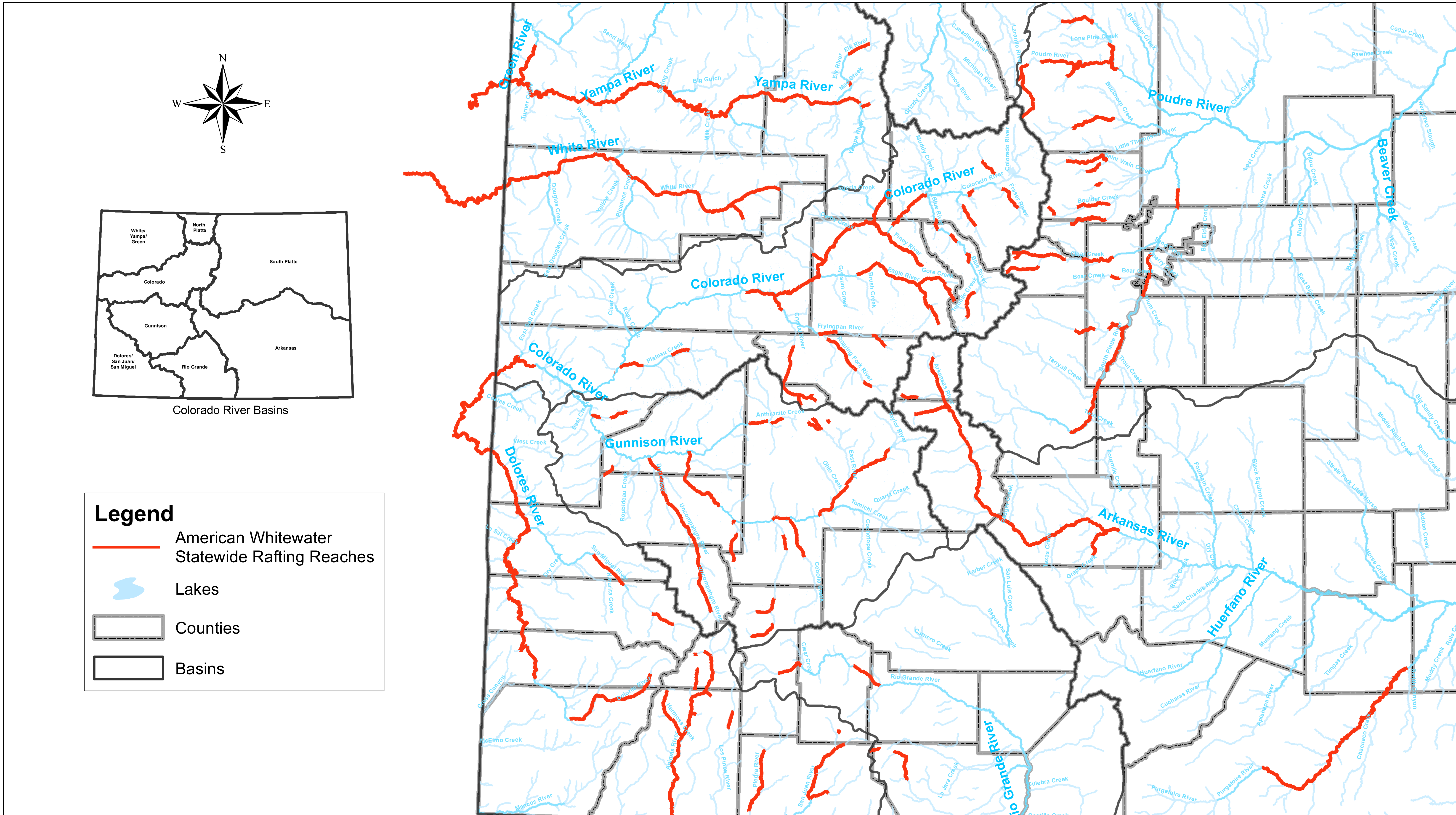
Figure 4-26
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Gold Medal Trout Lakes



Data provided by the following sources:

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Figure 4-27
Statewide Water Supply Initiative
Environmental and Recreational Coverages
American Whitewater Statewide Rafting Reaches

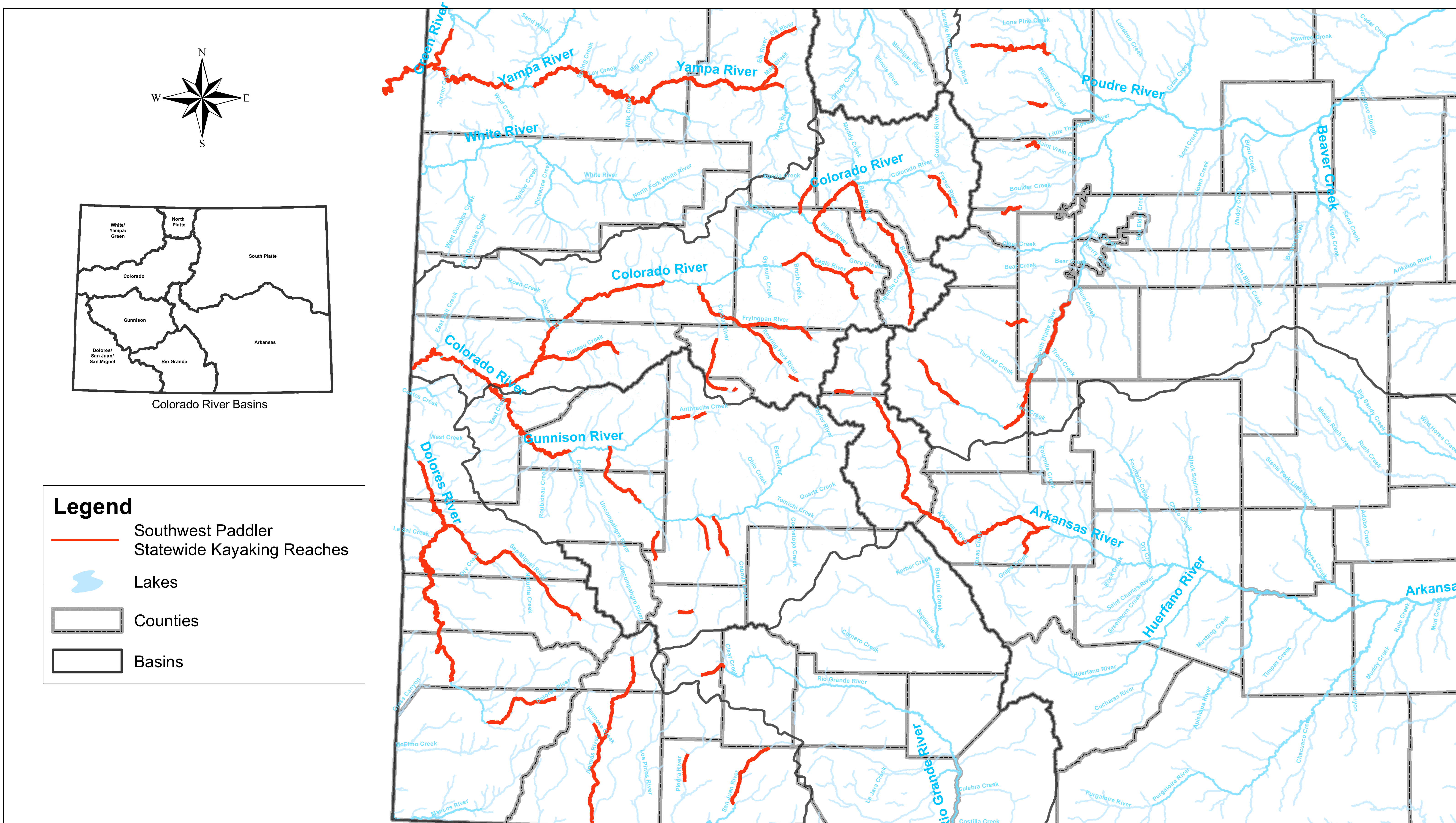

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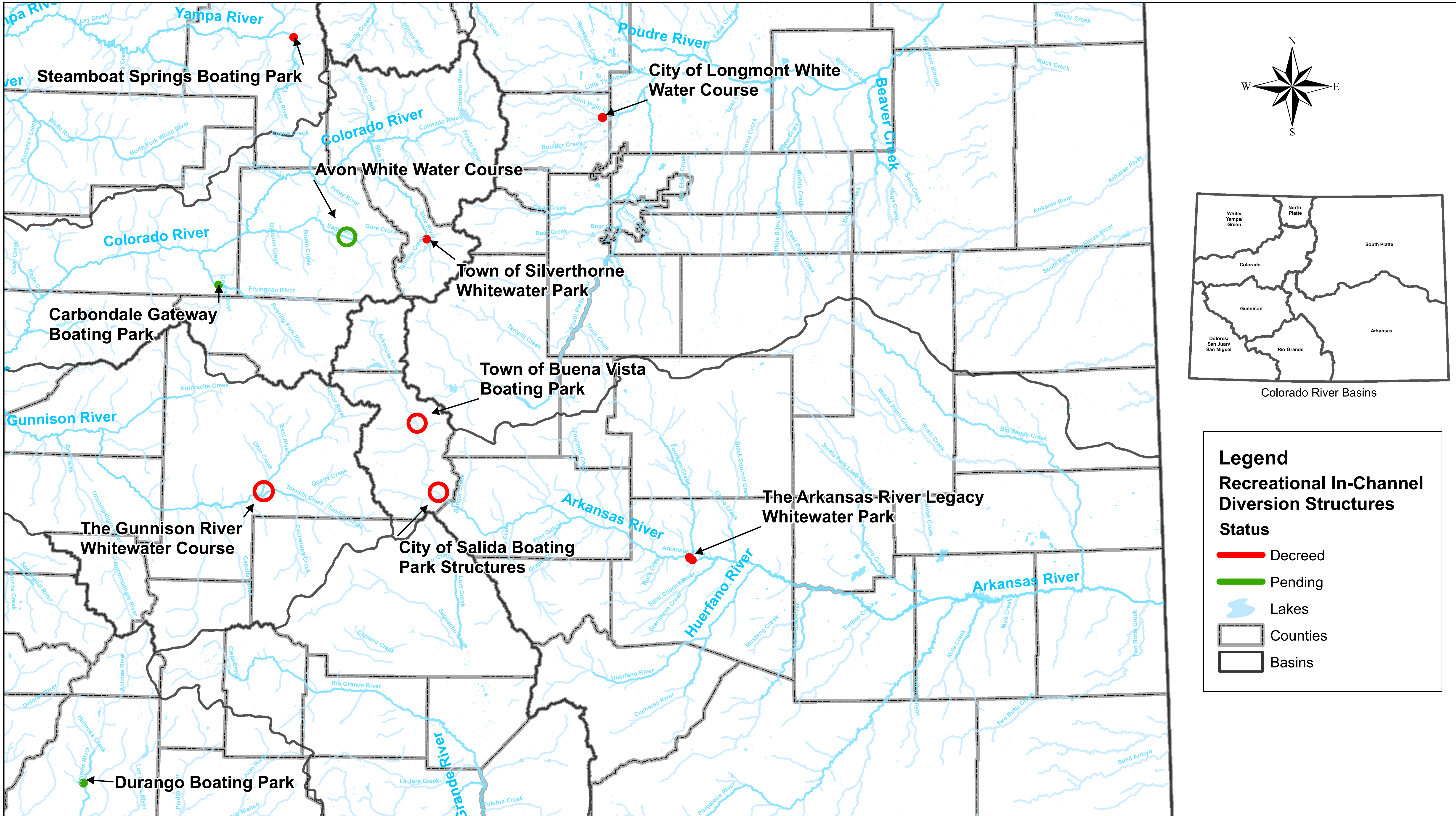
Figure 4-28
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Southwest Paddler Statewide Kayaking Reaches



Data provided by the following sources:

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Figure 4-29
Statewide Water Supply Initiative
Environmental and Recreational Coverages
Recreational In-Channel Diversion Structures

Addressing the Water Supply Gap (between Current Supply and Current and Future Water Needs) Technical Roundtable

5.1 Overview of Addressing the Gap Technical Roundtable

In 2003, the State Legislature authorized the Statewide Water Supply Initiative (SWSI). The legislation requested that the Colorado Water Conservation Board (CWCB) complete a comprehensive study to:

1. Examine all aspects of Colorado water use over the next 30 years.

2. Evaluate water supply and water management alternatives in each river basin.

3. Formulate strategies and build consensus on alternatives to meet future water needs.

To assist with the completion of SWSI and to address these goals, the CWCB established basin roundtables in each of Colorado's eight major river basins. The legislation also required that the study be complete in 18 months. With this ambitious mandate, the CWCB forged ahead with the recognition that water issues have always been contentious and building consensus would be a significant challenge. In fact, near the completion of SWSI, many of the basin roundtables raised concerns that they needed more time to understand and define their water supply and water needs, and there was some apprehension regarding examining water supply solutions.

To address these concerns, SWSI initially identified and catalogued those water supply alternatives that were/are being pursued by local water providers and identified basic strategies for meeting future demands. CWCB also recognized that additional time was needed to refine Colorado's water needs and to formulate water supply solutions. Consequently, the original SWSI Report did not extensively evaluate water supply solutions but recommended they be examined in future work. This section of the Phase 2 Report summarizes the results and process CWCB utilized to begin to identify and examine water supply solutions.

In fall 2005, the "Addressing the Gap" Technical Roundtable (TRT) was formed. This TRT was charged with helping examine and advance two fundamental findings and mission statements identified by SWSI and adopted by the CWCB Board. These findings and mission statements are summarized below.

The 80 Percent Solution for Municipal and Industrial Water Needs

The TRT's primary role regarding the "80 percent solution" involved examining whether the assumption that all M&I water plans and projects would be successfully implemented was valid or overly optimistic. This issue is discussed in greater detail in this section.

The 80% Solution for Meeting 2030 M&I Demands

Following the lead of local water suppliers, the state will:

- Monitor long-term water needs
- Provide technical and financial assistance to put the necessary plans, projects, and programs in place to meet those needs
- Foster cooperation to avoid being forced to make trade-offs that would otherwise harm Colorado's environment, lifestyle, culture, and economy

The 20 Percent M&I Gap, Agricultural Shortages, and Environmental and Recreational Enhancements

The Gap TRT was also tasked with developing multi-objective solutions to achieve the goals set forth in the mission statements. These solutions/alternatives are to help policymakers and stakeholders gain a deeper understanding of the benefits, impacts, other attributes, and trade-offs that are associated with water efficiency, agricultural transfers, and new water development. These solutions/alternatives must be considered in the context of meeting human needs for water and providing for the needs of Colorado's natural environment and recreation.

The 20% M&I Gap, Agricultural Shortages, and Environmental and Recreational Enhancements

Foster cooperation among water suppliers and citizens in every water basin to examine and implement options to fill the gap between on-going water planning and future water needs.

5.1.1 Technical Roundtable Discussions

The objective of the Addressing the Gap TRT was to examine alternatives for:

- Addressing the M&I gap and uncertainty with the M&I gap and IPPs.
- Existing agricultural shortages.
- Environmental enhancements.
- Recreational enhancements.

It was emphasized that all water supply solutions be considered. Solutions and alternatives should be analyzed and evaluated for both in-basin and transbasin concepts. Water conservation/demand management and transfer from existing uses (agriculture) should also be considered.

The following outcomes/products were to be produced as part of the Addressing the Gap TRT:

- Development of a range of alternatives that could be organized into thematic alternatives (i.e., conservation, agricultural transfer, and water storage).
- Examination of reconnaissance level yields for alternatives.
- Conceptual level costs for alternatives examined.
- Benefits of alternatives examined.
- Implementation issues of alternatives examined.

A finite number of alternatives were examined and a balance between the number of alternatives and the level of detail in the analyses was considered.

The SWSI Management Objectives—depicted in Figure 5-1—were to be kept in mind in crafting water supply solutions. Alternatives examined based on these objectives were to be considered reconnaissance level and further evaluation and analyses would have been required prior to implementation.

The TRT served as an initial forum to develop, refine, and discuss the alternatives. The development of the alternatives focused on:

- Identifying where collaboration between basins and within basins would create the greatest benefits.
- Addressing the most critical water shortage areas.
- Identifying how alternatives could be developed/operated in a manner that would benefit both the area where the water is diverted and the area where it is put to beneficial use.
- Showing tradeoffs between alternatives and potential benefits of collaboration and joint operations.

Figure 5-1
SWSI Objectives

Defining the Gap

The SWSI report found that population in Colorado will increase, on both the east and west slopes, with the majority of growth occurring on the east slope, though population growth rates are higher in many west slope basins. Table 5-1 summarizes the population trends in each basin and Figure 5-2 shows by the year 2030 water demand is projected to increase by an additional 630,000 AF.

Table 5-1 Population Projections by Basin

Basin	2000	2030	Increase in Population	Percent Change 2000 to 2030
Arkansas	835,100	1,293,000	457,900	55
Colorado	248,000	492,600	244,600	99
Dolores/San Juan/San Miguel	90,900	171,600	80,700	89
Gunnison	88,600	161,500	72,900	82
North Platte	1,600	2,000	400	25
Rio Grande	46,400	62,700	16,300	35
South Platte	2,985,600	4,911,600	1,926,000	65
Yampa/White/ Green	39,300	61,400	22,100	56
TOTAL	4,335,500	7,156,400	2,820,900	65

Source: Colorado Department of Local Affairs Demography Section

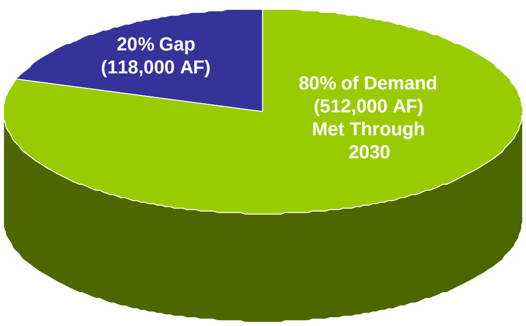


Figure 5-2
Under Optimistic Assumptions Local M&I Providers Have the Ability to Meet 80 Percent of Colorado's M&I Water Needs through 2030

Approximately 80 percent (512,000 AFY) of this projected future demand will be met if all providers' IPPs are successful in delivering the planned amount of water and planned water conservation savings are realized. The 20 percent (118,000 AFY) of projected future demands not met by IPPs is the "gap" between current supplies and future needs.

The distribution of the additional needed supplies and gap among the eight major water basins are presented in Figures 5-3 and 5-4. Figure 5-4 illustrates how the 20 Percent M&I gap (118,000 AFY) is distributed among basins. It should be noted, however, that while the east slope (South Platte, Arkansas, Rio Grande, and North Platte Basins) is responsible for the majority of the gap (91 percent), west slope gaps are still critical, especially in headwaters and rural areas.

In addition to the M&I gap, agricultural shortages were identified in the SWSI report and must be considered. Agricultural shortages are shown in Table 5-2 (difference between Irrigation Water Requirement and Water Supply Limited).

Table 5-2 Statewide Agricultural Demands

Basin	2000 Irrigated Acres	Irrigation Water Requirement (AF/Year)	Water Supply Limited Consumptive Use (AF/Year)
Arkansas *	405,000	748,000	619,000
Colorado	238,000	366,000	319,000
Dolores/San Juan/ San Miguel	255,000	370,000	294,000
Gunnison	264,000	473,000	396,000
North Platte	116,000	96,000	96,000
Rio Grande	633,000	1,108,000	776,000
South Platte	910,000	1,593,000	1,365,000
Yampa/White/Green	118,000	138,000	123,000
TOTAL	2,939,000	4,892,000	3,988,000

South Platte irrigated acreage in this table is based on 2001 aerials and represents a more refined analysis from the preliminary irrigated acres reported in the SWSI Report.

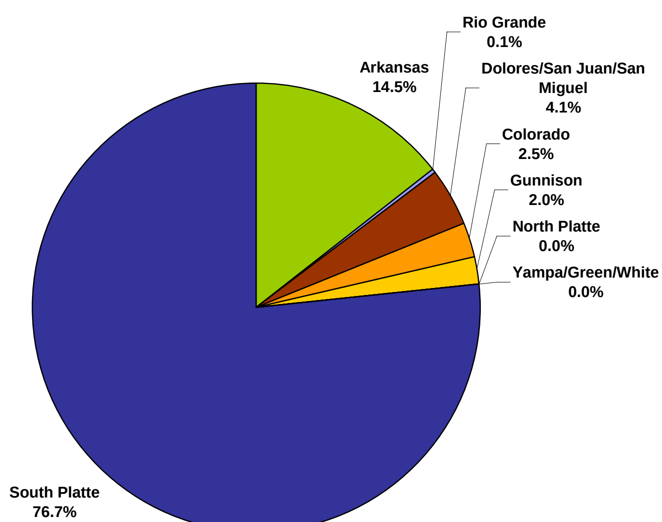


Figure 5-4
Gap Percentage by Basin

By 2030, Colorado will Need an Additional 630,000 AF of Water as Outlined Below

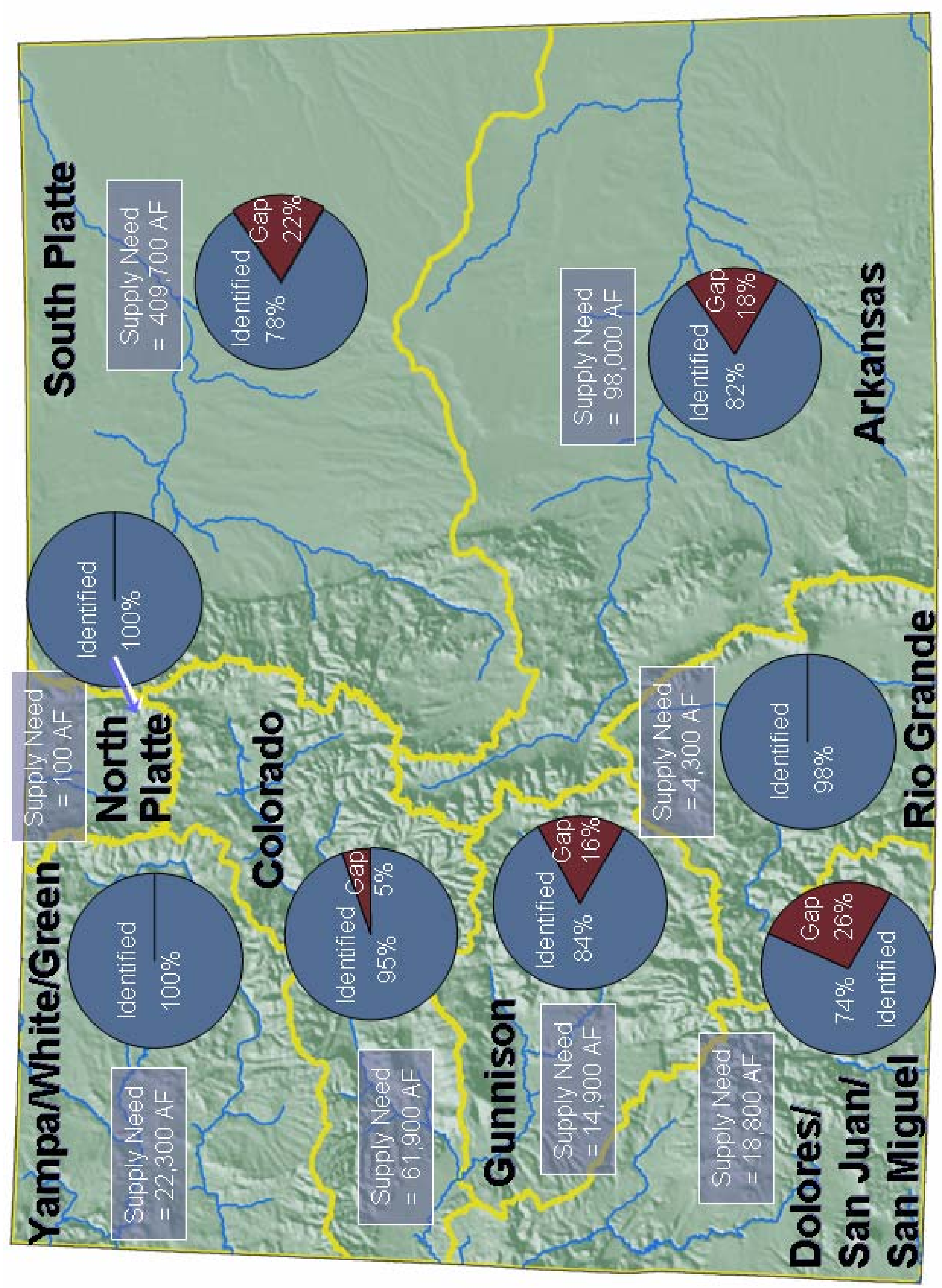


Figure 5-3
Effectiveness of Identified Projects and Processes in Meeting 2030 M&I and SSI Demands

Review of Table 5-2 shows that all river basins have agricultural shortages (i.e., the difference between the ideal amount of water needed (IWR) and the actual amount of water delivered (WSL). The TRT was asked to help refine which areas of the state face "critical" agricultural shortages and how we might define this. Many agricultural users have developed successful business plans to deal with current supplies while others may be struggling as a result of shortages. It is clear that areas of the South Platte, Arkansas, and Rio Grande Basins are suffering critical shortages that are resulting in lost agricultural production and impacts to the local economy and farms and ranches.

In addition, activities M&I providers undertake to fulfill their future demands and address the gap will have an effect on agricultural, environmental, and recreational needs. Separate TRTs were formed to address these issues and are discussed further in their respective sections in this report. Key items to be considered when addressing the M&I gap are:

- The potential decrease in irrigated acreage and its impact on the local economy (see Figure 3-1) in Section 3.
- Impact on stream flows and lake levels that support tourism and the environment and are benefits enjoyed by and important to our citizens.
- Environmental impacts on reduced return flows and/or water quality.
- Conflicts over water use can lead to delays in the implementation of IPPs and increase costs.

5.2 Summary of Major Discussion During Addressing the Gap Technical Roundtable Meetings

One of the major concerns brought up at the Gap TRT meetings that affect all basins is the uncertainty associated with the IPPs. Since the completion of the SWSI Report, providers have indicated increased levels of risk and uncertainty associated with implementation of their plans and projects. Figure 5-5 shows the increase in the gap at IPP uncertainty levels of 25 percent and 50 percent. If 25 percent of the IPPs do not successfully deliver the projected water, the gap increases from 118,200 AFY to 246,100 AFY. At 50 percent IPP incompletion rate, the gap increases to 374,100 AFY statewide.

In the South Platte Basin alone, four major projects—Northern Integrated Supply Plan (NISP), Windy Gap Firming Project (WGF), Moffat Firming, and Halligan-Seaman Reservoir Expansion—are still in the NEPA process and have yet to receive approval. Figure 5-6 shows the large impact the failure of any of these projects would make in the gap.

5.2.1 Summary of Gap Areas Statewide

Basin specific discussion and key points are summarized below by major river basin. The water supply gap in several subbasins in each major basin was quantified and is tabulated in Figures 5-7 to 5-12. The reader should note the tables only reflect the supply need to fill the gap. The entire supply need is shown in the small box.

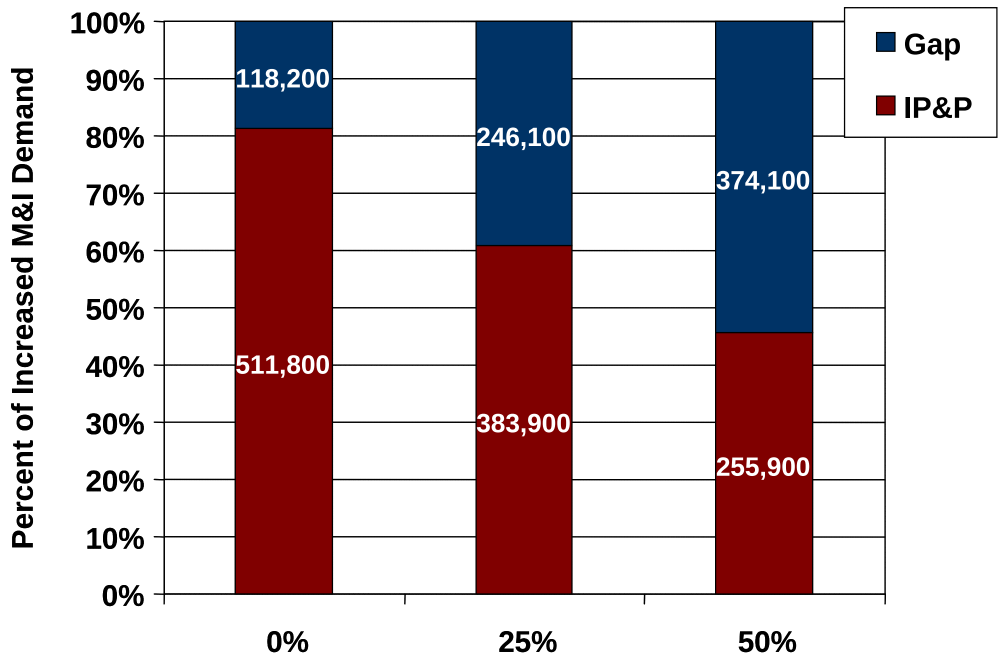


Figure 5-5
Uncertainty in Identified Projects & Processes

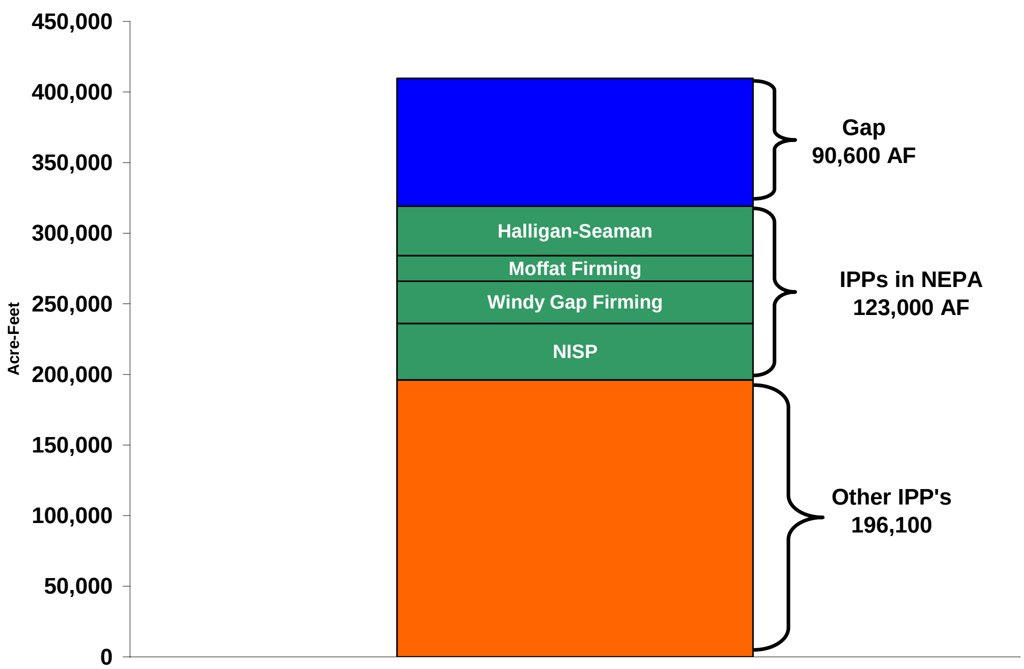
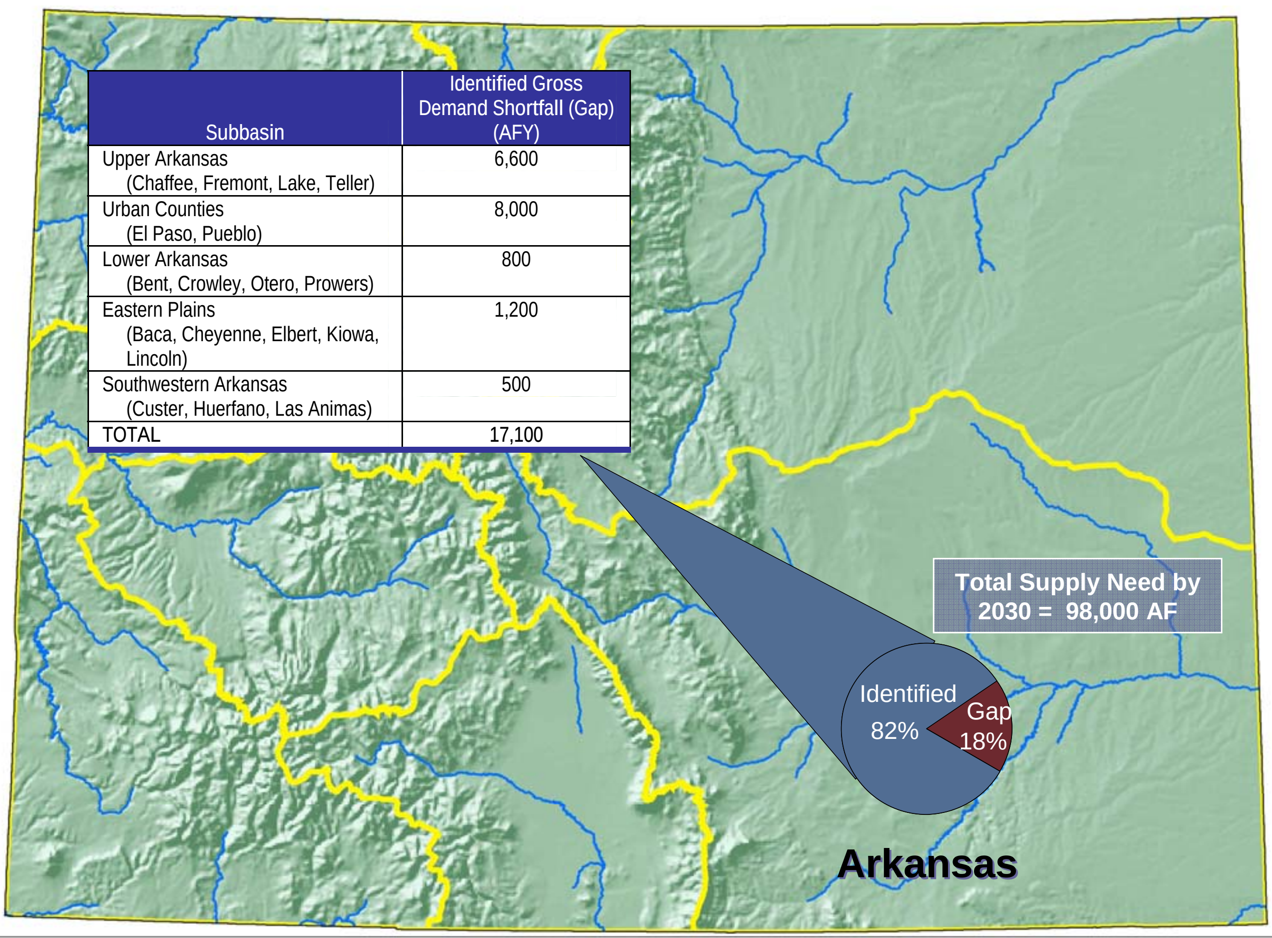


Figure 5-6
Water Supply Gap and Firm Yield from Projects in NEPA Process in the South Platte Basin

Arkansas Basin

- Little to no water availability for development due to Compact limitations.
- The success of two major projects are key to meeting future water needs.
- Growth in the headwaters region will present challenges in obtaining augmentation water for new demands.
- Concerns over agricultural transfers and its impact on rural economies in the lower basin.
- Concern over water quality and suitable drinking water in the lower basin.
- The urban landscape is very important to the economy and an important component to quality of life.

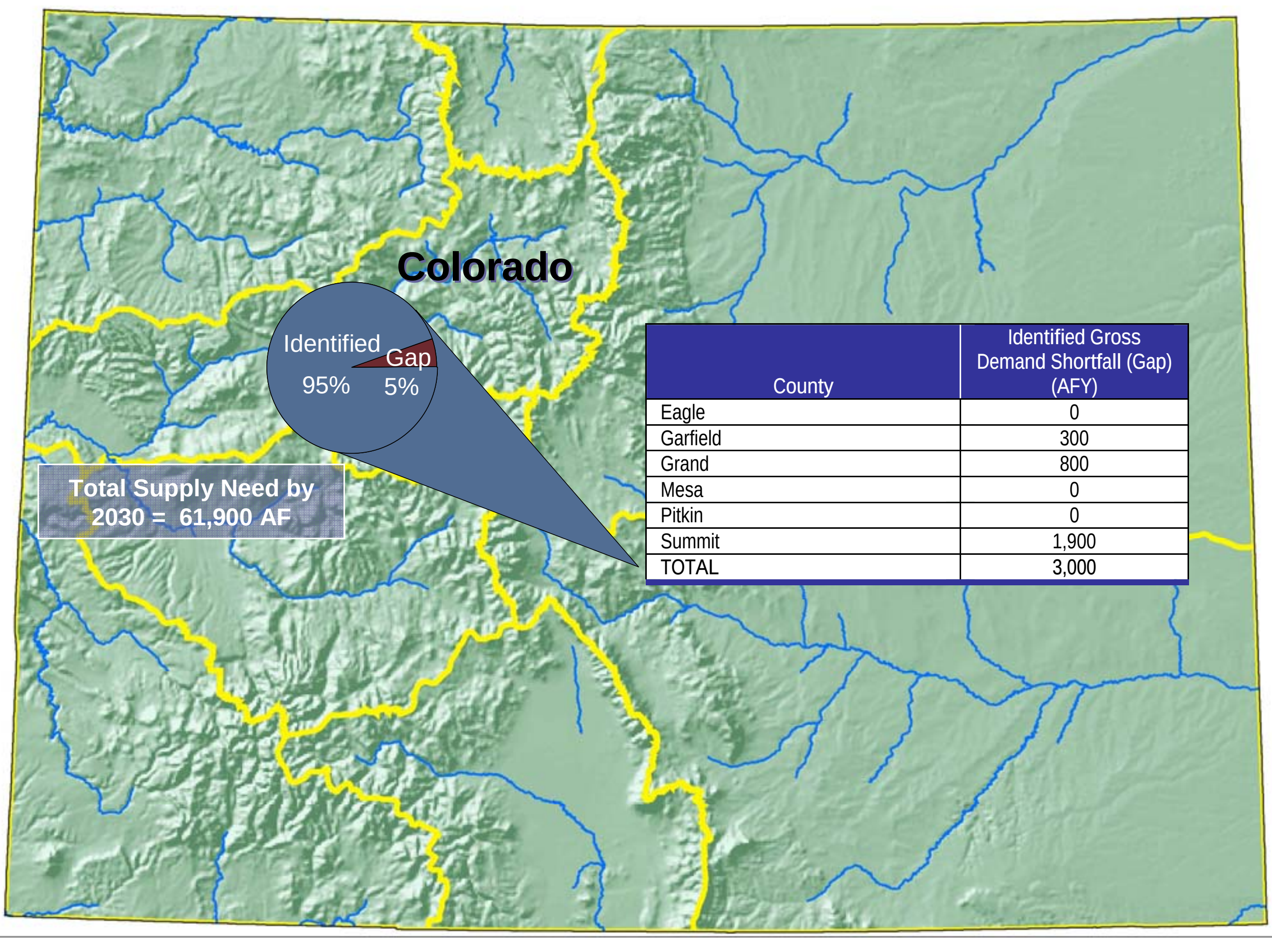


Subbasin	Identified Gross Demand Shortfall (Gap) (AFY)
Upper Arkansas (Chaffee, Fremont, Lake, Teller)	6,600
Urban Counties (El Paso, Pueblo)	8,000
Lower Arkansas (Bent, Crowley, Otero, Prowers)	800
Eastern Plains (Baca, Cheyenne, Elbert, Kiowa, Lincoln)	1,200
Southwestern Arkansas (Custer, Huerfano, Las Animas)	500
TOTAL	17,100

Figure 5-7
Summary of Gap Analysis for Arkansas Basin

Colorado Basin

- Rapid growth in the headwaters areas and lack of available supplies or storage are significant challenges to meeting future water needs.
- Agriculture, tourism, and recreation are important components to this basin's economy.
- Uncertainties associated with potential oil shale and energy development.
- The success of the Endangered Species program is critical to help protect current and future water use.
- Concerns over a potential compact shortage during severe and sustained drought.
- The impacts of transbasin projects are a concern and their effect on in-basin supplies must be considered.

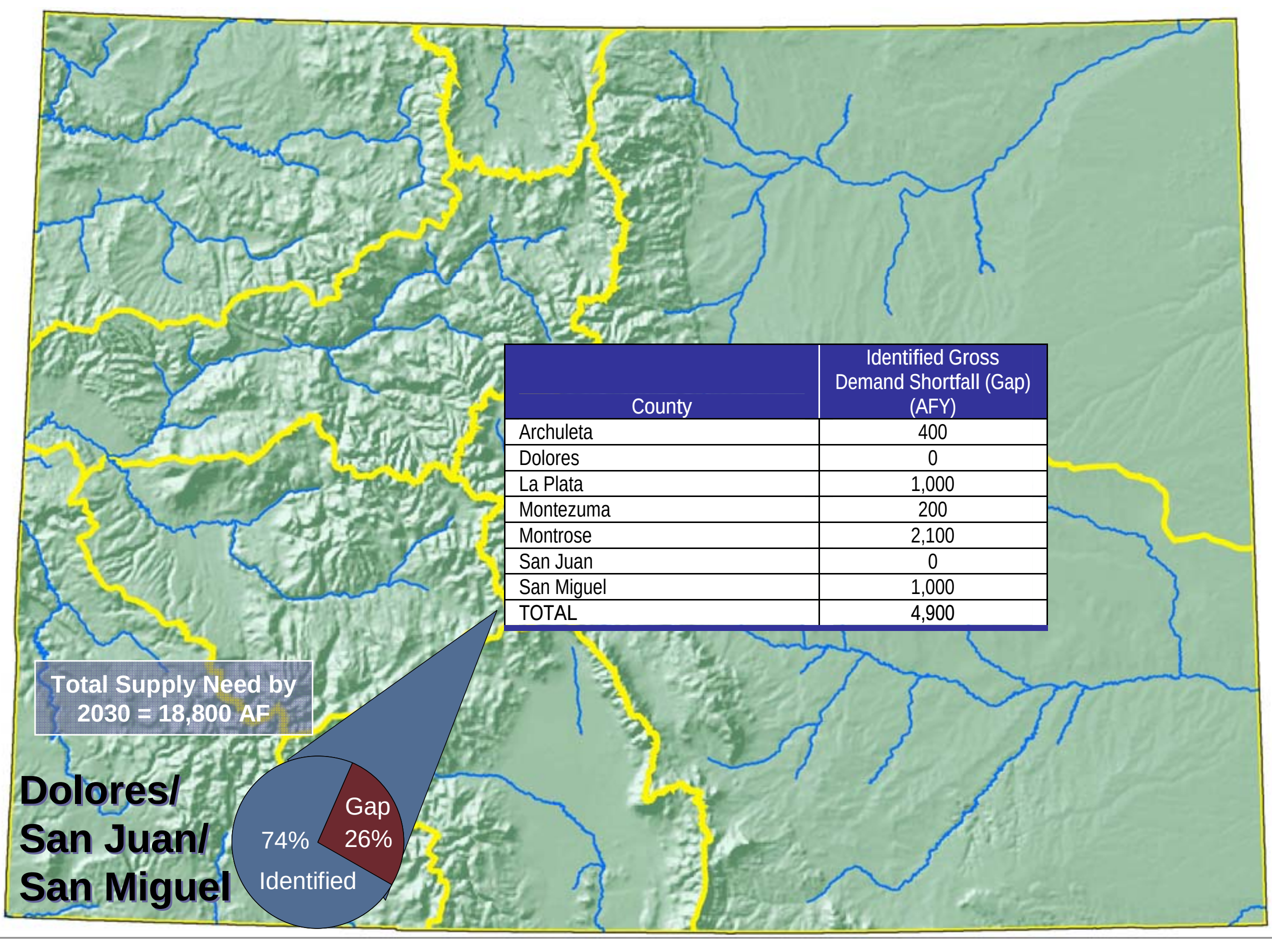


County	Identified Gross Demand Shortfall (Gap) (AFY)
Eagle	0
Garfield	300
Grand	800
Mesa	0
Pitkin	0
Summit	1,900
TOTAL	3,000

Figure 5-8
Summary of Gap Analysis for Colorado Basin

Dolores/San Juan/San Miguel Basin

- Diverse with changing demographics.
- The Pagosa Springs-Bayfield-Durango corridor is rapidly growing; has areas of localized water shortages.
- The Cortez area remains strongly agricultural but is also experiencing growth.
- The San Miguel area is a mix of recreation and tourism along with a strong desire to maintain agriculture.
- Overall water supply is available but getting sufficient infrastructure and water distribution will be a key challenge.
- The Colorado River Compact places pressure on uses of the San Juan River because New Mexico's primary source of the upper Colorado River Basin supplies is the San Juan River.

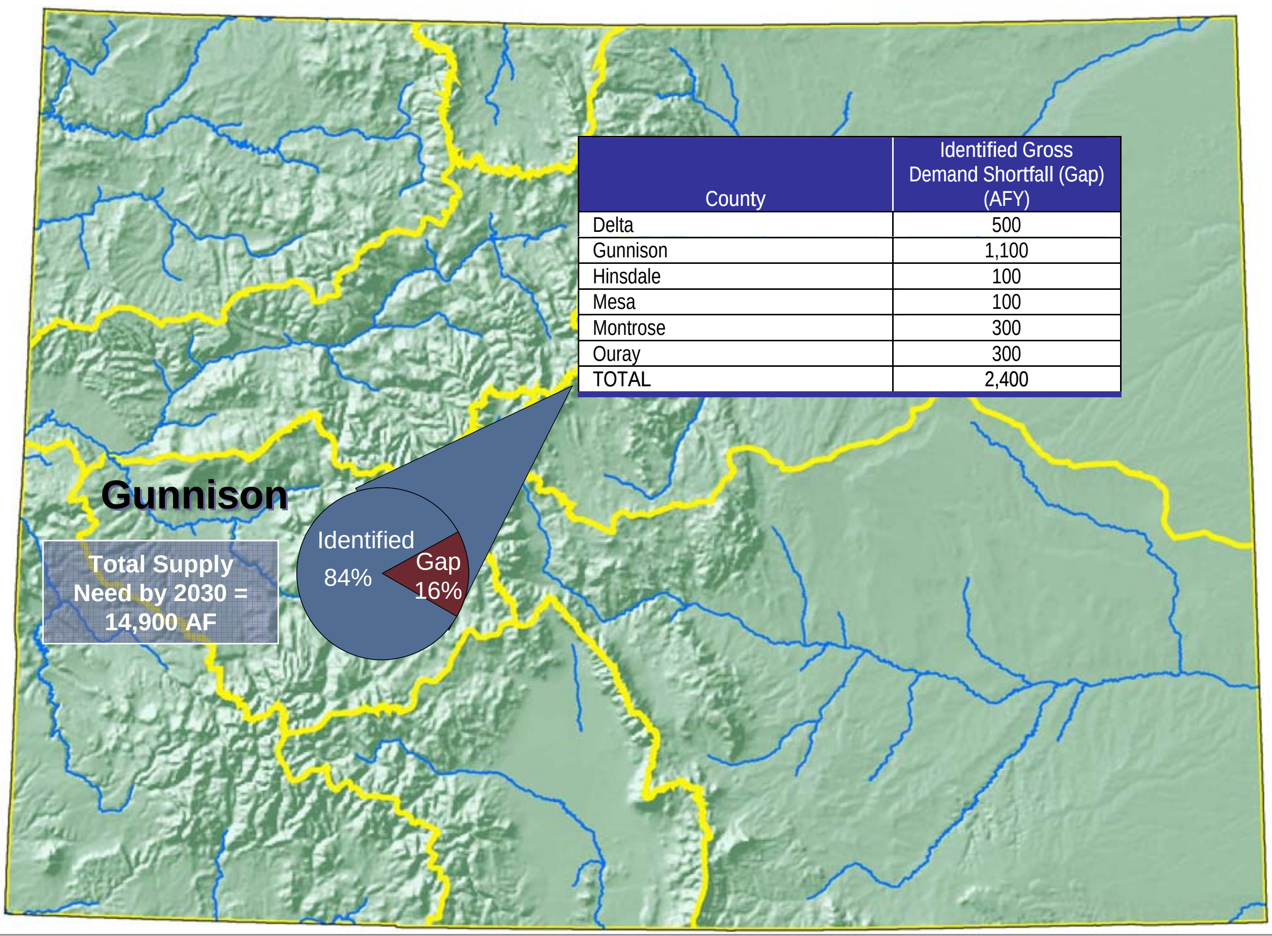


County	Identified Gross Demand Shortfall (Gap) (AFY)
Archuleta	400
Dolores	0
La Plata	1,000
Montezuma	200
Montrose	2,100
San Juan	0
San Miguel	1,000
TOTAL	4,900

Figure 5-9
Summary of Gap Analysis for Dolores/San Juan/San Miguel Basin

Gunnison Basin

- Growth in the Upper Gunnison and North Fork and Upper Uncompahgre headwaters and Uncompahgre Valley are challenges.
- Agriculture, tourism, and recreation are important components to this basin's economy.
- Addressing agricultural water shortages in the upper portion of the basin is a goal; lack of financial resources is an impediment.
- There is concern over possible future transbasin diversions and the effect this might have on the basin's future.
- Resolving federal issues (reserved water rights and endangered species) is a priority.



County	Identified Gross Demand Shortfall (Gap) (AFY)
Delta	500
Gunnison	1,100
Hinsdale	100
Mesa	100
Montrose	300
Ouray	300
TOTAL	2,400

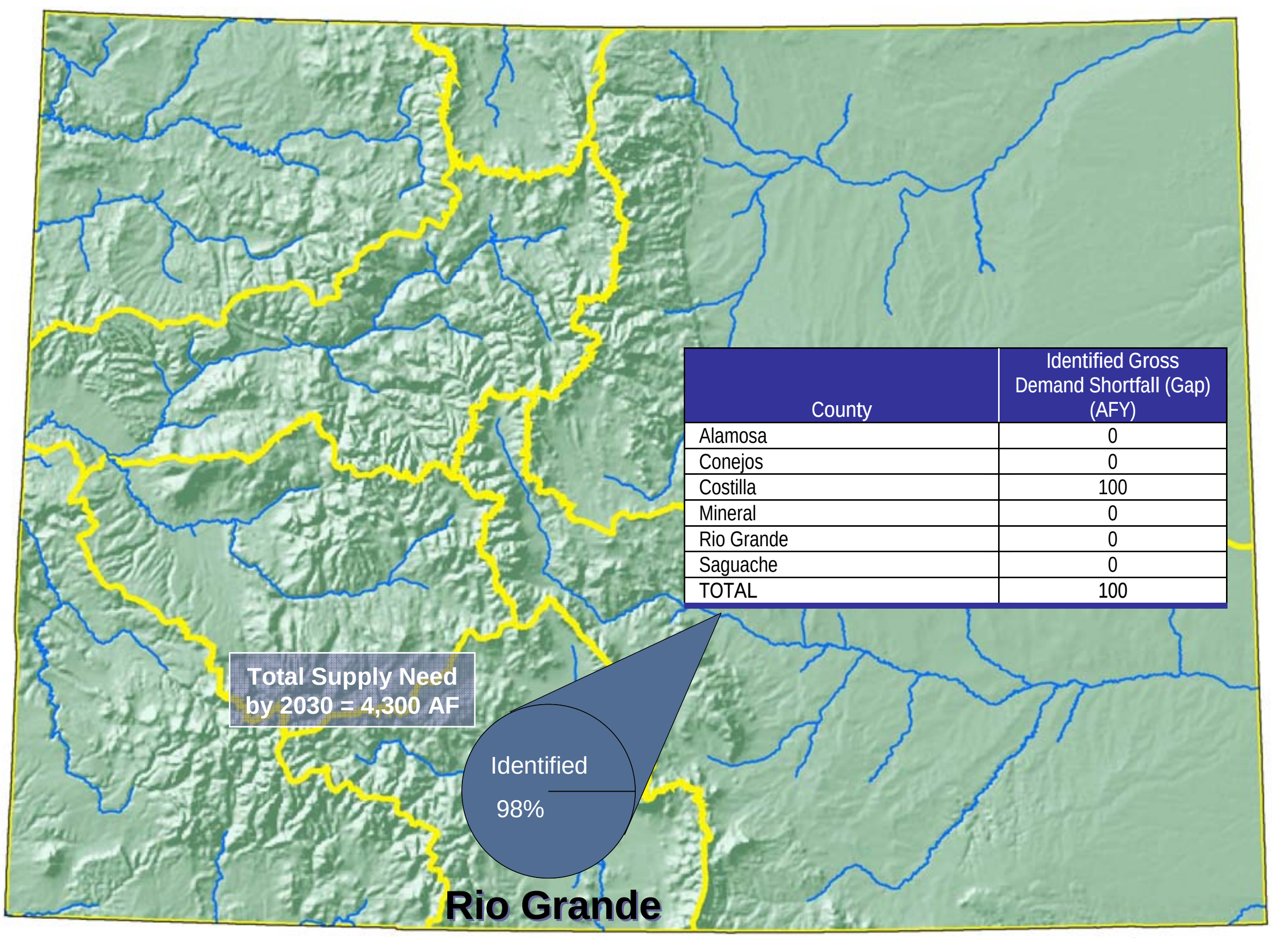
Figure 5-10
Summary of Gap Analysis for Gunnison Basin

North Platte Basin

- No significant gap identified.
- Concerns over lack of growth and economic development.
- Desire to ensure protection of existing water supplies.
- Concern over the impact of the lack of forest management.
- Critical that Endangered Species issues on the Platte River in Central Nebraska are successfully resolved and in a manner that does not put pressure on North Platte water users to reduce existing uses.
- The equitable apportionment decree quantifies the amount of available water and lands that can be irrigated.

Rio Grande Basin

- The Rio Grande Compact and the effects of sustained drought make new water development very difficult.
- Agricultural water use is at unsustainable levels.
- Economic impacts of reducing irrigation use of groundwater supplies will be difficult to address.
- Groundwater is a key component of water use in the basin for both M&I and agriculture.
- Rapid growth in the South Fork area creates need for augmentation supplies.



County	Identified Gross Demand Shortfall (Gap) (AFY)
Alamosa	0
Conejos	0
Costilla	100
Mineral	0
Rio Grande	0
Saguache	0
TOTAL	100

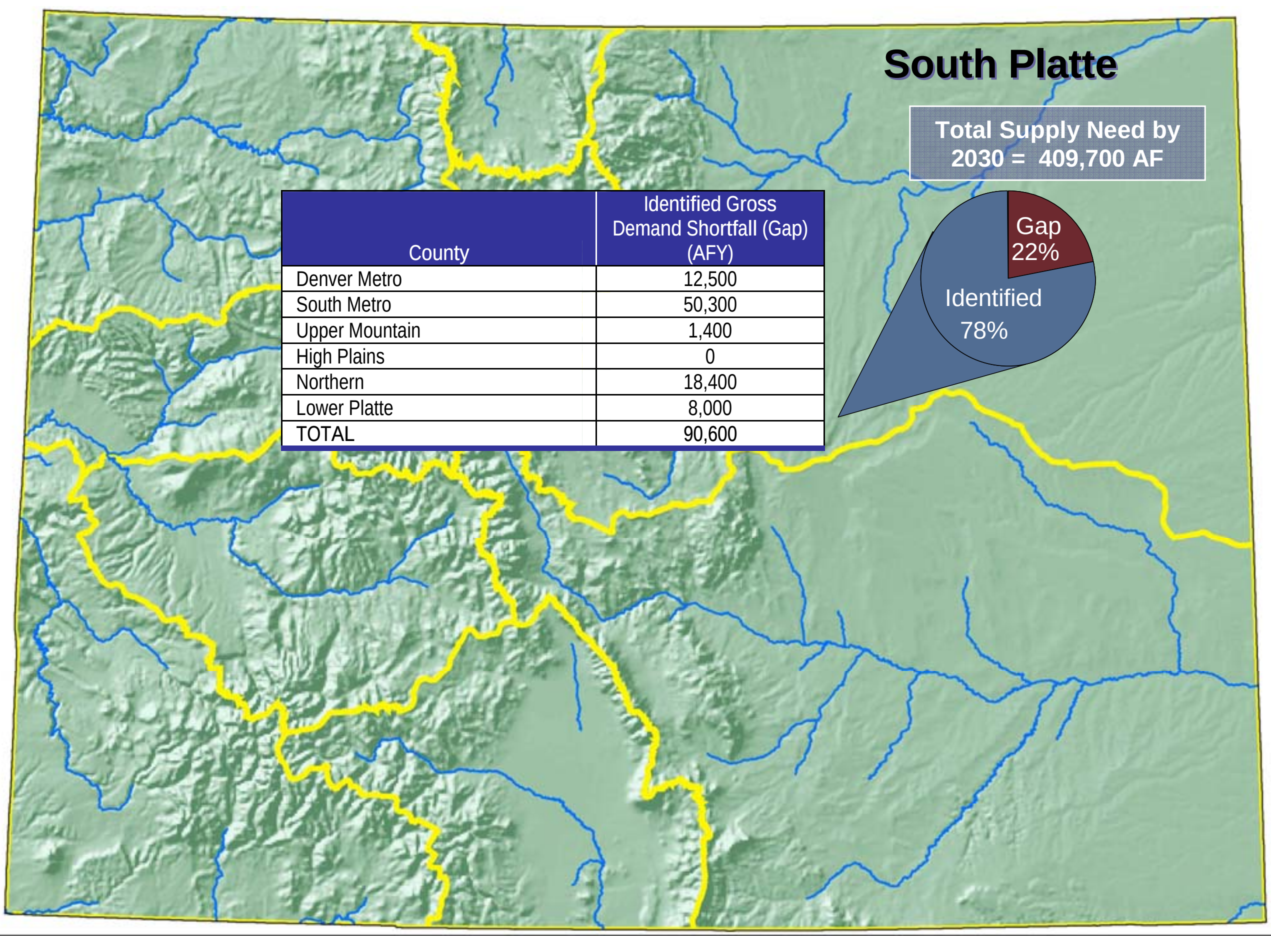
Figure 5-11
Summary of Gap Analysis for Rio Grande Basin

South Platte Basin

- Competition for water is fierce and it is unclear how much competition there is for the same water supplies.
- Transfers of agricultural water rights to M&I use will continue to be a significant option for meeting future needs.
- There is support for a market for agricultural water transfers but concerns over impacts to rural communities from water transfers are a key concern.
- South Metro reliance on non-renewable groundwater is an unresolved issue.
- Water reuse and conservation are major components to meeting future water needs but this will put added pressure on agriculture as return flows diminish.
- The urban landscape is very important to the economy and an important component to quality of life.

Yampa/White/Green Basin

- No significant gap identified.
- Agriculture, tourism, and recreation are important components to this basin's economy.
- Industrial uses, especially power production, are a major water use.
- Uncertainties associated with potential oil shale and energy development.
- The basin is not developing as rapidly as other portions of the state.
- Concern that the basin will not get a "fair share" of water use under the Colorado River Compact.
- Implementation of a successful Endangered Species Program is vital to ensuring protection of existing and future water uses.



County	Identified Gross Demand Shortfall (Gap) (AFY)
Denver Metro	12,500
South Metro	50,300
Upper Mountain	1,400
High Plains	0
Northern	18,400
Lower Platte	8,000
TOTAL	90,600

Figure 5-12
Summary of Gap Analysis for South Platte Basin

The M&I gap for each basin is summarized in Table 5-3.

5.3 Options for Water Supply Alternatives

After considering all water supply options it is apparent that in general terms water supply options will be a mixture of conservation, reuse, agricultural transfers, and new water supply projects involving storage.

5.3.1 Conservation

Water conservation will be relied on as a major tool in meeting future M&I demands, but conservation alone cannot meet all of Colorado's future water needs. Section 2 of this report provides a detailed examination of the role that water conservation can play in meeting future water demands and meeting the gap. Various conservation measures were reviewed and ranges of potential statewide water conservation savings estimated.

Projected Long-Term Savings from Conservation and Efficiency Measures

As part of the Conservation TRT effort, a matrix of potential conservation water savings from the implementation of the various measures was developed. The TRT conservation savings matrix (Table 2-1) reveals there is significant potential for water use reductions by Colorado M&I water providers through the implementation of many measures. Some of these measures are programs, while others represent policies that would be implemented by the water provider or land use governing authority.

These measures, if successfully implemented, represent a range of demand reduction from 287,000 to 459,000 AFY by 2030. The level of penetration, which can be defined as the extent to which the conservation measure is implemented or adopted by consumers, is the most sensitive variable that affects the amount of reduction in water demand (conservation) that may be achieved.

The greatest single potential for water savings is bluegrass turf replacement. This measure alone accounts for approximately 40 percent of the total potential savings. For example, in evaluating turf replacement, a statewide savings of 125,000 to 210,000 AFY was based on 25 percent of single family residences having no more than 60 percent turf in their landscape by 2030. In highly urbanized areas, such as the Denver metro area, new residential development by 2030 may have both smaller lot sizes and significantly less bluegrass in the overall landscape mix.

Table 5-3 Municipal and Industrial Gaps

Basin	Increased Demand for M&I and Self-Supplied Industrial	Estimated Gap, AFY in 2030	Locations of Gap
Arkansas	98,000	17,100	Upper and Southwestern regions (augmentation credits) and Lower region and unincorporated El Paso County (firm water supply)
Colorado	61,900	3,000	Smaller providers in Garfield County, Grand and Summit Counties
Dolores/San Juan/ San Miguel	18,800	4,900	San Miguel (water supply) and San Juan (infrastructure to deliver existing and future water supplies)
Gunnison	14,900	2,400	Upper Gunnison and Ouray County (need for augmentation credits)
North Platte	100	100	No gap anticipated due to low increase in demand
Rio Grande	4,300	100	No gap anticipated due to low increase in demand
South Platte	409,700	90,600	All areas
Yampa/White/ Green	22,300	0	Concerns over drought reliability due to transit losses. Oil shale development in White River basin could significantly increase demands.
Total	630,000	118,200	

Rural and suburban residential development and higher income areas, as seen on the West Slope and Douglas, El Paso, Larimer, and Weld counties on the Front Range may, however, continue to have larger lots and extensive bluegrass landscaping. Residential lot sizes are generally a function of the housing market and usually cannot be controlled to a meaningful level by local water providers. However, lot sizes can be influenced by the local land use governments, particularly in the planning and zoning process. Water utilities can also exert influence in this area by developing a water tap fee (also termed system development charge or water resources and plant investment fee) structure that takes into consideration lot size and the projected demands that each new customer will place on the system.

The Role of Water Conservation in Water Supply Planning and Meeting the Gap

The role that water conservation can play in helping address the gap identified in SWSI requires further investigation and discussion. Implementing additional conservation measures in some of the major gap areas (Northern El Paso, Arapahoe, and Douglas Counties) where water demand is primarily supplied by non-renewable groundwater can reduce rate of mining of the groundwater and extend the useful life of the aquifers. This would result in a reduction of future renewable water supplies needed to meet future demands, but does not provide a renewable water supply for these water providers. Also, it would be inaccurate and misleading to look at the potential statewide conservation savings and arithmetically apply it to the gap areas. This would assume that saved water in other basins or other geographic areas can or would be delivered to gap areas. There has not been any indication that water providers who achieved future water conservation savings would be willing to perpetually allocate saved water to other water providers. In the event that water providers would agree to permanently sell conserved water to the gap areas, additional infrastructure would be needed to store and deliver the conserved water.

During the Gap TRT, this topic was discussed several times. In order to build on thematic conservation alternatives, it would be useful to have specific information on the source and estimated quantity of supply that would be saved through conservation/demand reduction. Without this detailed information generalized assumptions can be made but it will be difficult to fully evaluate the strengths, implementation issues, and costs.

The implementation of M&I conservation will result in some reduction in wastewater and lawn irrigation return flows. Even without additional conservation, M&I water providers will continue to increase their use of legally consumable return flows, whether from lawn irrigation or wastewater effluent. This will inevitably result in reduced supplies to downstream agricultural users who have benefited from these increased flows over the past 40 years, thus increasing their water supply gap.

The role water conservation can play in meeting future water supply needs and the gap continues to be debated and can generally be characterized in the following manner.

It would be inaccurate and misleading to look at the potential statewide conservation savings and arithmetically apply it to the gap areas. This would assume that saved water in other basins or other geographic areas can or would be delivered to gap areas.

Water providers recognize the important role that conservation plays in reducing future demands. At the same time, since conservation measures take decades to fully implement, and given the fact that there is uncertainty in the total amount of water saving that can be achieved, water providers also believe they must concurrently pursue structural water storage and management projects to ensure that future water needs are met.

Conservation and environmental interests believe that conservation is cost-effective and should be pursued first; before storage and other structural projects are constructed.

Since water projects take almost a decade and in some cases much longer to design, permit, and implement, conservation will likely be pursued as part of an integrated water resources strategy with structural alternatives. Water demand beyond the year 2030 will continue to grow and both conservation and storage are needed to address future needs beyond 2030.

Clearly both perspectives raise valid points. The differences in the approaches are closely tied to goals and the objectives of each group. Water providers have an affirmative responsibility to provide water supplies and reliably meet the needs of their citizens. Environmental/conservation interests sometime see this as causing unnecessary impacts. The TRT process developed a greater understanding of these issues but significant differences in perspective still exist and are likely to play out on a case-by-case basis.

5.3.2 Water Reuse in Colorado

As competition for Colorado's limited water supplies increases, reuse of legally consumable water has become increasingly prevalent. At the same time, new water management constraints are becoming evident. Recent events in the western United States and in Colorado in particular, have brought significant interest in water reuse. Perhaps the most influential event was the intense drought conditions of 2002, drawing significant attention from utilities and the public to reuse as an available resource.

Colorado's water needs and supply challenges mimic those seen across much of the growing West. As Coloradans look to meet major increases in water demands in the urbanized Front Range areas, many Western Slope groups vigorously oppose more trans-basin diversions of raw water supplies from their basins. This philosophy is often augmented with a call for Front Range entities to fully reuse their water supplies. Water providers along the Front Range are projecting significant increases in nonpotable and indirect potable reuse as water supply strategies.

In investigating reuse options, there are many impacts and tradeoffs to consider, such as:

- Interplay between conservation and reuse. Stronger conservation programs reduce inflows to wastewater treatment plants and reduce reuse opportunities. Conversely, reuse can be an effective means to fully utilize supplies.
- Limitations on the legal ability to reuse supplies due to water rights issues.
- Impacts of additional urban reuse on streamflows, flow availability for downstream users and the associated impacts on water rights administration.
- Implications of urban and agricultural irrigation efficiency projects on reusable flows.
- Mismatches between peak summer demands for water and the relatively constant wastewater and irrigation return flows.
- Most Front Range water providers have already included maximization of reuse opportunities in their future water supply estimates.
- Management of water treatment waste streams from indirect potable reuse treatment processes, such as concentrate (brine) from reverse osmosis treatment.
- Potential constraints on reuse related to endangered species flow considerations and federal permit conditions requiring maintenance of return flows, even if they are legally reusable.

Authorization and Regulation of Reuse in Colorado

Regulation of reclaimed domestic wastewater reuse in Colorado has evolved from case-by-case, "write-in" requirements in individual wastewater treatment facilities' discharge permits to development of a specific control regulation adopted by the State of Colorado in 2000. In implementing reuse regulations and projects in Colorado, the reuse community has identified the following guiding principles:

- Protect public health and environment.
- Prioritize authorization of those uses that are most likely to be widely implemented.
- Establish sensible, clear, and consistent requirements for authorized uses.
- Establish and maintain confidence in reuse.
- Keep reuse viable and attractive to both treaters and users.

The initial Colorado regulation was limited to landscape irrigation applications, since most reuse projects in the state fell within this category at the time the regulation was developed. Drought conditions that brought about unprecedented water use restrictions along the Colorado Front Range in 2002 spurred significant interest in using reclaimed water for a plethora of new, creative, but unauthorized, applications. Through implementation of the baseline landscape irrigation regulations and assessment of additional uses for potential regulatory authorization in 2004, members of the Colorado reuse community worked cooperatively with the State to develop regulations that address public health and environmental protection needs while encouraging continued and expanded reuse in this semi-arid state.

Status of Reuse

Reuse has rapidly expanded in recent years throughout Colorado's Front Range, in terms of:

- Number of reuse "treaters" and "users."
- Volume of reclaimed water put to beneficial use.
- Increased diversity of applications.

It is expected that these trends will continue for the foreseeable future, within the limits of water rights and other constraints on reuse.

While reuse has rapidly expanded in recent years, several utilities have had reuse systems in place for decades. For example, the City of Aurora has produced reclaimed water for irrigation since 1968 and currently operates a 5-million-gallons-per-day (mgd) base loaded wastewater treatment plant with tertiary treatment. Water produced at the Sand Creek Water Reuse Facility is distributed through 20 miles of pipeline and used for landscape irrigation at several of the city's parks, golf courses, street medians, municipal center, and other locations throughout the city.

Colorado Springs Utilities first provided reclaimed water to a city-owned golf course for landscape irrigation during the drought of 1964. Today, through some 20 miles of distribution pipeline, Colorado Springs Utilities provides tertiary-treated reclaimed water to sites for landscape irrigation, including several golf courses, municipal parks, and schools, and also utilizes it at its own Las Vegas Wastewater Treatment Facility for in-plant processes.

Newer reuse programs span a wide range of conditions. The Town of Kremmling, Colorado is planning a reuse system to help optimize its water resources portfolio. And in 2003, Denver Water completed construction of its Recycling Plant and a major reclaimed water distribution system through heavily urbanized areas to serve certain industrial and municipal irrigation demands. Denver's system has a current treatment capacity of 30 mgd; a future second phase is envisioned to increase that capacity to 45 mgd.

The Colorado Department of Public Health and Environment (CDPHE) administers the state's reuse program, implementing the Water Quality Control Commission's Regulation No. 84, which specifies design and operational requirements for authorized reuse programs. The state does not maintain a database of reuse programs. Future efforts may include development of a Colorado-specific reuse database, or participation in national efforts such as a nationwide database being developed under a WateReuse Foundation research project. Colorado utilities with authorized reuse programs (as of January 2007) are listed in Table 5-4.

Table 5-4 Colorado Utilities with Authorized Nonpotable Reuse Programs

Name
City of Aurora Water Department
City of Westminster Reclaimed WTF
Plum Creek Wastewater Authority
City of Louisville Wastewater Treatment Plant
Colorado Springs Utilities / Las Vegas Wastewater Treatment Facility
Colorado Springs Utilities' -- Northern Water Reclamation Facility
Fairways Metropolitan District
Denver Water
City and County of Broomfield
Parker Water and Sanitation District (PWSD North and South WWTP)
Lone Tree Creek WWTF
Lone Tree Creek WWTF
Fort Collins Utilities
Tamarron Management Associates, LLC
City of Yuma
Metro Wastewater Reclamation District
Cornerstone Metropolitan District No. 1's *Cornerstone Wastewater Treatment Facility*
Kremmling Sanitation District

In addition to direct reuse programs – those that use a distribution pipeline network to deliver reclaimed water from a wastewater treatment plant to a user's site—treated wastewater effluent in Colorado is reused in many other ways. For example, several utilities exchange their treated effluent for the right to divert water further upstream for potable supply or other uses.

More recently, Front Range utilities have begun to implement indirect potable reuse programs. Indirect potable reuse involves the capture of legally reusable return flows and reintroduction of these captured flows into the municipal raw water supply. The return flows that are captured may have been discharged to a river or stream and mixed with other waters. Other options include the capture of treated wastewater effluent and additional treatment. The captured flows are then reintroduced into the municipal raw water supply system. This type of water will likely require advanced water treatment methods beyond current treatment levels before the recaptured water can be introduced into the raw water supply.

5.3.3 Agricultural Transfers

The transfer of water from agriculture to M&I use will continue, especially in the South Platte and Arkansas Basins. SWSI Phase 1 estimated potential changes in irrigated acreage. This figure is in Section 3 of this report as Figure 3-1. Section 3 of this report provides further discussion of alternative agricultural transfer methods. Two structural water supply concepts were discussed and developed during the TRT process—one in the Arkansas Basin and one in the South Platte Basin. These structural projects seek to provide a permanent and reliable water supply to meet major Front Range gap areas. The method of acquiring and transferring the water is not specifically delineated in the alternative and could be one or more of the methods described in Section 3. Section 5.4 of this report provides more detail on the Agricultural Transfer Alternative from the South Platte and Arkansas Basins.

5.3.4 New Water Supply Projects Including Storage

New storage and the more effective use of existing storage are means to provide additional water supplies. Given current shortages in headwater areas, the desire to provide for the environment and recreation in headwater areas, and the fact that water supply generally increases as you move downstream indicates that the opportunity to develop or use existing storage should generally focus on areas in the middle to lower reaches of watersheds. To maximize the use of new and existing storage it is also prudent to look at conjunctive use of groundwater and surface water.

5.4 Major Water Supply Alternatives for Select Gap Areas

As part of the Gap TRT, a total of seven major water supply alternatives using the above strategies were investigated. The intent of looking at structural alternatives was to create infrastructure and nonstructural options that would have a multi-purpose focus integrating M&I, agricultural, environmental, and recreational needs and also basin specific options (local water supply projects and needs) that were identified in SWSI.

The following water supply alternatives were developed at a conceptual level to address the M&I water supply gap.

1. Agricultural Transfers (Traditional or Alternative) from the Arkansas and South Platte Basins.
2. Blue Mesa Reservoir Pumpback.
3. Colorado River Return Project.
4. Flaming Gorge Reservoir Pipeline.
5. Green Mountain/Blue River Reservoir Pumpback.
6. Yampa River Pumpback.

The potential options were discussed in general terms outlining some of the benefits and implementation issues of the options. After hearing the discussion, the TRT concluded that it would be valuable to have the Gap TRT continue its work and to look further at and develop more information on each of the options. Overall the TRT felt there was value in having additional data to help understand the issues and opportunities that our state faces. It was emphasized that the process is not making the decision; it is providing information for future consideration.

5.4.1 Elements of Water Supply Alternatives

Each basin was looked at broadly from a supply availability standpoint and for the reasons stated in Section 5.3.4 pumpback options were developed in areas of potential physical and legal availability of supply. There is no general agreement on how much additional water can or should be developed under the Colorado River Compact for either in-basin or transbasin uses. This issue of supply availability will be further evaluated as part of the Colorado River Supply Availability study to be conducted by the CWCB.

This section looks at infrastructure alternatives, recognizing that the issue of supply availability could limit or eliminate alternatives. To the extent that information has been developed on any of these alternatives, this report has examined and relies on and summarizes information generated from these previous studies. These studies include the South Metro Regional Water Master Plan (SMRWA 2007), Super Ditch presentations (Lower Arkansas WCD 2007), Colorado River Return Reconnaissance Study (CWCB 2003), Flaming Gorge presentations (Million Resources Conservation Group (2006-2007), Reconnaissance Study: Blue River Pumpback and Wolcott Reservoir Alternatives (CRWCD et al. 2007), Multi Basin Water Supply Investigation (NCWCD 2006).

It should be noted that many of the concepts discussed involve potential shared infrastructure and/or exchanges of yield. No individual or group or providers have agreed to these concepts. The concepts are shown to illustrate potential opportunities.

Associated engineering elements, potential benefits, potential implementation issues, and attributes are summarized for each option below.

In order to develop comparable costs of each alternative, it will be necessary to determine capital and annual O&M costs. Examples of these costs are as follows:

- Capital Costs. permitting, mitigation, water rights, land acquisition, land easements, pumps, pipe, treatment, storage, general contingency, and engineering/legal contingency.
- Annual O&M. energy, equipment maintenance, and replacement costs.

These costs should then be presented in terms of net present value and then on a cost per AF basis in order to compare alternatives.

Preliminary estimates of the Colorado River Return Project and the Yampa Pumpback indicate the capital costs are in the $2 to $6 billion range for projects delivering 150,000 to 250,000 AFY. It is anticipated that the cost for Blue Mesa multipurpose and the South Platte and Arkansas agricultural transfer pumpback will be in the same range.

5.4.2 Agricultural Transfers from the Arkansas and South Platte Basins

There is sufficient irrigated acreage in the South Platte and Arkansas Basins to meet the gaps in these basins if agricultural water is transferred to M&I use. In order to provide the needed additional water supply for these two basins there must be an annual dry up of some irrigated land, regardless if it is a traditional agricultural transfer or one of the alternatives identified by the Alternative Agriculture Transfer TRT. The amount of acreage required to be dried up annually will be a function of the seniority of water right, firm annual yield required, available storage, ability to recapture consumable return flows and losses in storage, delivery and treatment. As an example, in order for 90,000 AF of firm annual yield to be supplied to the gap area of the South Platte and Arkansas Basin, an estimated 50,000 to 66,000 irrigated acres would be taken out of agricultural production annually. As described in Section 3, under a rotational fallowing alternative

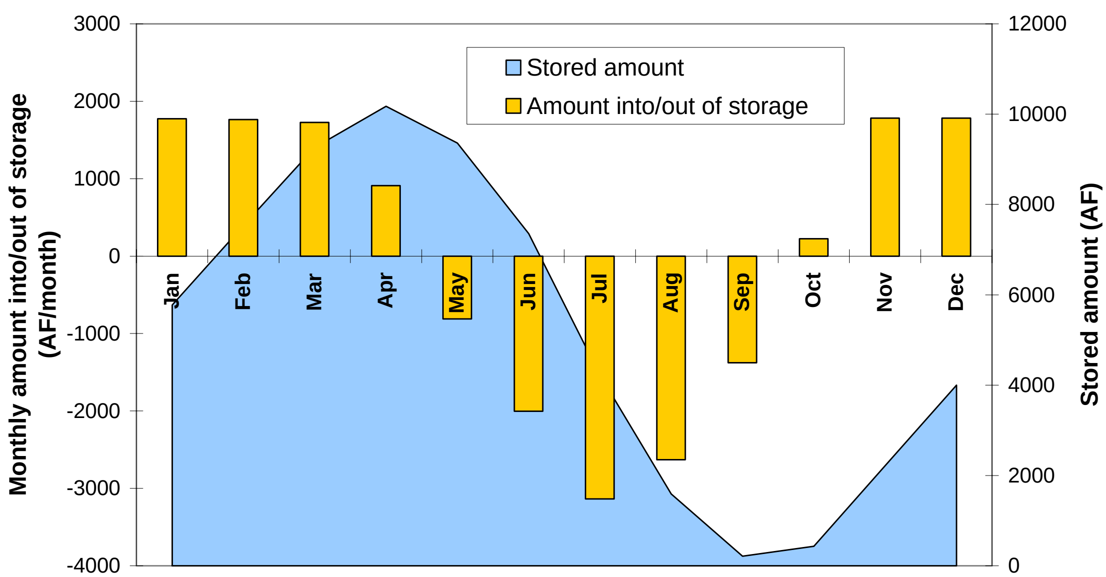


Figure 5-13
Storage, Inflows and Releases from M&I Reservoir Receiving Baseload Deliveries

transfer involving a 1 in 5 year fallowing, 125,000 to 330,000 acres of agricultural land would be needed in the fallowing program to produce 100,000 AF of firm annual yield. Storage would also be associated with this alternative and the volume of storage required is specific to the irrigation company system. It is estimated that 100,000 to 200,000 AF of storage could be required to produce 100,000 AF of firm annual yield that would be delivered every year including during extended drought periods.

Under a rotational fallowing, 125,000 to 330,000 acres of agricultural land would be needed in the fallowing program to produce 90,000 AF of firm annual yield.

Conceptual schematics of an agricultural pumpback diversion are shown in Figure 5-14. This figure illustrates the likely components of the water diversion system and firming storage system for a South Platte or Arkansas agricultural transfer alternative.

Water quality in the lower reaches of the South Platte and Arkansas Basins is not suitable to directly provide for drinking water supply using conventional water treatment processes. There is limited opportunity to exchange the transferred agricultural water upstream to points of diversion where water quality is higher and compatible with standard water treatment processes. Total dissolved solids (TDS) in the South Platte range from approximately 700 milligrams per liter (mg/L) in the Brighton area to over 1,000 mg/L downstream of Greeley. In the Arkansas, TDS also progressively increases as the river flows downstream. Removal of TDS greater than 500 mg/L and other constituents of concerns such as hardness, nitrates, and organics will require advanced water treatment processes. Due to low water quality, alluvial pretreatment (bank filtration) is assumed as a pretreatment step for organics removal and to precondition the water for advanced membrane processes such as reverse osmosis. A comparison of a conceptual treatment process for conventional treatment of higher quality water and two advanced treatment processes for treating TDS supplies with higher TDS or organic carbon are shown in Figure 5-15.

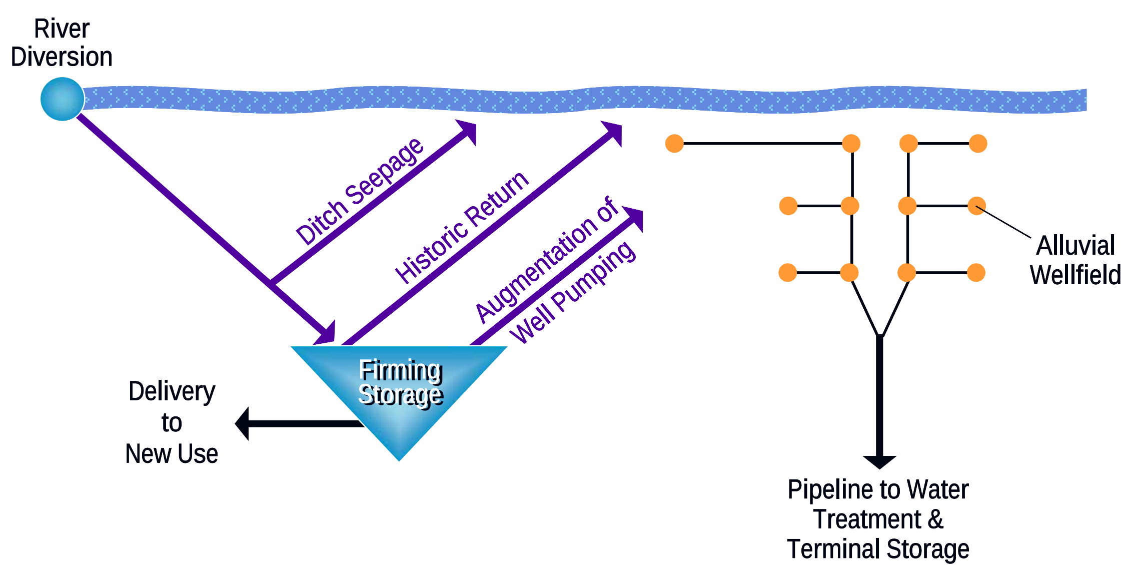
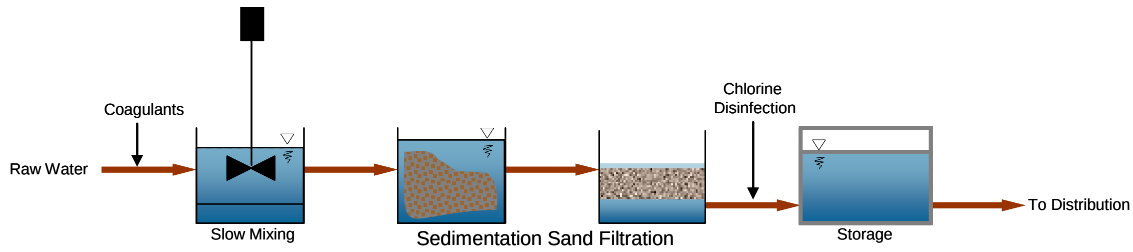
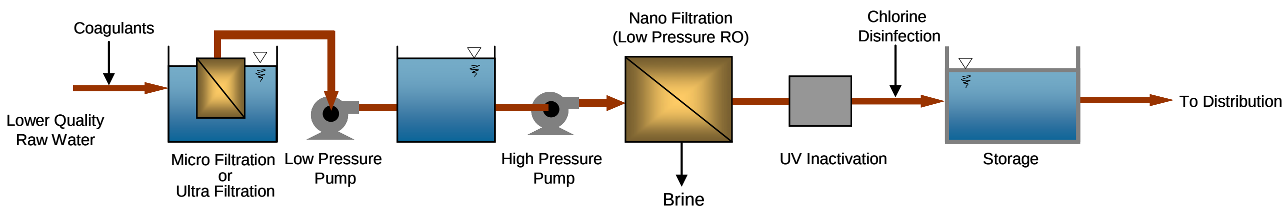


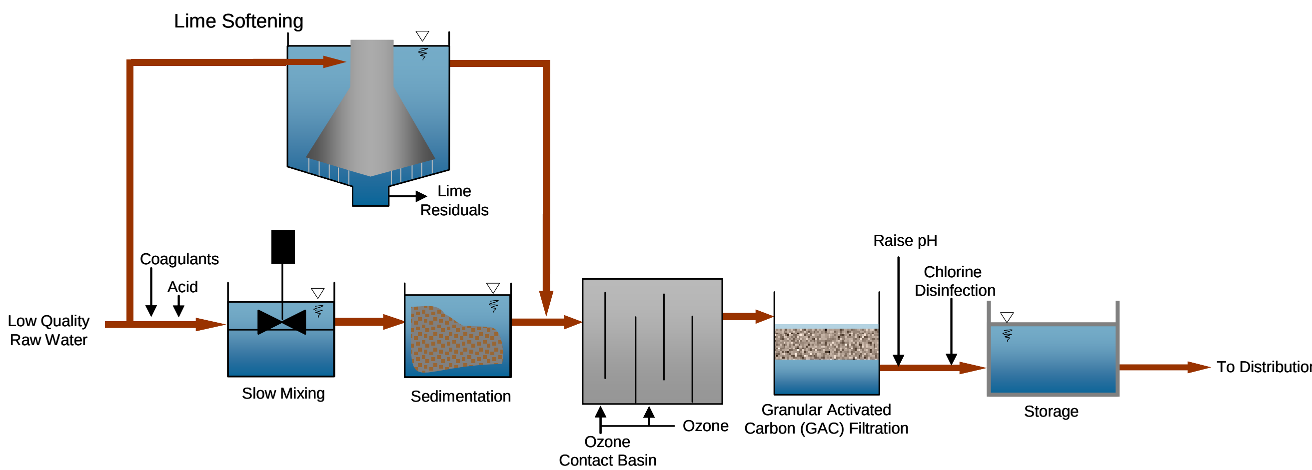
Figure 5-14
Conceptual Schematic of Diversions and Firming Storage for Agricultural Pumpback Alternative



Conventional Treatment of High Quality Raw Water from Snow Melt



Advanced Treatment Process of Lower Quality Raw Water using Membrane Technology



Alternative Advanced Treatment Process of Low Quality Water

Figure 5-15
Conceptual Conventional and Advanced Treatment Processes for Agricultural Pumpback Alternative

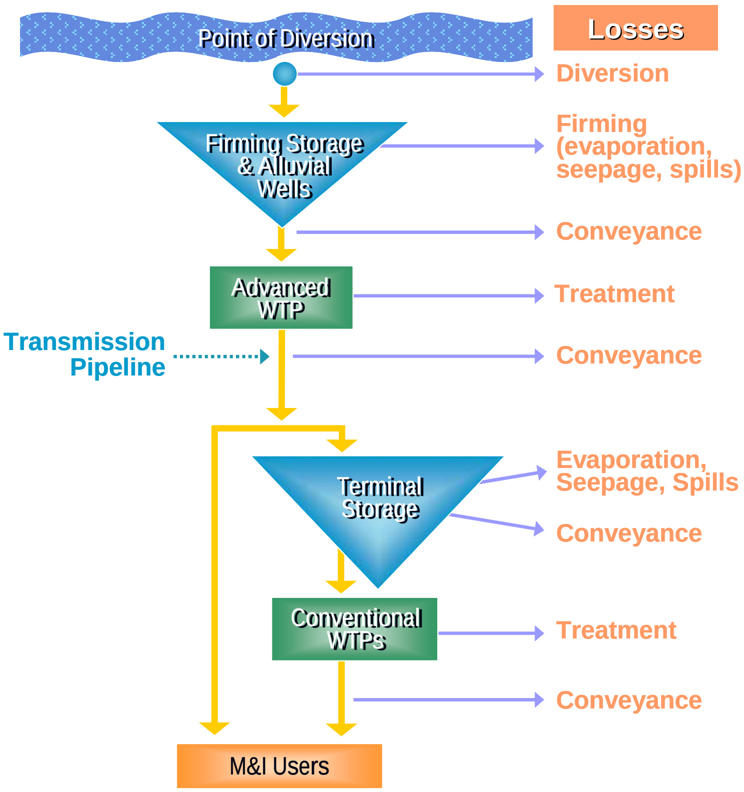


Figure 5-16
Schematic of Losses from Diversion to End User for an Agricultural Transfer Alternative

There will be losses in the delivery of water from the point of diversion to the final end user as conceptually shown in Figure 5-16. Losses include historical ditch seepage and irrigation returns, evaporation, and seepage from firming reservoirs, water lost during the water treatment processes and evaporation and seepage in terminal reservoirs before delivery to local water treatment facilities.

Water treatment processes are significantly more complex and costly for both capital construction and O&M. Reverse osmosis is shown in this schematic for treating the high TDS water though there are other potential treatment processes that may meet some or all of the end user water quality goals and drinking water standards. An advanced oxidation process with side-stream softening is shown for treating water with a high percentage of municipal or agricultural return flow that typically has higher levels of dissolved organics and hardness.

The conjunctive use (CU) of nontributary groundwater as part of this alternative can potentially improve overall project operations. Under this concept, during above average years when agricultural rights are yielding more, additional surface water can be recharged into the nontributary aquifers for later withdrawal. During conditions of below average streamflow, when surface water agricultural water rights are producing less, the water stored in above average years can be withdrawn from the aquifers to provide additional dry year yield. Additional pipeline, pumping, and treatment capacity would be required, but there would be a potential reduction in the volume of storage required. This CU concept has not been analyzed and would require additional investigation on the aquifer storage and recovery concept. A schematic of a CU surface water and groundwater aquifer storage and recovery layout is shown in Figure 5-17. Additional information regarding potential groundwater storage opportunities can be found in two studies:

- *Artficial Recharge of Ground Water in Colorado – A Statewide Assessment* (2004) prepared by Ralf Topper, Peter E. Barkmann, David A. Bird, and Matthew A. Sares for the Colorado Geological Survey, Department of Natural Resources; and,
- *SB06-193 Underground Water Storage Study* (2007) prepared by CDM for the Colorado Water Conservation Board.

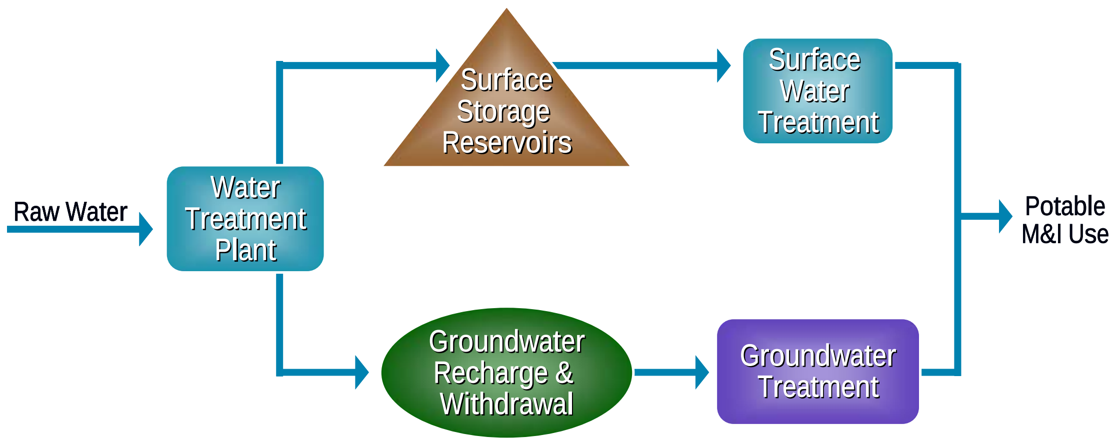


Figure 5-17
Schematic of Conjunctive Use of Surface Water and Groundwater/ASR

Conceptual layouts of piping infrastructure for the South Platte could run from the Greeley, Weldona or Sterling areas north to the South Metro Gap area as depicted in Figure 5-18. This route could allow a tie-in to existing and planned pipelines from the Brighton area to the South Metro area. Elevation profiles for the conceptual pipeline alignments were developed and are shown in Figure 5-19. The total elevation gain for the South Platte pipeline alignments to the South Metro gap area vary from approximately 1,500 to 2,100 feet, depending on the intake and ending locations.

Conceptual layouts of an Arkansas pumpback are shown from Avondale, Boone and LaJunta north to the El Paso county gap area as shown in Figure 5-20. It may be possible to exchange water upstream and divert higher quality water at upstream locations. Elevation profiles for the pipeline alignments were developed and are shown in Figure 5-21. The elevation gain for the Arkansas pipeline alignments vary from approximately 2,000 to 3,500 feet, depending upon starting and ending location.

The following are some of the key considerations when examining the project elements, benefits, potential implementation issues and potential attributes for this alternative.

Project Elements—Lower South Platte/Arkansas Pumpback Option

- Can accommodate a traditional or alternative agricultural transfer.
- Pipeline and pumping from lower South Platte to South Metro area, and from the Arkansas to northern El Paso County and other areas.
- Storage would be required at both ends of the pipeline in order to provide for firm annual yield and maximize the use of pipe and pumping infrastructure capacity by delivering water on a full pipe baseload basis.
- Alluvial pretreatment (bank filtration) is assumed as a pretreatment step for organics removal and to precondition the water for advanced membrane processes such as reverse osmosis.
- Advanced water treatment (reverse osmosis) would be required to remove total dissolved solids and other constituents and there would be associated high capital and O&M costs for advanced water treatment and the disposal of the water treatment waste stream concentrate.

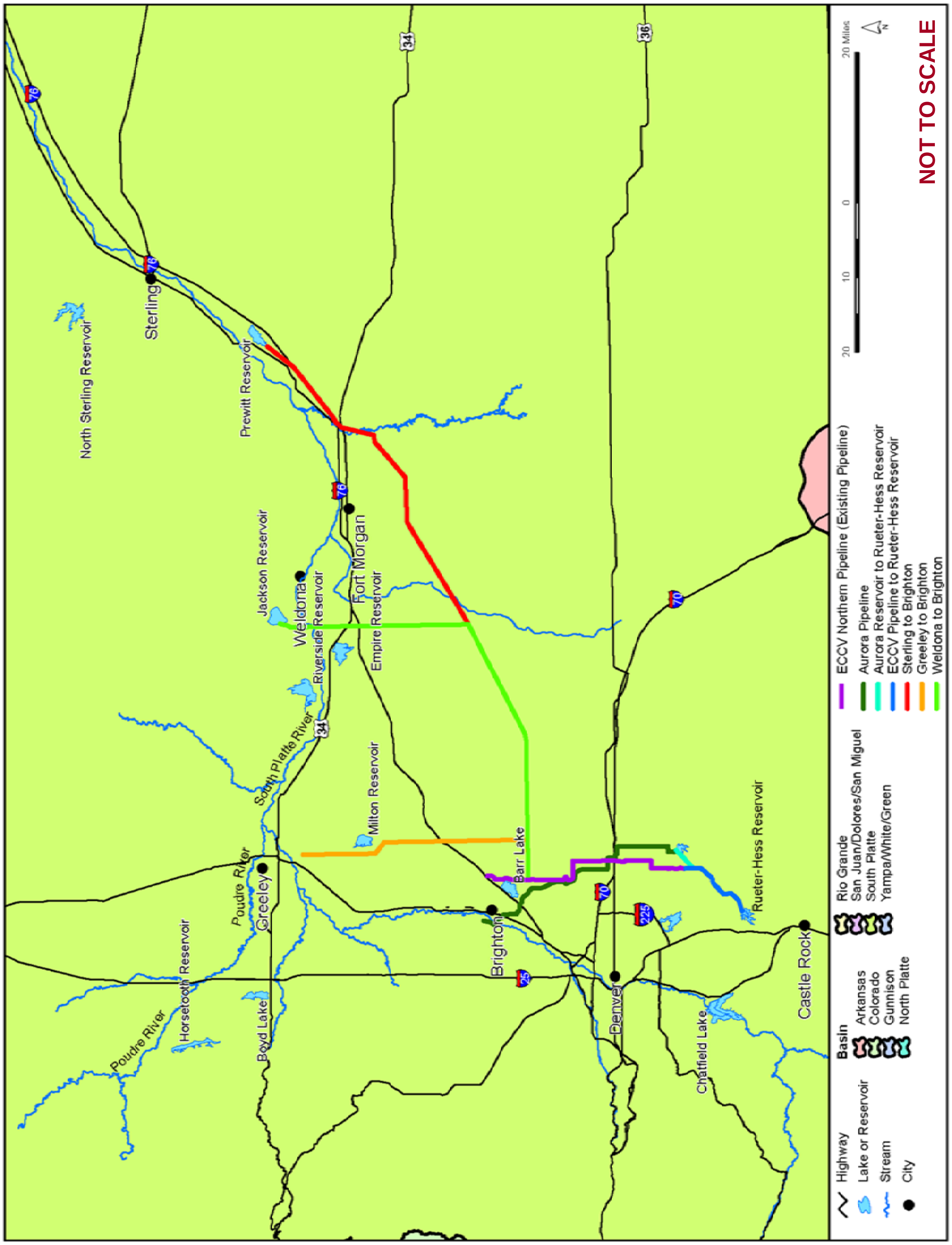


Figure 5-18
Conceptual South Platte Pumpback Pipeline Alignments

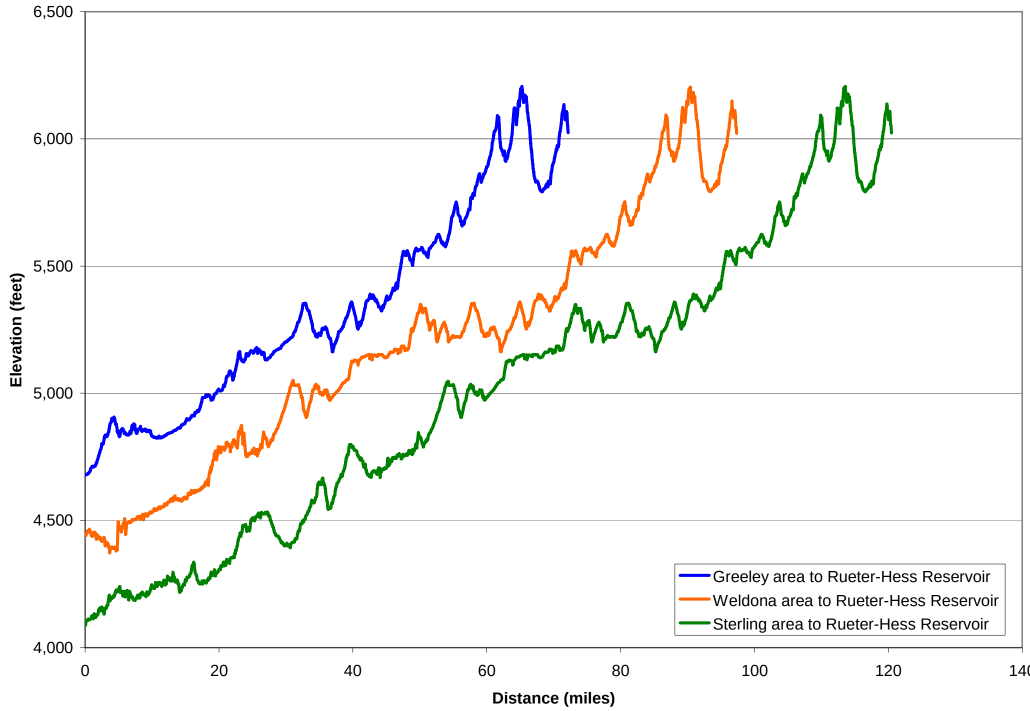


Figure 5-19
Profiles of Conceptual South Platte Pumpback Pipeline Alignments

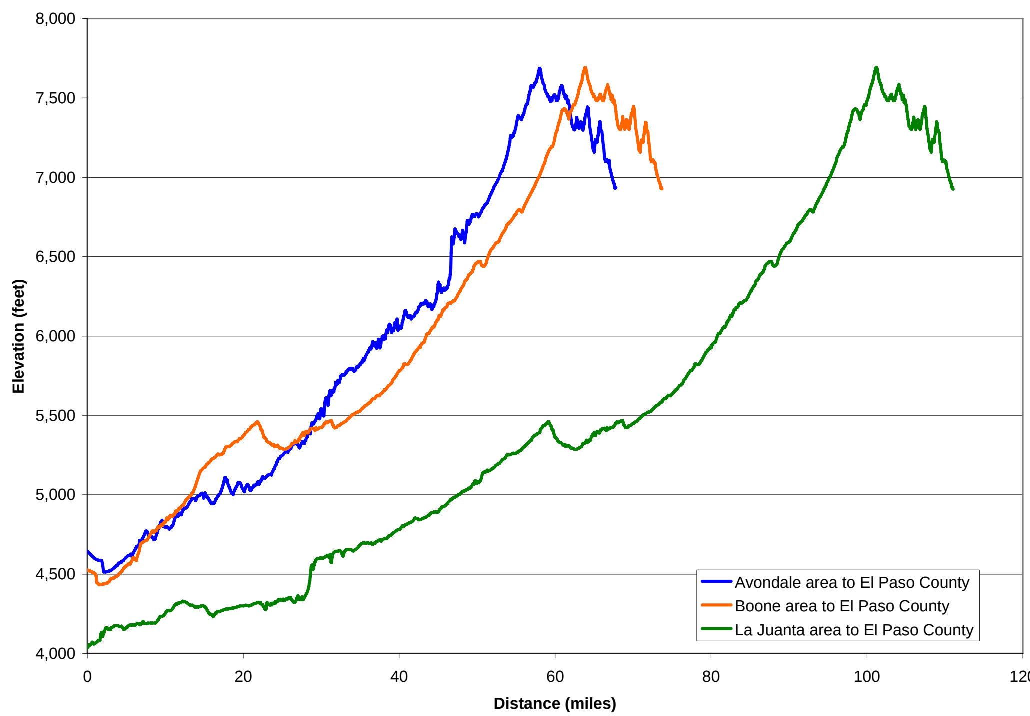


Figure 5-21
Profiles of Conceptual Arkansas Pumpback Pipeline Profiles

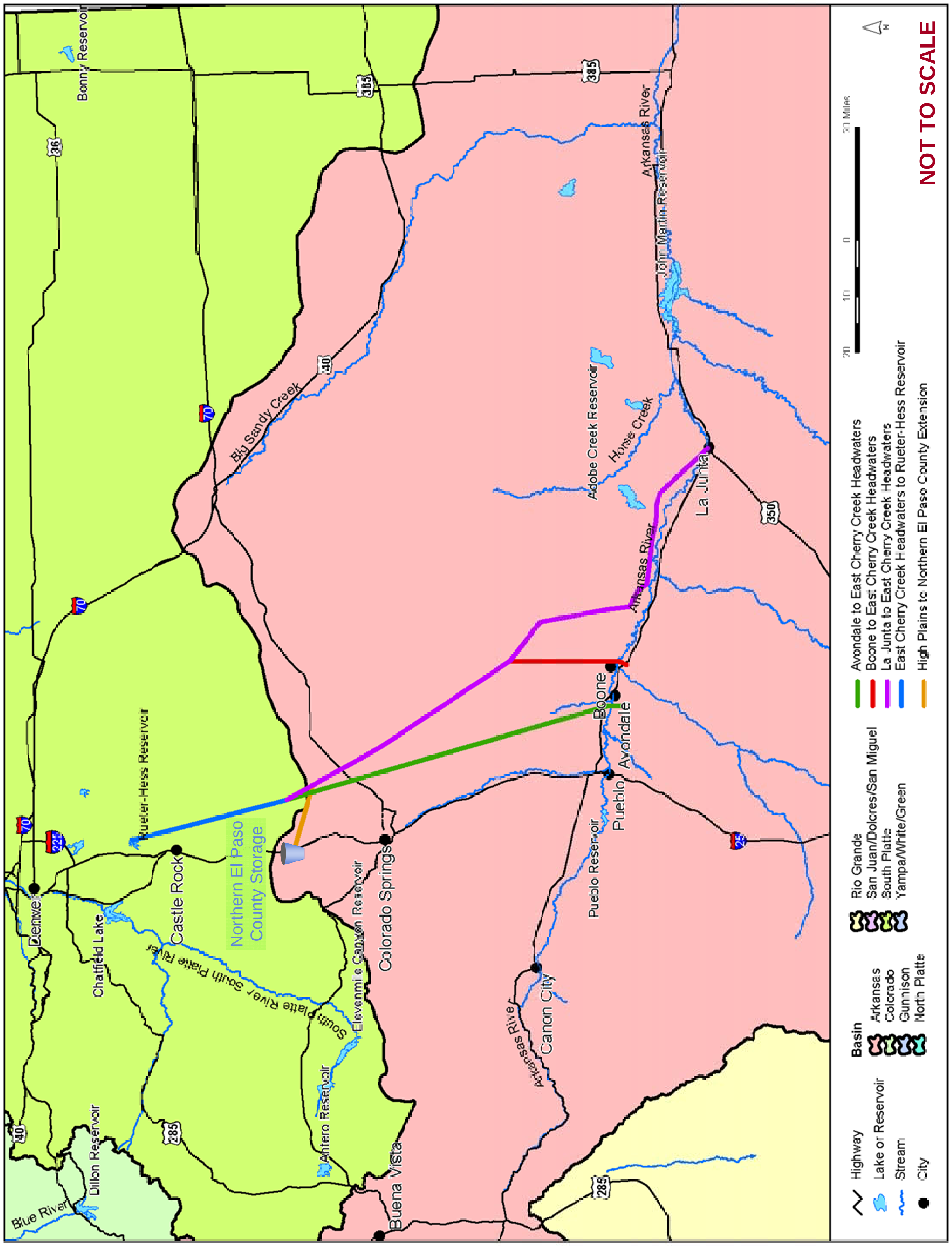


Figure 5-20
Conceptual Arkansas Pumpback Pipeline Profiles

Benefits:

- Less reliance on additional deliveries from headwaters areas, thus minimizing streamflow impacts in environmentally sensitive areas.
- Decreases the need for additional transbasin diversions.
- No net increase in depletions to the river system.

Implementation Issues:

- Water quality is poor and treatment costs (capital and O&M) are very high.
- Disposal of treatment waste stream concentrate is a challenge and very costly.
- Loss of irrigated acreage in production annually regardless of the type of agricultural transfer.
- Significant energy requirements for pumping and water treatment.

Potential Attributes:

- Potential to collaborate with remaining agricultural users to construct lower basin storage or recharge facilities to improve agricultural yields or provide for well augmentation.
- Shared infrastructure among water providers, resulting in economies of scale for capital and O&M.
- Can provide for coordinated acquisition of agricultural rights for either a traditional or alternative transfer preserving higher quality/ value agricultural production.
- Conjunctive use with non-tributary groundwater can potentially improve the overall project operation.

5.4.3 Blue Mesa Multipurpose Project

A Blue Mesa Multipurpose Project could divert water from or downstream of Blue Mesa Reservoir for delivery to users areas in the South Platte and Arkansas basins. This would require a contract with the Bureau of Reclamation (BOR) for a contract for a portion of the Aspinall yield or the filing of a new water right(s). A new water right would likely require payment to the BOR for power interruption, since the Aspinall Unit power call effectively appropriates the remaining firm annual yield in the Gunnison at Blue Mesa Reservoir. Payment of power cost to reduce the Redlands Call could also increase the yield of a junior water right. The amount of water that may be available for any news consumptive use, whether from a BOR contract or a new appropriation is subject to significant differences of opinion and may range from 0 to over 240,000 AFY. As shown in Figure 5-22, water supplies would be pumped from Blue Mesa Reservoir to Antero Reservoir in the South Platte Basin where the supplies could be gravity fed via the South Platte River to the South Metro gap area and other South Platte water users. In addition, a diversion would also be provided to the headwaters of the Arkansas where water could be diverted by water users throughout the basin. A major pipeline would be required from the Arkansas to provide delivery to the gap area of northern El Paso County.

The project could have the potential to provide benefits across multiple basins addressing the gap areas in the Upper Gunnison, South Platte, Arkansas, and potentially alleviating some of the pressure on the headwaters of the Colorado due to transbasin diversions. However, the benefits from the project in any single year would be influenced by available yield. To help ensure protection of in-basin water rights, endangered species, environmental flows and recreational use in Blue Mesa and the Gunnison River downstream, the project would store average to wet year water in Blue Mesa Reservoir for these deliveries. There would also be additional storage required on the Front Range in the South Platte and Arkansas Basin such as expansion of Rueter Hess Reservoir, Pueblo Reservoir, other expanded or new surface reservoirs or alluvial groundwater storage. In addition, it may be beneficial to combine this option with CU and agricultural transfer to increase flexibility and minimize implementation issues.

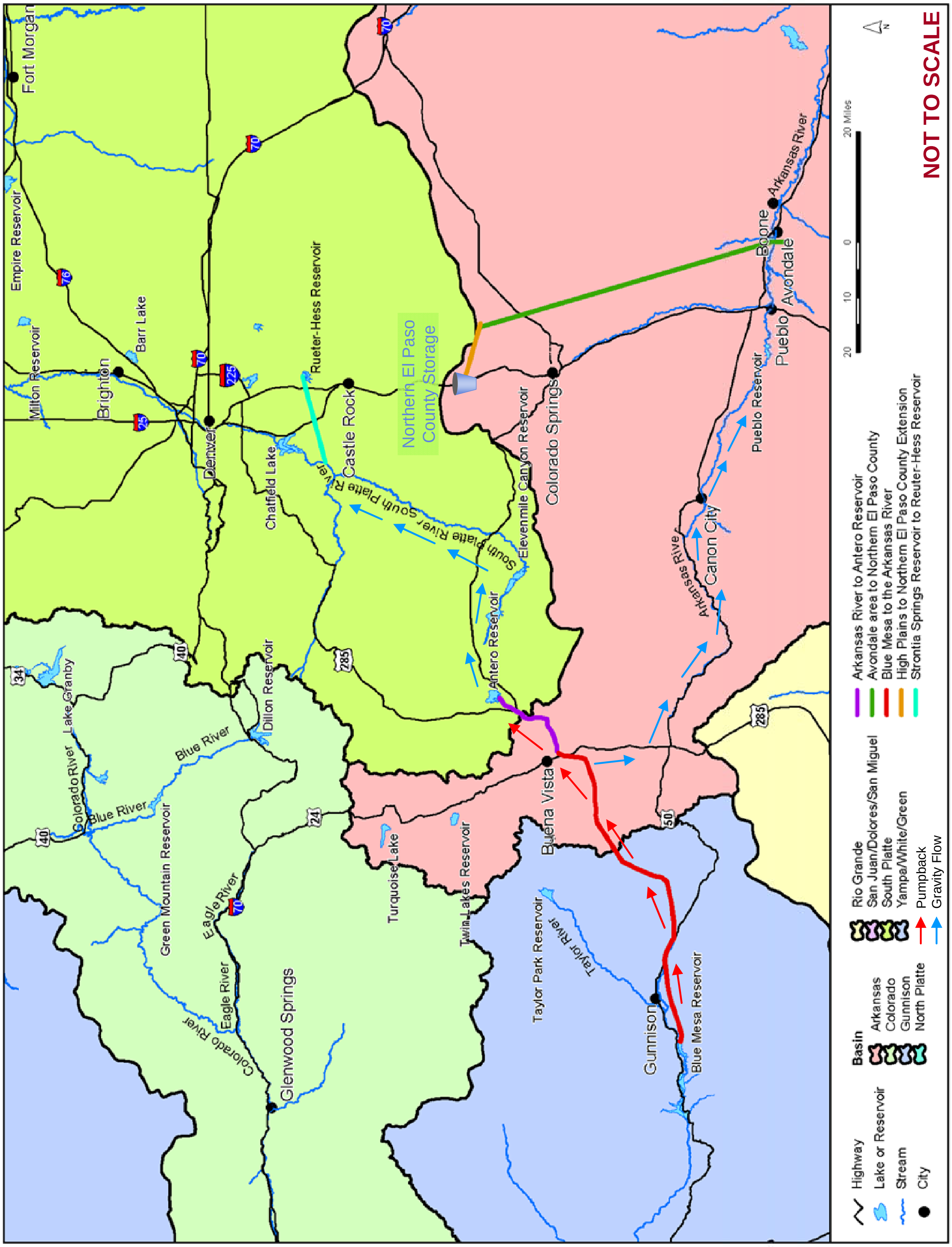


Figure 5-22
Conceptual Pipeline Alignments from Blue Mesa to South Platte and Arkansas

Supplies would consist of relatively high quality water. However, diversions may only be available in average to wet years if new junior water right(s) must be acquired. Storage in Blue Mesa Reservoir must be negotiated with the BOR. Agreements on minimum water levels in Blue Mesa Reservoir to provide for flatwater recreation opportunities and minimum power pool reservoir levels would also need to be provided and negotiated. The quantification of the Black Canyon of the Gunnison federal reserved water right could affect not only the availability of unappropriated water in the basin, but the yield of the existing Blue Mesa Reservoir and BOR Aspinall Unit Project and upper basin absolute and conditional water rights.

A Blue Mesa Pumpback has not been analyzed in any level of detail. Additional analyses of supply availability, Aspinall operations, Black Canyon reserved right, endangered species flows and other considerations would be required before a determination could be made on available yield for this project.

The following are some of the key considerations when examining the project elements, benefits, potential implementation issues and potential attributes for this alternative.

Project Elements

- Contract with BOR for portion of Aspinall pool or new water right appropriation with payment to BOR for power interruption.
- Pumpback to South Platte and Arkansas with storage in each basin.
- Diversions from pipeline for deliveries to upper Gunnison for agricultural firming, domestic well augmentation, and instream flows.
- Possible exchange for diversion from the Colorado Basin to augment flows in headwaters areas of the Blue and Fraser Rivers.
- Possible additional flexibility on Fry-Ark Diversions to benefit east and west slope communities

Benefits:

- Minimizes loss of irrigated acres in South Platte and Arkansas basins.
- High quality water that can be treated with conventional water treatment and/or blended with lower quality water.
- Maximizes Colorado's Colorado River compact entitlement.
- Additional flows in upper South Platte and Arkansas Rivers, providing for additional environmental and recreational enhancement.

Implementation Issues:

- Endangered species flows could be impacted in the Gunnison Basin.
- Less water for future in-basin needs (quantity and quality).
- Recreation impacts on Blue Mesa Reservoir and downstream.
- Potential for increased compact call.
- Large energy requirements.

Potential Attributes:

- Delivery to in-basin users for agricultural domestic augmentation and instream flows.
- Development of additional storage in the Gunnison, South Platte, and Arkansas Basins.
- Financial contribution or other mitigation to Gunnison Basin.
- Provide funding for additional water quality improvements in the Uncompahgre River and Lower Gunnison River.
- Limit diversions to average to wet year water.
- Potential for augmenting flows in Colorado River basin headwater, providing for additional environmental and recreational enhancement either through a direct discharge to Colorado basin or exchange of Blue Mesa water with existing transbasin diverters, allowing them to leave additional water in Colorado basin headwaters.

- Conjunctive use with non-tributary groundwater can potentially improve the overall project operation.

5.4.4 Colorado River Return Project

The Colorado River Return Project (CRRP) was a reconnaissance-level investigation of a diversion from the Colorado River near the Utah state line downstream of Grand Junction for delivery to multiple basins in Colorado. It was conducted to establish operational requirements and the preliminary size, type and location of CRRP facilities; identify the most significant environmental and water quality issues; distinguish the major differences between alternative CRRP configurations and the advantages and disadvantages of those configurations; provide a preliminary indication of technical and economic feasibility for each configuration; and identify the types of potential CRRP sponsors and funding alternatives. The CRRP was studied by the CWCB at a greater level of detail than the alternatives discussed in this section. The report can be found on the CWCB website at http://cwcb.state.co.us/IWMD/coRiverReturnReconnStudy.htm (CWCB 2003).

The CRRP looked at delivery of water from the Colorado River near the Utah state line to delivery areas in the headwaters of the Colorado River and the Front Range. Three conveyance corridors were identified based on considerations of land use, wilderness and national park boundaries, and terrain, with the overall objective of minimizing the length of the delivery pipeline. These alternative corridors have been identified as the Northern, Central, and Southern Corridors. Within each corridor, a variety of specific alignments were evaluated. All three of the corridors begin on the Colorado River near the Utah State line:

1. The Northern Corridor traverses the White/Yampa River Basin before turning south into the upper Colorado River Basin and on to the South Platte and Arkansas Basins.

2. The Central Corridor extends up the Colorado River mainstem and its upper basin tributaries and on to the South Platte and Arkansas Basins.

3. The Southern Corridor traverses the Gunnison River Basin before entering the Arkansas basin and extending on to the South Platte Basin.

The CRRP would help supply water needs using water that is potentially available to the state in accordance with the Colorado River Compact, a long standing agreement between the seven states within the Colorado River Basin. The CRRP identifies and evaluates configurations for three levels of water diversion and demand: 250,000, 500,000 and 750,000 AFY. The general locations of the alternative conveyance corridors are shown in Figure 5-23.

The water would be diverted under a new water appropriation. As with any new west slope consumptive use, the issue of supply availability, endangered species and other considerations would be required before a determination could be made on available yield for this project. Water quality in the Colorado River at the proposed diversion location contains high levels of total dissolved solids. Treatment processes similar to those proposed for a South Platte or Arkansas agricultural transfer pumpback and handling of the water treatment waste stream concentrate would be required. Temperature issues may also be significant depending on the delivery point.

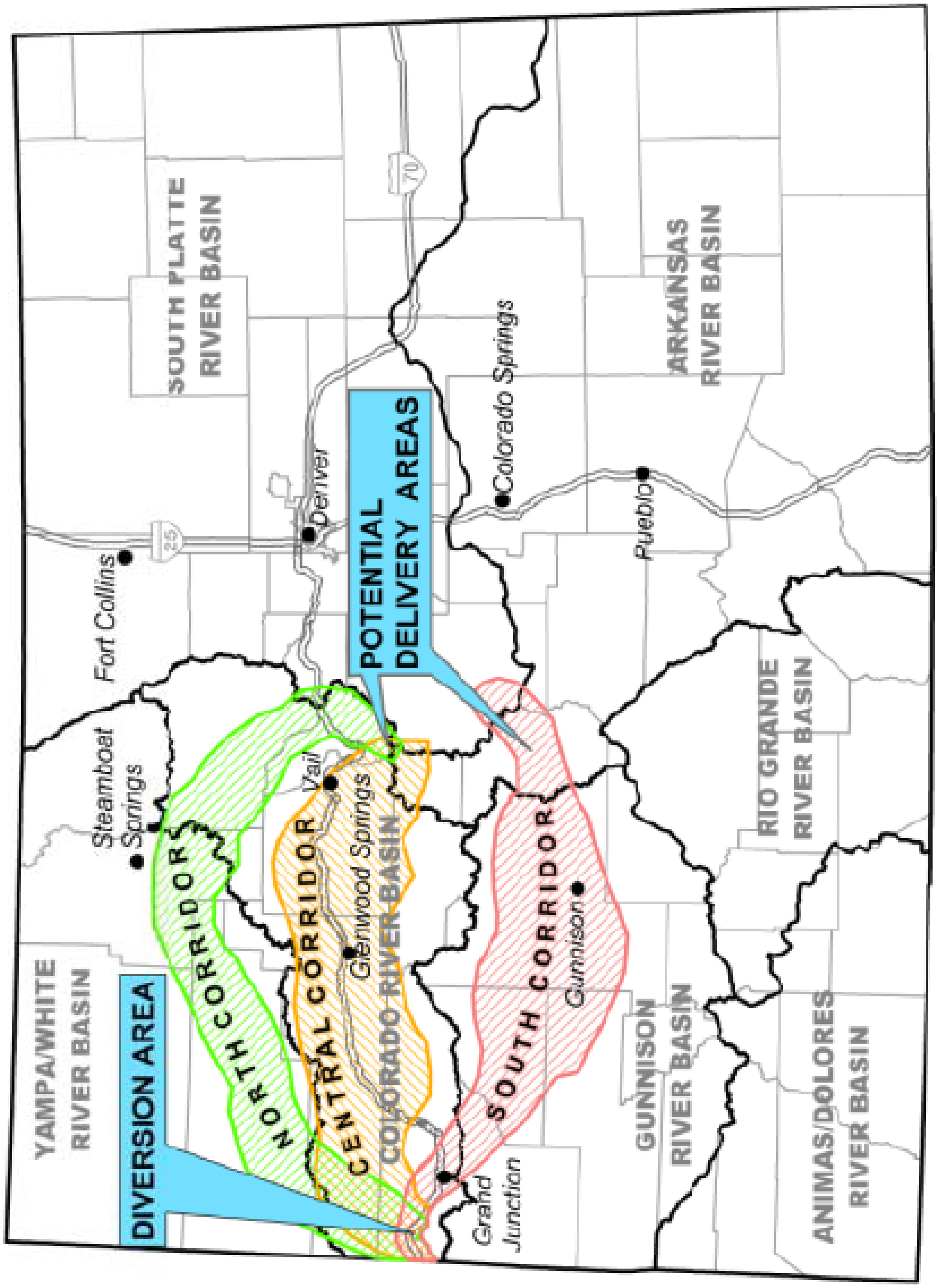


Figure 5-23
Colorado River Return Project Pipeline Corridors

The following are some of the key considerations when examining the project elements, benefits, potential implementation issues, and potential attributes for this alternative.

Project Elements

- Divert unused compact entitlements near the state line downstream of instate users.
- Delivery to multiple basins.
- Storage in Arkansas and South Platte to regulate deliveries to end users.
- Advanced water treatment (reverse osmosis) would be required to remove total dissolved solids and other constituents and there would be associated high capital and O&M costs for advanced water treatment and the disposal of the water treatment waste stream concentrate.
- Conjunctive use with non-tributary groundwater can potentially improve the overall project operation.

Benefits:

- Minimize loss of irrigated acres in South Platte and Arkansas.
- Diverts below all major users in Colorado.
- Maximize Colorado's compact entitlement.
- Less reliance on additional deliveries from headwaters areas, thus minimizing streamflow impacts.
- Additional flows in upper South Platte, Arkansas, and Colorado Rivers, providing for additional environmental and recreational enhancement.
- Multiple basin delivery.

Implementation Issues:

- Water quality is poor and treatment costs (capital and O&M) are very high.
- Disposal of treatment waste stream concentrate is a challenge and very costly.
- Potential for increased compact call.
- Stream temperatures, nutrients, and TDS in water after treatment will be different than streams receiving discharge from project.
- Reduction of flows in the main stem Colorado River and the presence of federally listed fish species below the diversion.
- Significant energy requirements.

Potential Attributes:

- Delivery to in-basin users for agricultural, domestic augmentation, and instream flows.
- Exchanges for additional flows in Colorado headwaters.
- Allows water development while protecting recreational and environmental flows in Colorado basin.

5.4.5 Flaming Gorge Pipeline

The Million Resource Conservation Group is evaluating the feasibility of a potential future pipeline from Flaming Gorge Reservoir, a BOR facility located in southwest Wyoming at the Utah state line. This group plans to initiate environmental documentation under the National Environmental Policy Act (NEPA) process. The source of water for the project would be a contract with the BOR for yield from Flaming Gorge Reservoir or a new water appropriation. Project proponents estimate that 150,000 to 250,000 AFY of water could be diverted from the Green River at several possible locations including:

- From Flaming Gorge Reservoir, Wyoming.
- Directly from the river near Green River, Wyoming.
- From Browns Park National Wildlife Refuge in Colorado.

As shown in Figure 5-24 a 400-mile, 7- to 8-foot diameter pipeline would be constructed to convey this water to the Front Range. The most likely pipeline route would travel along Interstate 80 through Wyoming to Laramie, then convey supplies south past Fort Collins and Greeley to the south metro area with a potential extension to El Paso County and other areas in the Arkansas.

The Million Conservation Resource Group has stated it would like to start construction within the next few years. However, potential delays associated with developing a customer base, interstate compact complications, financing, permitting, technical, political, and other issues are likely. Agreements with end water users have not been identified. Concerns have been raised by certain water users in Colorado regarding supply availability, potential impacts on existing Colorado water rights and administration of this water right. Among other concerns, the potential diversion within a National Wildlife Refuge, coupled with potential impacts to federal endangered fish species downstream of the proposed diversion sites, are significant issues that could impact the implementation schedule or affect the viability of this project. As with any new west slope consumptive use, the issue of supply availability and other considerations would be required before a determination could be made on available yield for this project.

The following are some of the key considerations when examining the project elements, benefits, potential implementation issues and potential attributes for this alternative.

Project Elements

- Pump from Flaming Gorge Reservoir via 400 mile pipeline aligned along Interstate 80 in Wyoming to Colorado's Front Range.
- Additional storage in Front Range or direct tie-in to provider systems.

Benefits:

- Minimize loss of irrigated acres in South Platte and Arkansas Basins.
- Acceptable quality water source that may not require advanced water treatment processes.
- Maximizes State of Colorado's Colorado River Compact entitlement without impacting streamflows in Colorado.

Implementation Issues:

- Potential downstream endangered fishes and depletion issues.
- Enlargement or construction of additional storage in South Platte or Arkansas.
- Large energy requirements.
- Potential for increased compact call.
- Coordinated administration of water rights in the event of a compact call.

Potential Attributes:

- Delivery to in-basin users for agricultural, domestic augmentation, and instream flows.
- Exchanges for additional flows in Colorado headwaters.
- Allows water development while protecting recreational and environmental flows in Colorado Basin.

5.4.6 Green Mountain/Blue River Pumpback

A recently completed study of Blue River pumpback and Wolcott Reservoir alternatives was prepared for seven west slope entities in the Colorado River Basin, Denver Water, and the Northern Colorado Water Conservancy District (CRWCD et al. 2007). The information in this section has been taken from this report. Additional detail and supporting information on alternatives can be found in this report.

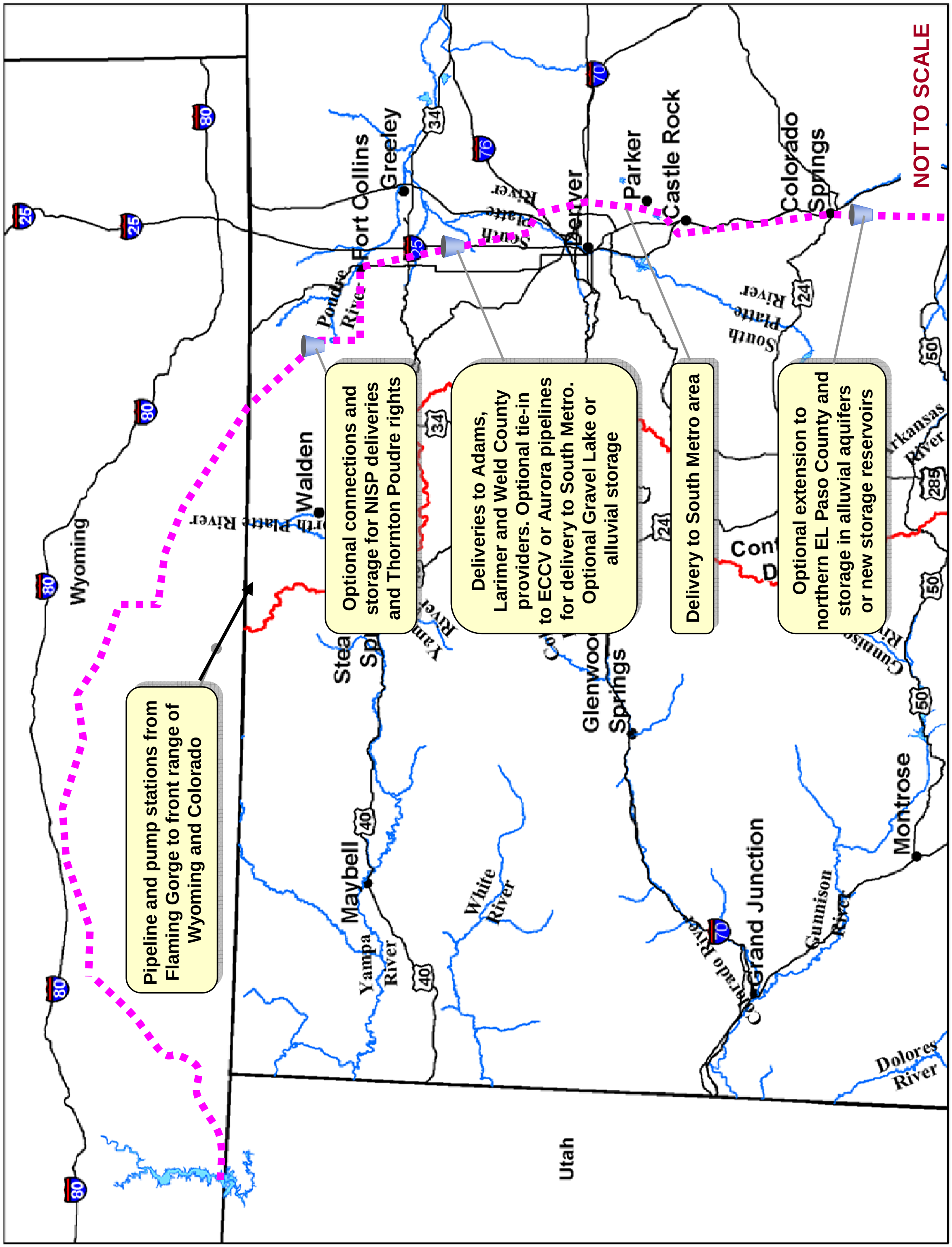


Figure 5-24
Proposed Flaming Gorge Pipeline Alignment

The question of the utility of a Blue River Pumpback has been studied a number of times. In 1987, the Colorado Water Resources and Power Development Authority completed a study on various sized pumpbacks from Green Mountain Reservoir to Dillon Reservoir. Most recently, the Upper Colorado Basin Study (UPCO) reported on a smaller pumpback from the Everist gravel pit, located upstream and south from Green Mountain Reservoir, to Dillon Reservoir. The various studies did not examine the system-wide implications of a pumpback, nor did they examine environmental impacts of a pumpback.

In March, 2006 a number of East Slope and West Slope entities entered a Study Participation Agreement to further study alternatives for a Blue River Pumpback, including the so-called Everist Pumpback and Green Mountain Pumpback, and replacement water and new supply from a Wolcott Reservoir. The scope of work was to estimate yields from various alternatives and configurations, update costs from previous studies for comparative purposes, and examine impacts of the alternatives. The study was not intended to examine in detail the impacts of a pumpback, but was simply intended as a reconnaissance-level effort to help the study participants determine whether additional examination was warranted. Participation in the study did not signify support for the project. Several of the participants have expressed significant reservations about any change in the function or operation of Green Mountain Reservoir and the impacts of Wolcott Reservoir on streamflows and water quality.

The Study consisted of three primary aspects: 1) evaluation of hydrologic effects and potential additional supply; 2) preparation of preliminary opinions of probable construction and operating costs; and 3) assessments of likely effects on water quality.

Hydrologic effects and supply assessments were performed using Denver Water's PACSM model and, for the Everist Pond pumpback option, an additional spreadsheet analysis. Simulations were conducted over the historic period of record of 1947-1991 (45 years). Shown below are the four modeling scenarios used in the Study:

Scenario	Description
Existing System and Existing Demands (Simulation 1)	Existing water demand conditions imposed on historical hydrology; model reflects current water resources infrastructure and administration in the Colorado and South Platte River basins
Existing System, Full Use Demand (Simulation 2)	Future demand conditions imposed on historical hydrology; model reflects current water resources infrastructure and administration through the Colorado and South Platte River basins
Everist Pond Pumpback (Simulation 3)	Green Mountain decree reduced by 10,000 AF; Wolcott Reservoir firms 20,000 AF of new West Slope use; Everist Pumpback analyzed by post-processing results
Green Mountain Reservoir Pumpback (Simulation 4)	Pumpback from 62,000 AF pool in Green Mountain Reservoir; Wolcott Reservoir assumes CBT exchange function and firms 20,000 AF of new West Slope use

The Green Mountain Pumpback would involve the pumpback of water supplies from Green Mountain Reservoir to Dillon Reservoir. This would increase the yield of Dillon Reservoir. Supplies pumped back from the Green Mountain Reservoir would be conveyed via Denver Water's Roberts Tunnel to the North Fork of the South Platte River where supplies would be gravity fed to the South Platte. Wolcott Reservoir would be constructed to, in part, replace Green Mountain Reservoir's current operational purposes of replacing out of priority diversions from the Colorado-Big Thompson (CBT.) The Green Mountain Reservoir Pumpback option can potentially produce new water supply of up to 68,600 AFY on average. Under the current modeling assumptions, the average annual supply to a new East Slope demand is approximately 53,000 AF. About 10,500 AF is from the South Platte River and 42,700 AF is from the Green Mountain Reservoir Pumpback. Other benefits of the Green Mountain Reservoir Pumpback include the opportunity to support new West Slope uses from an 85,000 AF (active capacity) Wolcott Reservoir. A conceptual layout of a Green Mountain pumpback is shown in Figure 5-25.

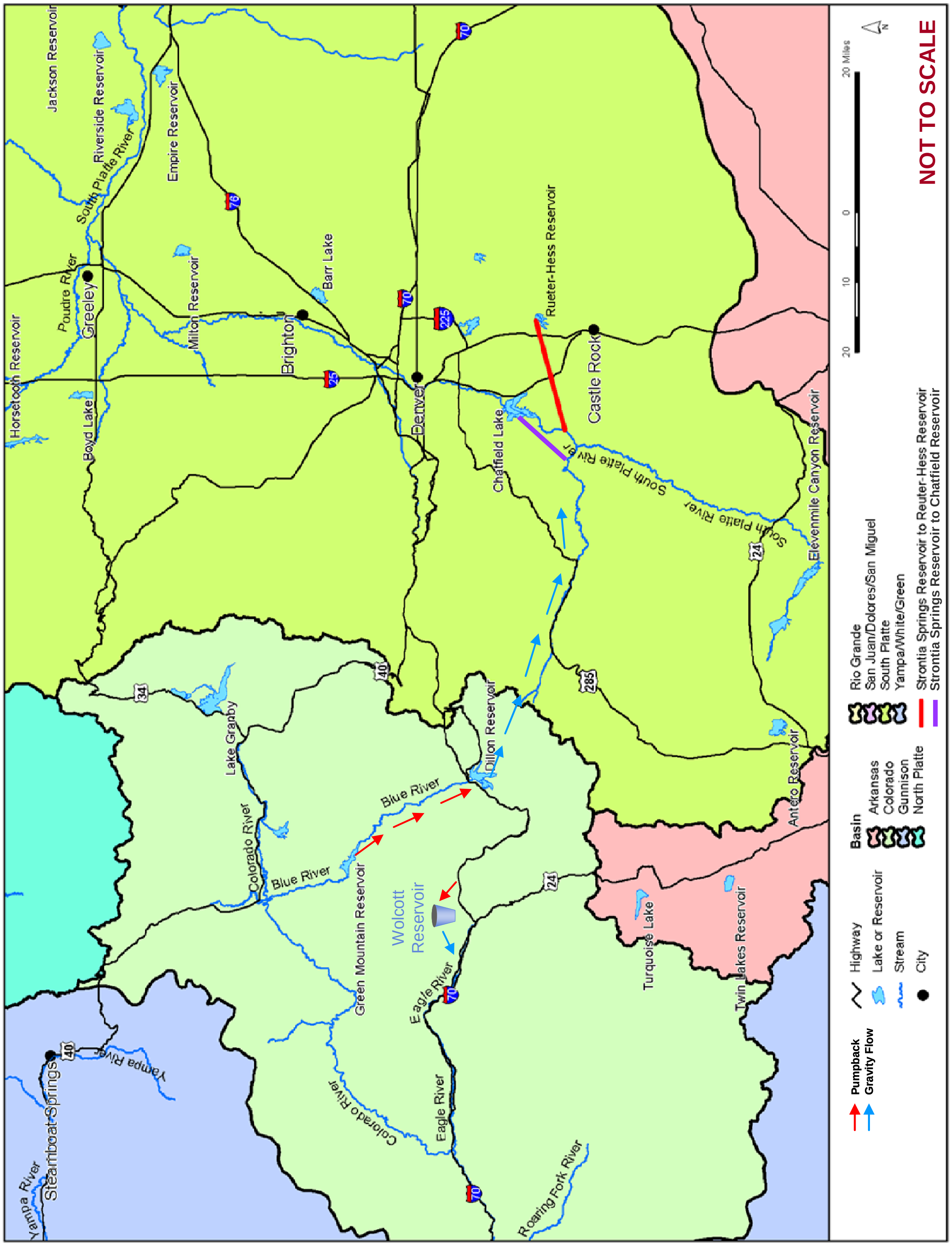


Figure 5-25
Blue River/Green Mountain Pumpback

A Blue River Pumpback could result in a significant number of benefits to the West Slope and ameliorate a number of West Slope problems, as described below. The following list is intended to be illustrative and may not be exhaustive.

- Grand County Streamflow Management. Grand County has experienced problems with low stream flows in the Upper Fraser and its tributaries and in the Colorado River below Windy Gap and is undertaking the development of a streamflow management plan to address streamflow needs. Related to these streamflow issues, a consortium of Grand County interests is purchasing shares in the Vail Ditch, which, with Denver Water's help and cooperation, could be wheeled to different points in the Upper Fraser. Additionally, a secondary benefit of a Green Mountain Pumpback could be a reduction in Denver Water's needs for substitution water from Williams Fork Reservoir and Wolford Reservoir, creating a possible source of storage water in Grand County for other uses, including stream flow enhancement.
- Additional Grand Valley Water Supplies. Grand Valley entities have expressed a desire for additional water supplies for Green Mountain Reservoir Historic User Pool (HUP) entities and the "Slot Group," which includes entities outside Grand Valley. Fundamental to a Blue River Pumpback is the use of a portion of storage in Green Mountain Reservoir for the pumpback and the development of Wolcott Reservoir to replace Green Mountain storage. A Wolcott Reservoir might be sized larger to accommodate the Grand Valley's needs for additional water.
- Dillon Reservoir Levels. Summit County wants to maintain higher Dillon Reservoir levels during the summer recreation season. Water pumped back to Dillon Reservoir after Dillon fills and spills could be held there during the recreation season, thereby improving reservoir levels, and then delivered to the East Slope after the recreation season. In years in which Dillon Reservoir doesn't fill, the pumped water could improve water levels during the entire recreation season.

  Additional Water Supplies for the Upper Blue River. Water from the Pumpback could be exchanged for diversions by municipal and industrial users upstream of Dillon Reservoir or released from Dillon Reservoir for municipal and industrial users below Dillon.

- Additional yield for Clinton Reservoir. Parties to the Clinton Reservoir Agreement have expressed a need for additional yield from the reservoir. Water from the pumpback could be used to provide a firm annual yield equal to the physical capacity of Clinton Reservoir. In addition to this increased yield in Summit County, a portion of the increased yield could be exchanged by Denver Water, using its facilities, for additional bypass flows in the headwaters of the Fraser River for West Slope use.
- Blue River Flow Enhancement. Summit County has identified an interest to improve stream flows in the Blue River below Dillon Reservoir. Yield from a Pumpback could be utilized for this purpose.
- Additional West Slope Supplies. In the study, Wolcott Reservoir was sized to meet 20,000 AF of unspecified, future West Slope water demands. As mentioned above, Wolcott Reservoir could be sized to accommodate other West Slope needs. In addition to additional HUP and Slot Group demands Wolcott Reservoir could be sized to provide some or all of the 10,825 AF of water supply that the West Slope and East Slope have committed to provide to the 15-Mile Reach to aid recovery of endangered fish species. Wolcott Reservoir could also be sized to maintain a recreation or conservation pool.
- Abandonment of Eagle River Rights. The East Slope use of the Blue River Pumpback could be an alternative for the East Slope's remaining conditional water rights in the Eagle River basin other than rights used to develop the Wolcott Reservoir.

It is unknown if a Blue River pumpback project were to be developed if any yield would be made available to the South Metro water providers or other gap areas or users in the South Platte Basin. The cost of payments to Denver Water for the use of Dillon Reservoir and the Roberts Tunnel would need to be negotiated.

As with any new west slope consumptive use, the issue of supply availability and other considerations would be required before a determination could be made on available yield for this project. There are issues associated with compact administration, permitting, technical, political, and other issues. Concerns have been raised by certain water users in Colorado regarding supply availability, potential impacts on existing Colorado water rights and administration of any new depletive Colorado River water right. In addition, west slope entities have stressed that "as a practical matter, that because a Blue River Pumpback relies on use of storage in Green Mountain Reservoir, the viability of a pumpback is contingent on the consent and cooperation of the West Slope. Accordingly, it first must satisfy West Slope needs without causing unacceptable impacts. If a Blue River pumpback passes that threshold test, then the question becomes whether it can be a viable supply for the East Slope." (Preface to Executive Summary by Colorado River Water Conservation District, September 19, 2007)

The following are some of the key considerations when examining the project elements, benefits, potential implementation issues and potential attributes for this alternative.

Project Elements

- Pump from Green Mountain Reservoir to Dillon Reservoir.
- Replace Green Mountain Reservoir functions with other Colorado Basin storage.
- Additional Storage in Arkansas and South Platte Basins.
- Conjunctive use with non-tributary groundwater.
- Payment to Denver for use of system.

Benefits:

- Minimize loss of irrigated acres in South Platte and Arkansas Basins.
- Maximize Colorado's Colorado River compact entitlement.
- Additional flows in Upper South Platte.
- Grand County streamflow management.
- Additional Grand Valley water supplies.
- Dillon Reservoir levels.
- Additional water supplies for the upper Blue River.
- Additional yield for Clinton Reservoir.
- Blue River flow enhancement.
- Additional west slope supplies.
- Abandonment of some Eagle River rights.

Implementation Issues:

- Potential for increased compact call.
- Additional in-basin storage.
- Diminished flows in rivers below proposed diversions with potential increases in TDS and other water quality impacts.
- Phosphorus levels in Dillon Reservoir.
- Green Mountain Reservoir levels.
- Green Mountain Reservoir/Wolcott Reservoir Swap.

Potential Attributes:

- Delivery to North Fork of South Platte upstream of Denver Metro area for gravity delivery to Denver Water customers and other water providers.
- Protect or enhance Blue River flows.
- Exchanges for additional flows in Colorado headwaters.
- Multi-purpose storage for endangered species and other Colorado Basin needs.
- Ability to exchange water for Summit County Municipal and Industrial purposes.
- Recreation component for Wolcott Reservoir.

5.4.7 Yampa Pumpback

The Yampa Pumpback Project would draw water from the Yampa River and transport it through an approximately 250-mile network of pipelines, pumps, and reservoirs to the Front Range. Figure 5-26 shows three pipeline alignments presented in the NCWCD 2006 reconnaissance study titled the "Multi-Basin Water Supply Investigation."

Water would be diverted from the Yampa River just north of Maybell. A 500,000 AF reservoir would be constructed to capture flows producing a firm yield of approximately 300,000 AF annually. Deliveries of 500 cubic feet per second (cfs) would be made to the Front Range through a single 108-inch diameter pipeline or parallel 78 inch pipelines or a combination of the two. Where possible, the pipeline would be placed along existing easements, avoid wilderness areas and national parks, and minimize impacts in other areas through the use of tunnels. A 75,000 AF reservoir would be built along the Front Range northwest of Fort Collins, which would provide approximately 2 months of aqueduct delivery. Both West Slope and East Slope reservoirs would be constructed as earthfill dams. Approximately three pump stations with 60 AF reservoirs would be necessary to move water from west to east. Three hydropower stations may be included in the eastern segment.

According to the report, the Yampa River at Maybell is of good water quality (TDS less than 300 mg/L) and would likely not require treatment levels exceeding conventional treatment. Preliminary analysis in the study concluded that the diversion of 300,000 AF of firm yield annually could be operated in such a manner to avoid potential constraints imposed by the Colorado River Compact obligations and Endangered Species Act (ESA) compliance on the Yampa and Green River. Additional environmental documentation would be required to ensure fulfillment of ESA requirements as well as assess environmental and recreational impacts. A major rafting reach and endangered species are downstream of the proposed diversion. A preliminary project schedule proposes construction of the reservoirs followed by the other necessary components beginning in March 2019. According to this schedule, water supplies could be online by May 2023.

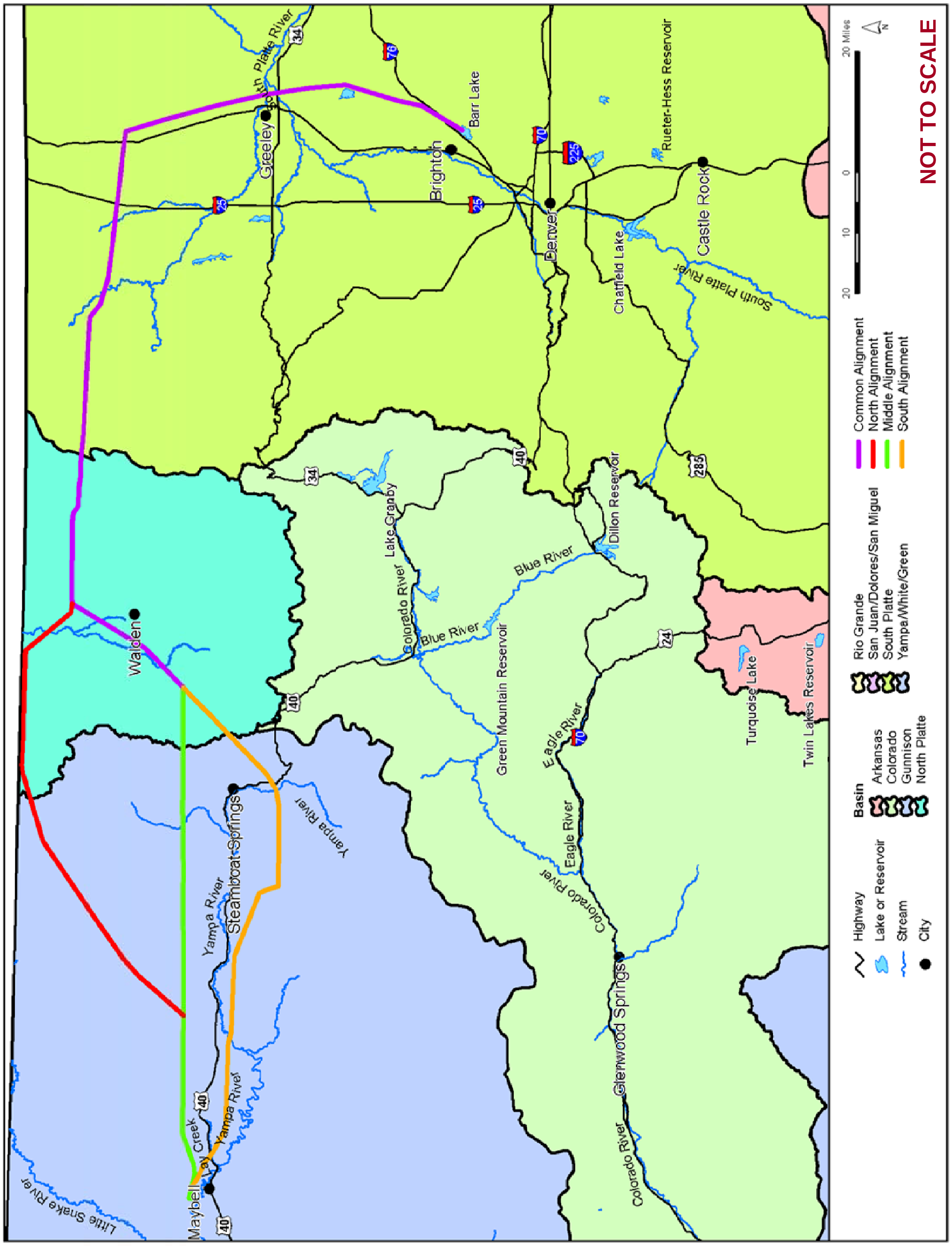


Figure 5-26
Conceptual Yampa Pumpback Pipeline Routes

The yield from this project based on supply availability has been preliminarily analyzed. As with any new west slope consumptive use, the issue of supply availability and other considerations would be required before a detailed determination could be made on available yield for this project. There are issues associated with developing a customer base, compact administration, financing, permitting, technical, political, and other issues. Agreements with end water users have not been identified. Concerns have been raised by certain water users in Colorado regarding supply availability, potential impacts on existing Colorado water rights and administration of any new depletive Colorado River water right. Among other concerns, the potential diversion upstream of Dinosaur National Monument, coupled with potential impacts to federal endangered fish species downstream of the proposed diversion sites, are significant issues that could impact the implementation schedule or affect the viability of this project.

The following are some of the key considerations when examining the project elements, benefits, potential implementation issues and potential attributes for this alternative.

Project Elements

- Diversion and 500,000 storage reservoir near Maybell.
- Pumpback to South Platte Basin.
- New 75,000 storage reservoir in South Platte Basin.
- Deliver to existing or planned pipelines in Brighton area for delivery to south metro water providers.

Benefits:

- Minimize loss of irrigated acres in South Platte and Arkansas Basins.
- Maximize Colorado's Colorado River Compact entitlement.

Implementation Issues:

- Potential for increased compact call.
- Large energy requirements.
- Endangered species on Yampa and Green Rivers.
- Dinosaur National Monument located downstream of proposed diversion.

Potential Attributes:

- Multiple Front Range delivery locations.
- West Slope and East Slope storage.
- East Slope hydropower facilities.

5.4.8 Considerations in Developing Structural Alternatives

There are significant supply availability, schedule, permitting, supply availability, and cost uncertainties with each of the structural alternatives described in this section. Successful implementation will involve partnering with other water providers and other agencies. Table 5-5 presents a summary of potential considerations on water source, conveyance and storage, water quality, treatment costs, technical implementability, permitting acceptability, and timely implementation.

Table 5-5 Project Elements and Considerations for Water Supply Alternatives

Alternatives	Water Source	Conveyance and Storage	Water Quality and Treatment Costs	Technical Implementability	Permitting	Timely Implementation
South Platte River Agricultural Pumpback	• South Platte agricultural water rights from either a traditional or alternative transfer. • Cost of water rights will likely decrease further downstream and away from urban areas.	• Water must be pumped 60 to 100 miles with an elevation lift of 1,500 to 2,100 ft. • Conveyance costs will increase the further downstream the diversion location due to increased distance and pumping head. • Firming storage and alluvial wells required near points of diversion.	• Water quality will decrease further downstream and treatment costs will increase. • Expected TDS levels of 750 to 1,200 mg/L. • Reverse osmosis or other advanced water treatment required. • Disposal of water treatment waste stream concentrate.	• Land permanently dried up from an agricultural transfer will require revegetation. • Fallowed land under an alternative transfer may require weed and soil management. • Recent water quality legislation allows water quality impacts to be reviewed as part of an agricultural transfer.	• Would likely require local and perhaps federal permits. • Three States Cooperative Agreement and lack of new depletions should assist in addressing ESA issues. • Permitting for disposal of liquid water treatment waste stream will be challenging.	• Water rights acquisition, design, permitting, and construction could begin immediately. • Water court transfer proceedings will take 3 to 5 years.
Arkansas River Agricultural Pumpback	• Lower Arkansas agricultural water rights. • Cost of water rights will likely decrease further downstream. • Lower Arkansas Water Conservancy District is forming a Rotational Fallowing Project (Super Ditch) as an alternative to traditional purchase and transfer of ag water.	• Water must be pumped 70 to 130 miles with an elevation lift of 2,000 to 3,000 ft. • Costs will increase the further downstream the diversion due to increased distance and pumping head and re. • Firming storage and alluvial wells required near points of diversion.	• Water quality will decrease further downstream and treatment costs will increase. • Expected TDS levels of 750 to 2,000 mg/L. • Reverse osmosis or other advanced water treatment required. • Disposal of water treatment waste stream concentrate.	• Land permanently dried up from an agricultural transfer will require revegetation. • Fallowed land under an alternative transfer may require weed and soil management. • Recent water quality legislation allows water quality impacts to be reviewed as part of an agricultural transfer.	• Would likely require local and perhaps federal permits. • Lack of new depletions should cover some permitting concerns. • Exchange upstream could raise water quality concerns for downstream users. • Local counties may adopt 1041 regulations. • Permitting for disposal of water treatment waste stream will be challenging.	• Water rights acquisition, design, and permitting could begin immediately. • Construction timing may be dependent upon local 1041 processes. • Water court transfer proceedings will take 3 to 5 years.

Table 5-5 Project Elements and Considerations for Water Supply Alternatives

Alternatives	Water Source	Conveyance and Storage	Water Quality and Treatment Costs	Technical Implementability	Permitting	Timely Implementation
Blue Mesa Pumpback	• Contract with BOR for water from the Aspinall pool and ESA. • Possibility for new appropriation options will be influenced by resolution of Black Canyon reserved right and agreement with BOR for interruption of power generated by Aspinall Unit. • Compact call and legal availability need to be resolved.	• Volume of firming storage required will depend on terms of BOR contract. • Limited or no Blue Mesa storage may be available. • Pumping, pipeline and tunneling required to deliver water to upper South Platte. • Conveyance on East Slope would be via South Platte and Arkansas Rivers.	• Relatively good quality. • Conventional treatment technology.	• Constructable and permittable West Slope diversion and storage sites and pipeline routes need to be verified.	• Would require permitting from all levels of government. • Local permitting would not be successful without local acceptance or participation in the project. • Basin of origin mitigation costs would likely be significant.	• Highly uncertain. • 20 to 30+ year timeline. • Permitting, construction details, etc. could significantly delay project.
Colorado River Return Pumpback	• New water rights appropriation. • Compact call and legal availability need to be resolved for a new appropriation.	• West Slope storage would not be required. • East slope storage required. • Pumping, pipeline and tunneling required to deliver water. • Conveyance on East Slope would be via South Platte and Arkansas Rivers.	• High TDS levels. • Reverse osmosis or other advanced water treatment required. • Potential water quality concerns related to temperature and other constituents with discharge to headwaters streams. • Reverse osmosis or other advanced water treatment required. • Disposal of water treatment waste stream concentrate.	• Constructable and permittable West Slope diversion and storage sites and pipeline routes need to be verified. Power project yield <150,000 AFY may impact cost effectiveness.	• Would require permitting from all levels of government. • Colorado River endangered species issues must be addressed.	• Permitting, construction details, etc. will require significant time.

Table 5-5 Project Elements and Considerations for Water Supply Alternatives

Alternatives	Water Source	Conveyance and Storage	Water Quality and Treatment Costs	Technical Implementability	Permitting	Timely Implementation
Flaming Gorge Pumpback	• Contact with BOR for water from the Flaming Gorge marketable pool, to the extent the BOR is willing to acknowledge and contract out of the pool and it is not opposed by other Colorado River basin states. • Compact call and legal availability and administration of depletions in Wyoming for use in Colorado need to be resolved.	• Volume of firming storage required will be dependent on terms of BOR contract. • Limited Flaming Gorge storage may be available. • Volume of firming storage is unknown. • Pumping, pipeline and tunneling required to deliver water to South Platte basin. • Conveyance on East Slope would be via pipelines to South Metro area.	• Would likely require higher level of treatment than other West Slope options. • TDS is higher than other West Slope options but lower than Lower South Platte or Arkansas.	• Constructable and permittable Flaming Gorge or Green River diversion and storage sites and pipeline routes need to be verified.	• Would require permitting from all levels of government. • Colorado River endangered species issues must be addressed.	• Uncertain • Project proponents claim that federal permits could be approved in <3 years, but likely is optimistic. • Significant issues regarding Colorado Compact and inter-state allocations. • Permitting, construction details, etc. will require significant time.
Blue River (Green Mountain) Pumpback	• Blue River water in the Colorado River basin. • Compact call and legal availability need to be resolved if a new appropriation.	• 85,000 AF Wolcott Reservoir. • 300 cfs Eagle River pump station. • Dillon Reservoir and Roberts Tunnel delivery to South Platte. • Conveyance on East Slope would be via South Platte River.	• Relatively high quality. • Conventional treatment technology.	• Slope stability concerns adjacent to Green Mountain Reservoir from reservoir drawdown may limit ability to fully use storage in Green Mountain Reservoir to regulate pumpback deliveries.	• Would likely require permitting from all levels of government. • Negotiations with various governmental and West Slope interests on replacement for Green Mountain Reservoir.	• Uncertain. • Depends on negotiations among West Slope, federal government, Denver Water, Northern Colorado Water Conservancy District.

Table 5-5 Project Elements and Considerations for Water Supply Alternatives

Alternatives	Water Source	Conveyance and Storage	Water Quality and Treatment Costs	Technical Implementability	Permitting	Timely Implementation
Yampa Pumpback	• New water rights appropriation. • Compact call and legal availability need to be resolved for a new appropriation.	• 500,000 AF storage reservoir near Maybell. • 75,000 AF east slope storage reservoir. • Would require approximately 250 miles of pipelines, 3 pump stations, two storage reservoirs. • Pumping, pipeline and tunneling required to deliver water to northern area of South Platte basin. • Conveyance on East Slope would be via pipelines to South Metro area.	• Moderate water quality. • Estimated water quality higher than Lower South Platte, lower Arkansas, or Flaming Gorge. • Conventional treatment technology.	• Constructable and permittable West Slope diversion and storage sites and pipeline routes need to be verified.	• Would require permitting from all levels of government. • Yampa and Colorado River endangered species issues must be addressed. • May require significant mitigation.	• Uncertain. • NCWCD conceptual study states could be online by 2023. • Permitting, construction details, etc. will require significant time.

5.5 Recommendations

The Gap TRT recommended that the future work should evaluate the water supply alternatives using similar assumptions and the group suggested that a more detailed evaluation of the options be performed. Development of comparable costs would be beneficial since there were differing assumptions on capacity, capital and O&M costs, yields, water rights, delivery locations, water treatment, etc. for each water supply alternative.

The general direction of the Gap TRT was to perform a detailed evaluation of each option using the following assumptions and approach:

- Delivery of similar water quality.
- Common or comparable storage areas should be included for all options.
- Common or comparable termination points should be included for all options.
- There should be a range of water delivery; the suggested range was 100,000 - 175,000 - 250,000 AFY.

The TRT also suggested the following evaluation elements be included:

- Include Capital and O&M costs as net present worth and annualized cost (infrastructure and operation and maintenance) and cost per AF.
- Additional information be added to the matrices that outline some of the initial benefits, impacts, and attributes of the options.
- Information and suggestions regarding base options (options that would be added to the major structural options) be obtained from the BRTs.
- Conservation be considered in developing alternatives.
- The Decision Support System be used to perform additional analysis of supply availability.
- Additional information be included regarding existing storage and infrastructure opportunities.
- Additional information be developed on: storage requirements, miles of tunnels required, river crossings, permitting considerations (i.e., Federal Lands, Wilderness Areas, 1041 considerations, wetlands etc.).
- Refinement and development of critical agricultural needs and solutions.
- Environmental and recreational enhancements.
- Refinement and development of local basin projects and needs in conjunction with the major structural options.

At the time of publishing this report, there has not been a final decision on how and when to proceed with the further definitions and refinements of the seven major structural projects.

The CWCB is working with BRTs, the Interbasin Compact Committee, and other stakeholders to identify the best venue and time to complete additional analysis.

5.6 Addressing the Gap Technical Meeting Outline and Roundtable Membership

The Gap TRT conducted four meetings between November 2005 and November 2006. Agendas for each meeting are shown in Figure 5-27. Table 5-7 lists the members of the Gap TRT. The CWCB expresses its deep gratitude to the Members of the Gap TRT for their assistance and participation.

Meeting #1
- Present Gap
- Present Identified Projects and Processes and risk
- Constraints
- Conjunctive use issues

Meeting #2
- Preliminary report from Conservation and Efficiency, Alternative to Agricultural Dry-up, and Recreational and Environmental Technical Roundtable
- Review and update previously identified water supply options
- Introduce potential major water supply options

Meeting #3
- Screening of alternatives
- Include information from other Technical Roundtables
- Combine options into three portfolios

Meeting #4
- Comparison of Alternatives
- Discussion of final SWSI 2 deliverable

Figure 5-27
Addressing the Gap TRT Meeting Agendas

Table 5-7 Addressing the Gap TRT Membership

Member	Organization	Interest Category
Gary Barber	El Paso County Water Authority; Palmer Divide Water Group	Local Government
Chips Barry	Denver Water	Municipal Water Providers
Bill Baum	General Council for Winter Park; Clinton Ditch and Reservoir Company Board Member	Recreation and Related Organizations
Janet Bell	Jefferson County	Local Government
Mike Berry	Tri-County WCD	Water Conservancy and Conservation Districts
Peter Binney	City of Aurora	Municipal Water Providers
Dan Birch	Colorado River WCD	Water Conservancy and Conservation Districts
Jim Broderick	Southeastern Colorado Water Conservancy District	Water Conservancy and Conservation Districts
Reeves Brown	Club 20	Business, Development, and Civic Organizations
Keith Catlin	CWCB Board Member	
Marc Catlin	Uncompahgre Valley Water Users Association	Water Conservancy and Conservation Districts
Tom Cech	Central Colorado WCD	Water Conservancy and Conservation Districts
Larry Clever	Ute WCD	Water Conservancy and Conservation Districts
Kristine Crandall	Roaring Fork Conservancy	Environmentalists and Related Organizations
Jeff Crane	North Fork River Improvement Association	Recreation and Related Organizations
Jeff Devere	Town of Rangely	Municipal Water Providers
T. Wright Dickinson	Rancher	Agricultural, Ranching, Ditch and Reservoir Companies
County Commissioners, Douglas County	Douglas County Commissioners	Local Government
Harold Evans	City of Greeley Water & Sewer Board	Local Government
Bill Ferguson	CRWCD	Water Conservancy and Conservation Districts
Joe Frank	Lower South Platte WCD	Water Conservancy and Conservation Districts
Mike Gabaldon	Bureau of Reclamation	Technical Advisor
Michelle Garrison	CWCB	Technical Advisor
Russ George	DNR	Technical Advisor
Steve Glazer	Upper Gunnison River WCD	Water Conservancy and Conservation Districts

Table 5-7 Addressing the Gap TRT Membership

Member	Organization	Interest Category
Brett Gracely	Colorado Springs Utilities	Municipal Water Providers
Alan Hamel	Board of Water Works of Pueblo, Colorado	Municipal Water Providers
Eric Hecox	DNR	Technical Advisor
Dan Henrichs	Rocky Ford Highline Canal	Agricultural, Ranching, Ditch and Reservoir Companies
Lynda James	Park County Land & Water Trust Fund	Environmentalists and Related Organizations
Mark Koleber	City of Thornton	Municipal Water Providers
Rod Kuharich	CWCB	Technical Advisor
Eric Kuhn	Colorado River WCD	Water Conservancy and Conservation Districts
Dave Little	Denver Water	Municipal Water Providers
Dixie Luke	Ragged Mountain Water Users	Agricultural, Ranching, Ditch and Reservoir Companies
Dan McAuliffe	CWCB	Technical Advisor
Louis Meyer	Schmueser Gordon Meyer Consulting Engineers	Technical Advisor
Harold Miskel	CWCB Board Member	Technical Advisor
Doug Monger	Routt County Commissioners	Local Government
April Montgomery	Independent Consultant	Technical Advisor
Ken Neubecker	Trout Unlimited	Environmentalists and Related Organizations
Dave Nickum	Colorado Trout Unlimited	Environmentalists and Related Organizations
Greg Peterson	Gunnison County Stockgrowers	Agricultural, Ranching, Ditch and Reservoir Companies
Mark Pifher	City of Aurora	Municipal Water Providers
John Porter	Independent Water Consultant and Southwest WCD	Technical Advisor
Dick Proctor	Grand Valley Water Users Association	Agricultural, Ranching, Ditch and Reservoir Companies
Ken Ransford	American Whitewater/Colorado Whitewater Assn.	Recreation
John Redifer	CWCB Board Member	Technical Advisor
John Rosapepe	CTU	Technical Advisor
Rick Sackbauer	Vail Resorts and Eagle River Water Sanitation Dist.	Recreation and Related Organizations
Dave Sarton	Colorado Springs Chamber of Commerce	Local Government
Terry Scanga	Upper Arkansas WCD	Water Conservancy and Conservation Districts
Donald Schwindt	CWCB	Technical Advisor
Mark Scott	South Metro Water Authority	Municipal Water Providers
Randy Seaholm	CWCB	Technical Advisor
Jim Sharkoff	USDA - NRCS	Technical Advisor
Thomas Sharp	Board Member	Technical Advisor
Karen Shirley	Upper Gunnison River WCD	Water Conservancy and Conservation Districts
Hal Simpson	Colorado Division of Water Resources	Technical Advisor
Jay Skinner	CDOW	Technical Advisor
Dennis Steckel	Upper Gunnison River WCD Board	Water Conservancy and Conservation Districts
Darryl Steele	Moffat County Commissioners	Local Government
Deick Stenzel	Basin Advisor	Technical Advisor
Gregg Strong	Redlands Water & Power Co.	Municipal Water Provider
Kent Vertrees	Blue Sky West	Recreation and Related Organizations
Fred Walker	Weld County Farm Bureau	Agricultural, Ranching, Ditch and Reservoir Companies
Eric Wilkinson	CWCB Board Member	Technical Advisor
Lane Wyatt	Summit Water Quality Committee; MWCCPG-QQ Committee	Local Government

Implementation and Recommendations for Colorado's Water Supply Future

6.1 Introduction

This section outlines the Colorado Water Conservation Board's (CWCB or Board) ongoing implementation plan for Colorado's Water Supply Future. It reflects the recommendations for each Technical Roundtable (TRT). These recommendations are presented in the context of the current statutory responsibilities of each of the CWCB sections and for the Board as a whole.

6.1.1 Colorado Water Conservation Board

Colorado Revised Statute, Title 37, Article 60 requires the CWCB to conduct the following activities in relation to utilizing the state's waters:

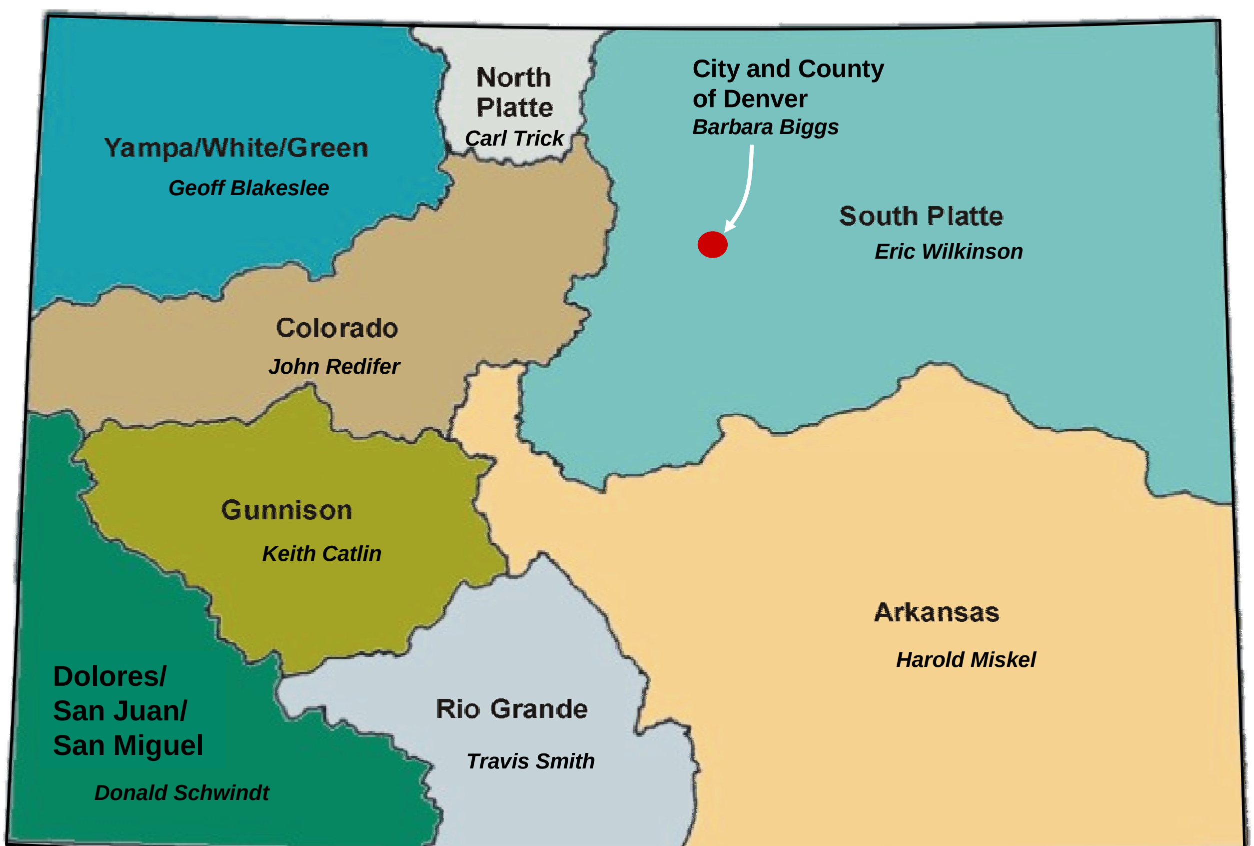
- Formulate methods, means, and plans.
- Gather data and information.
- Foster conservation.
- Recommend water infrastructure projects.
- Make mitigation recommendation to balance between development and the state's water resources.
- Protect the state's fish and wildlife resources.

The CWCB implements this statutory authority through: projects or activities associated with the findings and recommendations of the Statewide Water Supply Initiative (SWSI), information gained from stakeholders throughout the state, and the activities of the CWCB's programs/sections.

The Board is composed of 15 members. Nine voting members representing the eight major basins and the Denver Metro area. The Director of the Department of Natural Resources (DNR) is also a voting member and there are five non-voting members. The composition and membership of the Board is shown in Figure 6-1.

The Board annually reviews and revises its Strategic Plan, Objectives, and Workplans. Through this process the Board identifies key initiatives, new program directions, and allocates resources to meet current and emerging needs of Colorado's citizens.

SWSI served as a forum, engaging citizens in every river basin in the state, which allowed the Board to more thoroughly and completely identify these needs. The integration of SWSI with the interbasin compact basin roundtable process to address Colorado's Water Supply Future will enable the Board to continue the water dialogue, collect data, identify needs, make recommendations on water supply options, and allocate its resources, both staff and financial. The state continues to implement these activities for which it has the authority and funding.



Voting Ex-Officio Member:
Harris D. Sherman, Executive Director, Department of Natural Resources

Non-Voting Ex-Officio Members:
John Stulp, Commissioner, USDA
Dan McAuliffe, Acting Director, CWCB
To be Named, Director, CDOW
To be Named, State Engineer, Division of Water Resources
John Suthers, Attorney General

Figure 6-1
Approved Board Members of CWCB

Fundamentally, the Board is committed to:

- Sound technical and scientific decisionmaking.
- Ensuring that all water supply solutions are considered and evaluated.
- Exploring new and creative ways to meet our consumptive and nonconsumptive (environmental and recreational) needs.
- Ensuring our ability to fully utilize our compact entitlements.
- Conserving the waters of the state for wise and efficient beneficial uses.

To achieve these goals the Board will continue to implement Colorado's Water Supply Future and support the Basin Roundtable and Interbasin Compact process. The Board will explore new potential program directions and will sustain its commitment to key program elements.

CWCB's major programs include:

- Interstate Water Planning and Development
- Water Information
- Conservation and Drought Planning
- Water Supply Protection
- Instream Flow and Natural Lake Level Protection
- Flood Protection
- Water Supply Planning and Finance

Activities that can be undertaken by the Board and each section toward implementing the findings and recommendations of SWSI are presented below.

It is important to note that in discussing Board tasks, one is speaking not just of basin representatives, but also the CWCB Director, the DNR Executive Director, and other ex-officio members representing the Department of Agriculture, the Colorado Division of Wildlife, the State Engineer's Office, and the Attorney General's office. When the General Assembly created the Board and gave it such broad representation it meant for these Board members to work together to accomplish the mission it set forth. Members should focus on how they are collectively accomplishing the mission and not just the individual activities they are undertaking that contribute to accomplishment of the mission. This is absolutely essential – not only for the 80 percent municipal and industrial (M&I) supply to be realized, but also if the 20 percent water supply gap is to be filled and agricultural, environmental, and recreational needs satisfied.

With the above in mind, the following are some potential work plan tasks:

- Using the list of specific projects and options laid out by the Gap TRT in SWSI 2, report to other members and staff about the status of implementation efforts and viable alternatives.
- Identify specific ways to foster cooperation on a statewide basis.
- Support the implementation of identified projects and processes.
- Working with water suppliers, make a recommendation about how the staff should collaboratively track local project implementation.
- Promoting and facilitating coordinated operations of existing facilities and infrastructure.
- Promote and support the development of new projects that serve multiple purposes.
- Evaluate alternative methods for determining environmental and recreational needs, and creative ways to implement potential solutions.
- Convey "collective" information about Board activities issues and needs and challenges to their local elected officials to maintain a sense of order and facilitate communication when the need for legislative action arises.

6.1.2 CWCB Sections

The following discussion outlines each of the CWCB Section's roles and responsibilities.

Intrastate Water Planning and Development

This Section of the CWCB was created to implement the Statewide Water Supply Initiative (SWSI) and support the ongoing implementation of the Water for the 21st Century Act. This Section was used to manage the efforts of SWSI 2 in this report.

Highlights:

- Water Supply Reserve Account Grants
- Alternative and Agricultural Transfers Grant
- Identified Projects and Processes Database
- Consumptive and Nonconsumptive Workgroups

The Section must help ensure there is an adequate water supply for Colorado's citizens and the environment through a collaborative, cooperative, consensus approach to water resource issue resolution by focusing on strong local stakeholder involvement. Colorado will grow from 4.3 million to 7.1 million people by the year 2030 and will need 630,000 acre-feet (AF) more municipal and industrial (M&I) water. Water providers and planners under the most optimistic scenario have identified projects and processes to address about 80 percent (512,000 AF) of this additional water need. This leaves a M&I gap of 20 percent (118,000 AF).

The Section helps to avoid harmful competition for water and competing uses for water between "sectors" (municipal, industrial, agricultural, environmental, and recreational) by examining regional issues, impacts, and by proposing solutions. It does this by coordinating, managing, and conducting river basin technical roundtables to examine and develop structural and non-structural water supply alternatives, and manage technical assistance contracts to achieve project goals. It also identifies and tracks the status of individual projects and planning processes and identifies relevant legal, financial, or political issues that are impeding the resolution of these issues.

The Section reviews grant applications, manages the Water Supply Reserve Account (WSRA), and obtains approval of grant and loan applications based on the Criteria and Guidelines developed jointly with the Interbasin Compact Committee (IBCC).

This Section administers the Alternative Agricultural Water Transfer Methods to Traditional Transfers grant program. The Section will be developing an update to the Identified Projects and Processes (IPP) database. The Section will manage the Consumptive and Nonconsumptive Workgroup efforts and help provide a common technical platform of data and information.

The Section participates in contract scoping, provides roundtable updates on water use data, and informs and assists roundtables in improving their understanding of existing and future water supply needs and issues. It also performs outreach and education activities to increase public awareness of complex water issues.

Highlights:

- Basin Roundtables
- Interbasin Compact Committee
- Basin Needs Assessments

Finally, this Section implements the Interbasin Compact Process and provides ongoing coordination for the Basin Roundtables and the Interbasin Compact Committee.

The Section supports the development of each Basin's Needs Assessment, which includes:

- Consumptive and Nonconsumptive Needs Assessments
- Analyzing the availability of water supplies including unappropriated waters in each basin
- Proposing projects or non-structural methods for meeting water supply needs and utilizes unappropriated waters

Water Information Section

This Section of the CWCB produces essential technical information and computer models of water resources and water use that enable wise-water management decisions statewide. This Section will be focusing on ongoing development of the South Platte Decision Support System (SPDSS), while also continuing to improve and maintain the Colorado Decision Support Systems (DSSs) in the Colorado River and Rio Grande Basins.

Highlights:

- Supply Availability Study
- Colorado Decision Support System Application
- Rio Grande Decision Support System Maintenance
- South Platte Decision Support System Under Development
- Arkansas Decision Support System to be Initiated

SPDSS is in its fourth implementation phase. Phases 1 through 3 were related to data collection, with Phase 4 moving from data collection (including data for groundwater, surface water, and irrigated land delineation and classification) to implementation of the alluvial groundwater model and the Denver Basin bedrock model; the latter of which has been done in cooperation with the U.S. Geological Survey (USGS). The last phase will include the implementation of the surface water model. It is anticipated that SPDSS will be completed in 2008 to 2010.

The Upper Arkansas River Basin is the final basin scheduled for DSS development. Work is already being done in this basin by incorporating any available data into HydroBase, the DSS hydrological database, and making that data available through tools developed for existing DSS basins.

Colorado's DSSs have been crucial in assisting with water resources decisionmaking statewide by providing basic data as well as modeling studies to various efforts. Examples where the DSSs have made a difference include SWSI, recovery programs for endangered fish species in the Colorado River Basin, the Aspinall unit re-operations environmental impact statement (EIS), and Navajo Reservoir re-operation impacts. With the formation of the IBCC and the various roundtables, the DSS is important in providing a common foundation of water resource related data and tools. In addition, the groundwater model from the Rio Grande DSS has been used by the Division of Water Resources (DWR) in the rulemaking regarding new groundwater withdrawals in the Rio Grande.

The CDSS will provide the framework for conducting the Colorado River Water Supply Availability Study over the next several years.

New DSS implementation has benefited from the existing DSSs. In earlier efforts, a large part of the expense and time was associated with the development of both surface and groundwater models and other software tools, including those relating to data collection and storage. Subsequent DSSs can take advantage of these efforts, often with minor enhancements.

In the operation and maintenance (O&M) phase, the enhancement of the models and tools will continue, along with various data updates. HydroBase is refreshed continuously with new water resources data, such as diversions, water rights, and stream flow. For the SPDSS, O&M will also be associated with the groundwater data collection from new monitoring wells added to DWR's existing groundwater monitoring network.

Another example of an essential part of DSS O&M is the periodic updating of irrigated acreage for the state. This was originally done under the Colorado River DSS in 1993, and it was updated in 2000. It is currently being refreshed using 2005 Landsat imagery, which has been purchased for the entire state. The objective is to get a snapshot of irrigated lands every 5 years. This will enable irrigated land updates in other river basins in the state in addition to the Colorado River Basin. The Water Information Section is also looking at ways to provide these updates over shorter intervals and at cost-effective ways as technology advances.

Office of Water Conservation and Drought Planning (OWCDP)

This Section of the CWCB provided valuable technical assistance on the Conservation and Efficiency section of this report. The Section was originally created in 1991 and its importance to the state has grown significantly over the last few years.

Highlights:

- Climate Action Plan
- Public Education Water Conservation
- Water Use Reporting
- Water Planning and Efficiency Grant Program

The 2007 legislative session resulted in the passage of SB 07-008, expanding the Water Efficiency Grant Program. The Water Efficiency Grant Program supports water conservation and drought mitigation planning and water efficiency implementation projects, as well as water resource conservation public education and outreach. The bill not only appropriated additional monies into the grant program, but it also expanded the eligibility opportunities to state and local governmental entities, including small water providers. With the increased promotional and public outreach activities, including ongoing regional water conservation workshops around the state, the OWCDP is and will continue to experience an increase in the number of grant inquires and applications for the Water Efficiency Grant Program. The OWCDP anticipates that much of its focus and resources will be on and applied to the grant program.

The OWCDP will also focus attention on providing technical assistance in the areas of water conservation planning and implementation. Ongoing dialogue with water providers of all sizes around the state continues to point to the critical need for technical water conservation planning assistance both in identifying appropriate water savings measures and programs for their successful implementation. A number of new or updated water conservation plans, seeking to comply with the 2004 revised planning requirements, have been submitted to the OWCDP for evaluation and approval. This trend is projected to increase as more water providers seek to comply with the mandate for planning, take advantage of state financial assistance, and understand the role that water conservation savings can have in overall water resource system supply plans. The state's role in meeting this need will be fulfilled both in the additional OWCDP staff resource authorized under SB 008 and in its future program development.

The OWCDP is responsible for providing technical assistance in the areas of drought mitigation planning and implementation. To that end, the Office will begin an initiative to develop a set of comprehensive technical tools and programs to promote and facilitate water provider efforts in drought mitigation planning and to update the state's drought plan.

The OWCDP will also be responsible for developing a Climate Action Plan as a part of its drought planning mission. Water adaptation strategies necessary to address the potential impacts for climate change in Colorado is critical. This activity will be undertaken in conjunction with the Governor's Water Availability Task Force and other federal, state, and local partners.

The OWCDP will continue its ongoing programs targeted at water resource conservation public education and outreach. It will initiate the Statewide Water Conservation Public Awareness Research Study as a first step towards a statewide messaging and education campaign geared towards Colorado citizens in an effort to promote and support a water conservation ethic around the state as well as an appreciated value for this scarce resource.

Water Supply Protection Section

This Section of the CWCB addresses federal and interstate issues such as the Colorado River Compact, the Endangered Species Recovery Program, and Interstate negotiations.

Highlights:

- Addressing Federal Issues
- Endangered Species Recovery Program
- Colorado River Compact Negotiations
- Interstate Negotiations
- RICDs
- Colorado River Salinity Control

Conflicts concerning the use of Colorado River water and the management of Colorado River system reservoirs are increasing. The 2002 drought has brought many of these conflicts and concerns to the forefront and Colorado must be prepared to protect its interests and rights to the use of the Colorado River. Negotiations to address these concerns have been extremely difficult. The 7-Basin States have reached preliminary agreement on how to address shortage criteria and coordinated operations of Lake Powell and Lake Mead. That agreement along with proposed interim shortage guidelines have been transmitted by the 7-States to the U.S. Bureau of Reclamation (BOR). However, this agreement still contains some uncertainty regarding outstanding issues. Moreover, as the Department of Interior (DOI) and BOR develop the EIS associated with these shortage criteria and coordinated reservoir operations, Colorado will be required to continue to participate in the discussions. Litigation may still occur in the future regarding the Law of the Colorado River, but the Interim Shortage Guidelines will hopefully allay such through 2025. Colorado should be prepared to address future litigation related issues. Resources should continue to be provided to accomplish necessary technical and legal research.

Funding endangered species recovery and preservation activities will remain a critical goal to ensure existing and future water uses are protected or can proceed. Recovery Programs for the Upper Colorado River Basin and the San Juan River Basin will continue to implement recovery actions that will provide that protection. In addition the DOI has recently released a Final Environmental Impact Statement (FEIS), Biological Opinion (BO), and Record of Decision (ROD) evaluating the Platte River Recovery Implementation Program.

The Colorado Attorney General requested and the Board has approved $750,000 to support case resolution in the Kansas vs. Colorado litigation that will support water accounting activities and other compliance-related actions regarding the Arkansas River Compact. Work continues in several of the major expense areas that included: $100,000 for expert witness preparation, $250,000 for irrigation efficiency studies, $100,000 for weather station enhancement, and $300,000 for construction of two lycimeters and initial operation and all activities are expected to be completed within budget. The CWCB reported to the Colorado General Assembly on use of the litigation account funds in January 2007 and will do so again in January 2007. The initial set of lycimeter experiments are scheduled to begin in spring of 2007. Data collected from these experiments and the other studies will be used to refine depletion calculations in the Hydrologic Institution Model. The State Engineer and the CWCB are exploring opportunities to obtain long-term federal research funding for the lycimeter installation at Rocky Ford. A request for federal funding was submitted to Senator Salazar and meetings have been held with U.S. Department of Agriculture (USDA) – Agricultural Research Service.

Development of energy resources in Colorado has increased over the last several years and is likely to increase further if fuel costs remain high. This activity may result in water quality issues and other impacts that will need to be addressed through water quality programs such as the Colorado River Salinity Control Program. The energy development will also provide the state with additional severance tax revenue to help offset the impacts of some of the development.

Work to quantify the remaining federal reserved water rights for the Black Canyon of the Gunnison National Park and for Forest Service lands in Water Division 7 will continue in order to help define where and how much water remains for development in areas affected by these water right filings and decrees.

Instream Flow and Natural Lake Protection Section

This Section will move forward with both new junior and acquired water right filings to preserve or improve the natural environment to a reasonable degree. As a result of the passage of HB 07-1012, staff will continue to pursue

Highlights:

- Nonconsumptive Uses
- Instream Flow Program
- Explore Identify Opportunities for Water Rights Acquisition

temporary loans and leases of water rights. In addition, the Section will continue to play a key role in the SWSI and the Basin Roundtable processes. This effort will involve helping new water storage/ management projects move forward while still preserving the natural environment and identifying new and creative ways to meet environmental and recreational needs.

The Board's Instream Flow (ISF) Subcommittee or the Board as a whole will continue to address key issues that it identified during the 2005 revision of the Stream and Lake Protection Section's Strategic Plan. These issues included, but were not limited to: an enhanced public notification process and involvement evaluation; injury with mitigation policy, which the subcommittee discussed over the past year; analysis of issues associated with state-line flows and water availability. The later issues are especially important when recommending entities propose ISF segments in lower stream reaches.

The CWCB is in the process of renewing an Interagency Agreement (IGA) with the Division of Wildlife (DOW) that will be effective through June 30, 2009. The IGA documents the DOW's annual contribution of $296,027 from the Wildlife Cash Fund to the CWCB for implementation of a portion of the Instream Flow and Natural Lake Level Program. While DOW has provided this annual funding since 1978 without such an agreement in place, DOW requested that the CWCB enter into the IGA to address federal audit issues. To ensure stable and independent funding at some point in the next 2 years, the CWCB may elect to submit a decision item to provide long-term stability funding for the instream flow program.

Flood Protection Section

The Flood Protection Section implements floodplain map modernization activities throughout the state. An estimated $6 million in federal grants have been awarded for Colorado's benefit thus far, with several years of major funding allocations remaining. The map updates make use of state-of-the-art GIS and computer modeling techniques, and should greatly assist with wise floodplain management and land use decisionmaking at the local level.

Highlights:

- Habitat Restoration
- Watershed Protection
- Watershed Tax

Another important effort involves a creative and cutting edge process to reallocate existing flood control storage space, within a major federal reservoir, to water supply storage space that would benefit municipal and agricultural interests along the Front Range. The study includes complex technical analyses, reservoir modeling, environmental and water quality evaluations, recreational impacts, and substantial collaboration by the CWCB, U.S. Army Corps of Engineers (USACE), 15 participating water users, and a wide variety of project proponents advocating upstream, instream, and downstream benefits of the project. The CWCB provides overall coordination as the non-federal sponsor to the USACE to help ensure that the targeted storage space is obtained.

Stream and watershed restoration work has been greatly expanded in Colorado due to increasing interest at local levels as well as consistent funding through the CWCB and other sources to complete high priority studies and projects. A relatively new source of funds became available when the Colorado Watershed Protection Fund was enacted, naming the CWCB as one of the key executors of the fund. This fund receives revenue from elected State Income Tax "checkoff." Given the growing importance of environmental and recreational uses for water, this program has significant potential to grow over the coming years. The Fish and Wildlife Resources Fund can also be utilized to study or implement watershed restoration activities or to purchase water rights for environmental protection or enhancement within areas affected by existing water supply projects.

Water Supply Planning and Finance

This Section of the CWCB manages the Construction Fund and Severance Tax Trust Fund Perpetual Base funds. The Board must manage the funds to meet operational requirements, the demand for loans and non-reimbursable investments. Currently only the Construction Fund can be used to pay for operational and non-reimbursable investment expenses. Obtaining the ability to manage the Perpetual Base Account conjunctively with Construction Funds will help address long-terms needs.

Highlights:

- Construction Fund
- Severance Tax Trust Fund
- Water Partnering Projects

The Section has been challenged to defend the CWCB's financial resources and ensure that funds are not used for purposes unrelated to the CWCB's statutory authorizations.

If the Board is to be successful in meeting the needs identified by SWSI it must have the ability to remain flexible and its funding sources must be protected, for without stable and reliable financing, none of the projects or programs identified can be implemented.

New Program Initiatives and Highlights

Input from CWCB Board and DNR from the CWCB Board meeting on November 14, 2007.

6.2 SWSI Phase 2 TRT Recommendations

This section recaps the various TRT recommendations.

6.2.1 Conservation and Efficiency TRT

As its mission, the M&I Water Conservation TRT set out to "develop a deeper understanding and greater consensus on conservation and efficiency for municipal, industrial, and agricultural water uses." In the category of urban water demand, the TRT made significant advances that forward our understanding of the important role of water conservation and efficiency in municipal water planning. Successes include:

- Reaching consensus on how conservation may affect system reliability under various scenarios.
- Quantification of potential long-term savings available from conservation measures.
- Development of a range of potential water conservation savings from select measures that were in a comparable range to potential water conservation savings identified in the SWSI report.
- Common understanding on reaching some issues.

Limited progress was made on agricultural water efficiency and this remains a significant challenge. Based on initial work, there appears to be some opportunities to achieve additional efficiencies in agricultural water use. However, since agricultural return flows are used by downstream water users, at a watershed level there are significant limitations in the overall net potential savings that can be realized. Nevertheless, since agricultural water use accounts for over 85 percent of total water use in the state, follow-up efforts should include this group of water users. This issue is discussed in Section 3 of this report.

In addition the impacts of climate variability on water conservation and system reliability have not been addressed by this TRT.

The following conclusions and recommendations are made by CWCB staff after a review of the Water Conservation and Efficiency TRT efforts. The primary areas where there is a lack of consensus among TRT members is on the successful implementation of some of the conservation measures, especially turf replacement and the role of water conservation in eliminating the need for structural projects and processes that water providers have planned to meet future water demands.

Potential Impacts of Water Conservation on Supply Reliability and Potential Uses of Conserved Water

1. Issues related to conservation and reliability are specific to each utility and dependent upon the portfolio of water rights (type and priority).

2. Water planners are strongly encouraged to analyze safe yield and develop reliability criteria for their systems.

3. Water providers should evaluate the actual impacts of conservation on system yields and reliability through model runs and reasonable assumptions about technological and behavior savings that may be expected from customers during droughts before and after the implementation of conservation measures.

4. The impacts of the implementation of water conservation measures on the reliability of water systems should be examined based on the potential uses of the conserved water, such as new growth, instream flows, drought reserve, or lease or sale to other entities.

5. The use of a portion of conserved water for new growth or drought reserve by the conserving utility appears possible under most circumstances without impacting reliability.

6. The use of a portion of conserved water for environmental flows also is feasible, especially if the water is subject to a pull back by the utility during drought or other water shortages. Some conserved water, such as from in-basin direct flow rights, may have limitations if transferred to an environmental flow.

7. At this time, based on extensive utility feedback, it is very unlikely that any utility would permanently sell conserved water to another utility.

8. When evaluating demand reduction, it appears that some additional water savings can still be achieved through temporary drought measures and behavioral changes, even after the implementation of technological water conservation measures. Future efforts should attempt to quantify savings that could be achieved through temporary behavioral changes once technological water conservation measures have been successfully implemented.

Potential Savings from Water Conservation Measures

1. While most water providers have implemented significant conservation, there are opportunities to achieve even greater conservation savings. In the first phase of SWSI, it was estimated that providers across the state have implemented permanent conservation measures that will ultimately reduce future demand in excess of 12 percent, which would be included in the projected overall savings presented below. Based on information gathered by this TRT, it appears that additional demand reduction can be accomplished by a variety of measures. These measures, if fully and successfully implemented, represent a range of demand reduction from 287,000 AF to 459,000 AFY by 2030. As with all options, there are significant technical, engineering, legal, and institutional challenges associated with how much demand reduction can occur and how much this demand reduction can be used to address Colorado's future water supply need (see Section 5).

2. The average cost to achieve these water conservation savings is estimated to be $10,600/AF. The more inexpensive measures, i.e., the "low-hanging fruit" cost as little as $1,000 to $2,000/AF. This makes it a cost-effective option for most providers.

3. Some water conservation measures, such as sub-metering of multi-family housing and reduction of irrigated turf areas, will be much easier to implement with new development than through the retrofit of existing development.

4. Water conservation in most cases can reduce or delay the need for additional water supply development projects, reduce or delay the need

for water treatment plant expansions and other utility infrastructure, and reduce financing, operations, and maintenance costs.

5. Water conservation can potentially reduce costs to the water user through reduced water bills, energy savings, and reduced landscape maintenance costs. However, the unit cost for water may have to increase to recover lost revenues in response to overall reduction in water sales if additional customers are not added or utility operating costs reduced.

6. The impacts of water conservation must be factored in utility financial planning as it can result in net revenue losses to the utility if operating costs are not reduced, water rates increased, or revenues maintained through new sales to other users.

7. Many water conservation implementation concerns are related to cost. As the potential water savings matrix indicates, certain water conservation measures are cost-effective when compared against other options.

8. Utility managers and decisionmakers should analyze the overall net financial impact of water conservation on their utility operations.

9. Utility managers and decisionmakers should analyze the potential benefits of implementing water conservation measures that may allow for the delay of water acquisitions or infrastructure capital improvements against the risks of delay of implementation of water acquisitions or structural projects.

10. Another major implementation issue surrounds citizens' and utilities' willingness to develop and participate in conservation programs. As noted in the Colorado Springs Utilities' water customer survey, the past few years have seen an increase in awareness of the benefits of conservation and, as a result, an increased willingness to engage in conservation. The dialogue has shifted from whether to conserve to how much conservation is appropriate for a particular community.

11. If conservation is to be used successfully to meet growing demands in Colorado, it must be fully integrated into the water resources planning process. The CWCB-recommended conservation planning process is an excellent example of how to accomplish this. Few utilities in Colorado have successfully completed this type of integrated resources planning to date, but are strongly encouraged to use this process.

12. Conservation takes time to implement and verify. It is, this way, different than traditional supply development in that it is truly an incremental process.

13. Conservation would benefit from greater coordination inside water utilities' departments and between utilities and city and county governments, as sound decisions involve building and landscape codes and input from the development community, policy makers, and citizens.

14. A statewide social marketing campaign to promote the value and importance of sustainable water resources in Colorado for our people, land, environment, and economy will greatly assist conservation efforts and will help implement the conservation levels established in this document. Water is often a divisive issue in Colorado and such a campaign is a way to bring Coloradoans together to achieve common ground on the value of water and the importance of wise stewardship of our precious resources.

The Role of Water Conservation in Water Supply Planning and Meeting the Gap

By the year 2030, Colorado's population is expected to grow 65 percent, adding about 2.6 million more residents for a total population of 7.1 million people. This represents an increase in M&I demand of approximately 630,000 AF of water. SWSI identified that about 80 percent of this need could be met if M&I providers projects and plans are successfully implemented.

SWSI has catalogued the specific projects, plans, and processes that local water suppliers have identified and are undertaking as components of their own water supply planning efforts to meet the needs they themselves have identified. As a whole, if these projects are implemented, 80 percent of the state's long-term M&I needs will be met. This is the most optimistic scenario. But there is uncertainty and hurdles to overcome.

The mission of the state with respect to meeting 80 percent of our M&I water needs by 2030 should be:

Following the lead of local water suppliers, the state will monitor long-term water needs, provide technical and financial assistance to put the necessary plans, projects, and programs in place to meet those needs, and foster cooperation to avoid being forced to make trade-offs that would otherwise harm Colorado's environment, lifestyle, culture, and economy.

As previously stated, water conservation will be an important element of these plans; the state must also address the remaining 20 percent gap between supply and need. In addition, localized agricultural shortages have been identified in all basins along with significant environmental and recreational needs. Articulating the CWCB's role in helping to narrow and eventually eliminate this gap is much trickier – both institutionally and politically.

It is this gap that must be filled with "new" water. If water suppliers had the water to meet the demand represented by this gap, there would be no gap.

The mission for the state in filling this gap should be:

Foster cooperation among water suppliers and citizens in every water basin to examine and implement options to fill the gap between ongoing water planning and future water needs

The role that water conservation could play in helping address the future water supply needs and the gap identified in SWSI is discussed in general terms below. Additional detail can be found in Section 5 of this report that discusses alternatives for meeting the gap.

1. Implementing additional conservation measures in some of the major gap areas (Northern El Paso, Arapahoe, and Douglas Counties) where water demand is primarily supplied by non-renewable groundwater can reduce the rate of mining of groundwater and extend the useful life of aquifers. However, this does not provide a renewable water supply for these water providers. It would be inaccurate and misleading to look at statewide conservation savings and arithmetically apply it to the gap areas. This would assume that saved water in other basins or other geographic areas can or would be delivered to gap areas. There has not been any indication that water providers who achieved future water conservation savings would be willing to perpetually allocate saved water to other water providers. In the event that water providers would agree to permanently sell conserved water to the gap areas, significant infrastructure costs would need to be added to the costs in the Table 2-1 matrix. However, the successful implementation of conservation in the gap areas would reduce, but not eliminate the need for renewable water sources.

2. A portion of conserved water can be used for new growth, improving system reliability and environmental flows but it is unlikely that it will be used to provide water to other entities. There has not been any indication that water providers who achieved future water conservation savings would be willing to perpetually allocate saved water to other water providers. Rather, it is more likely that conserved water would be used first to increase system reliability and then any additional savings might be allocated to year to year M&I or agricultural leases or to enhancing environmental or recreational flows.

3. There is a need for the successful implementation of water conservation measures. However, successful implementation will not eliminate the need for additional water supply acquisition and development of structural projects to meet

growing water demands that will continue beyond 2030.

- The recent drought exposed the vulnerability of many providers' systems.
- Water providers have identified shortfalls in existing system reliability and meeting future demands.
- Coupled with the potential impacts of climate variability and the fact that growth will continue past 2030, it is clear that both water conservation and structural water projects will be needed to meet future M&I demands.
- Storage will be needed to carry over conserved water for droughts.

It would be inaccurate and misleading to look at statewide conservation savings and arithmetically apply it to the gap areas. This would assume that saved water in other basins or other geographic areas can or would be delivered to gap areas.

4. A concern expressed by many water providers to the implementation of water conservation measures is that water conservation may be used as a justification to delay the implementation of structural projects that will ultimately be needed.

5. Though not discussed by the TRT, CWCB believes that there may be a significant risk to water providers in delaying the implementation of identified projects and processes and other water supply development that will be ultimately needed even with successful implementation of water conservation. Competition for scarce supplies, cost escalation of water supply development, and the increasing difficulty in permitting projects suggest that delays in implementation may result in the inability to develop the project at a later date.

6. Water conservation implementation should be implemented concurrently with structural water supply development. Effective conservation programs make other supply alternatives, such as agricultural transfers and new reservoirs, more palatable to all parties, including utility customers, agricultural water users, environmental and recreational interests and citizens, businesses, and local government in neighboring river basins.

7. The "Gap" TRT should formulate alternatives, including a "conservation-oriented alternative" for addressing needs in specific "gap" areas, i.e., where there is a well-defined likely shortfall by 2030. Future efforts could involve formation of a sub-committee, made up of some members of both the Conservation and the Gap TRTs and perhaps some members of the inter-basin compact roundtables. These members could work together to clarify how "current" (2000), more recent (2006), and expected levels of water use will be factored into the "gap" analysis, especially for areas of the state expected to experience rapid growth or to face difficulty in meeting demand. This information should also be provided to the interbasin compact basin roundtables.

8. Both water conservation and structural projects need to be implemented now, since both take time to implement and produce the desired reduction in demand or increase in yield. Structural projects take time to permit and construct and conservation takes time for market penetration.

9. An issue not discussed by the TRT, but identified in the SWSI Report is that the implementation of M&I conservation will result in some reduction in wastewater and lawn irrigation return flows. It is likely that even without additional conservation, M&I water providers will continue to increase their use of legally consumable return flows, whether from lawn irrigation or wastewater effluent. This will inevitably result in reduced supplies to downstream agricultural users who have benefited from these increased flows over the past 40 years.

The Role of the Colorado Water Conservation Board and other Stakeholders

1. It is not the intent of the CWCB that the implementation of water conservation measures should interfere with the justification or permitting of needed structural water supply projects. As part of the adoption of the SWSI, the CWCB adopted the following mission statement:

Following the lead of local water suppliers, the state will monitor long-term water needs, provide technical and financial assistance to put the necessary plans, projects, and programs in place to meet those needs, and foster cooperation to avoid being forced to make trade-offs that would otherwise harm Colorado's environment, lifestyle, and economy.

2. The CWCB, through its OWCD, should continue to take a statewide role in promoting water conservation and drought planning. CWCB intends to continue to be proactive in drought planning by implementing an update to the drought and water supply assessment survey and studying the impacts of climate variability on water supply.

3. The CWCB should continue to provide grants to water providers for the development of water conservation plans and to assist in the implementation of the conservation measure outlined in the conservation plans. The CWCB should work with other key stakeholders to develop and implement requirements for standardized annual M&I water use data reporting to facilitate the collection of water use data and to track the implementation and effectiveness of water conservation measures.

4. The CWCB should continue the SWSI Water Conservation and Efficiency TRT as a multi-stakeholder resource, drawing on the expertise of the Colorado WaterWise Council, environmental interests, and M&I water planners.

5. The Water Conservation and Efficiency TRT should be used as a statewide technical resource to the interbasin compact basin roundtables and IBCC.

6. The CWCB, working with the Water Conservation and Efficiency TRT, the interbasin compact basin roundtables, Colorado WaterWise Council, MMC, and other interested stakeholders, should develop consensus statewide water conservation goals and BMPs. These might include the following goals:

   - Pursue agreement between interest groups to help ensure that both conservation and water infrastructure projects are implemented in a timely fashion. Water conservation should be pursued as an important component to water supply planning but not in lieu of critical infrastructure needs.
   - Metering is required by law for all water providers, regardless of utility size. Very small water systems of less than 600 water taps are presently exempt from this requirement. Financial assistance from state or federal agencies should be considered for small water providers, if necessary.
   - Development of moderate and advanced levels of water conservation BMPs, with the goal that the moderate level of water conservation should be implemented by all providers, regardless of size, geographic location, or water supply situation by 2030.
   - Development of average residential per capita water use goals for new development, taking into account local climatic differences impacting irrigation water requirements.
   - Development of a statewide social marketing campaign on the value and importance of sustainable water resources in Colorado for our people, land, environment, and economy. The goal of this campaign should be to promote the value of water in and for Colorado and the importance of using it wisely. This effort will help providers to achieve the conservation savings projected in this analysis and will demonstrate the commitment of the entire state to sustainable water resources. Water is often a

divisive issue in Colorado and this campaign is a way to bring Coloradoans together to achieve common ground on the value of water and the importance of wise stewardship of our precious resources.

6.2.2 Alternative Agricultural Water Transfer Methods to Traditional Purchase and Transfer TRT

Population Growth, Urbanization, and Issues Associated with Reliable Water Supply

Population growth, urbanization, and issues associated with reliable water supply availability are key factors that are leading to a reduction in irrigated farmland in Colorado. In addition there are significant financial, economic, and demographic factors (i.e., increasing average age of farmers and ranchers and fewer "young" people choosing it as a career) that are influencing the trend toward reduced farming and ranching in Colorado. Commodity prices, access to markets, fuel, equipment, and labor costs are a few examples of these factors. This report did not address these factors. It is essential to acknowledge that while one can examine and explore alternate methodologies to purchase and permanent transfer of water from agriculture and this may in turn assist in maintaining viable agricultural and ranching, unless these other factors are addressed the attractiveness and viability of farming and ranching overall will continue to be a challenge.

Future M&I Water

The M&I providers and users who need additional M&I water in the future have diverse needs including potential growth (rate and pattern), raw water infrastructure, and existing portfolio of water rights (i.e., water for base demand, water to replace non-renewable groundwater supplies, water for drought years, water for drought recovery, and water to replace interstate compact calls). For example, by 2030, water demand in Douglas and El Paso counties that are currently on non-renewable groundwater is projected to be near 100,000 AFY. Thus, there needs to be a number of alternative permanent agricultural transfer methods (interruptible supplies, fallowing, banks, etc.) available to match the irrigator's and users' needs. In addition, these alternatives must be flexible enough to allow variations to meet specific source and user situations. One size will not fit all.

Property Rights and/or Local Issues

Many subcommittee members expressed concern over how this process and involvement of the state might negatively affect the price of water, property rights, and/or local issues associated with water transfers. There are strong opinions on every side of the issue of water transfers; there are those that wish to retain their ability to sell water to the markets that provide the greatest returns; there are those that may not be part of the transfer and may wish to participate and share in the economic benefit; there are those that may not be part of the transfer that benefit (open space, views, wildlife habitat etc.) from the presence of the agricultural water user; and there are those that simply do not wish to see transfers. In addition to these opinions, the other key driver that influences how transfers are perceived and implemented relates to who retains ownership of the water (the agricultural user or the new end user) and what type of organizational/ institutional structure is "best" to ensure equity for those involved in the transfer and those affected by the transfer.

Economic and Social Impacts

Generally, in areas of the state where urbanization and transfer of water is occurring there is less concern over economic and social impacts as other industries and benefits accrue to the local community. In these areas the loss of open space and diverse landscapes can be a factor. In more rural areas with no significant development potential, when water is or may be transferred there is a deeper concern over the impact to the local economy and the long-term viability of the community. This can result in a division between the benefits that can accrue to the water rights holder versus potential impacts to the overall community.

Third-Party Impacts

The cost of third-party impacts from traditional agricultural transfers have not been, but should be, quantified so that the alternatives can be accurately compared.

Role of the State of Colorado

There may be a role for the state, through the CWCB for example, to "level the playing field" through the use of incentives to encourage M&I providers and users to use alternatives to traditional agricultural transfers in order to foster the maximum utilization of the state's waters and to ensure that other non-market values (open space, wildlife habitat) are retained.

The CWCB recently developed a grant program of up to $1.5 million for the Arkansas and South Platte Basins to help facilitate the evaluation of alternatives to traditional agricultural transfers. The grant(s) are available on a competitive basis and are aimed at helping advancing alternatives to traditional agricultural transfers.

6.2.3 Delineating and Prioritizing Colorado's Environmental and Recreation Resources and Needs TRT

Figure 6-2 outlines the process that was recommended by the Environment and Recreation TRT that the basin roundtables use to move from initial attribute selection to implementation of a management method or protection strategy for environment and recreation uses.

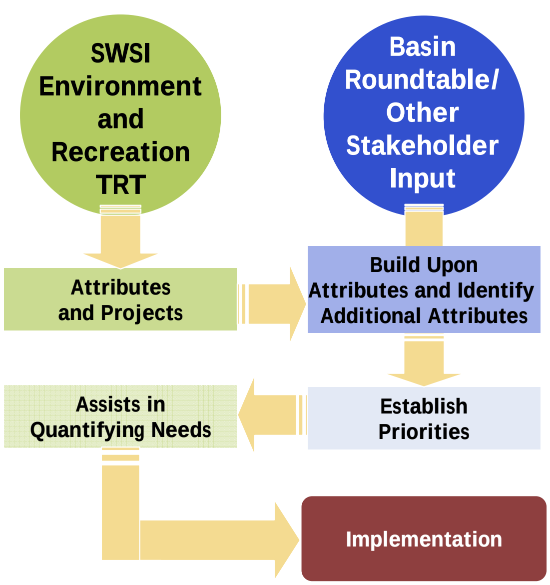


Figure 6-2
Environment and Recreation Prioritization

Since the completion of the TRT process, a nonconsumptive work group comprised of members from the BRTs and the Environment and Recreation TRT was formed to assist the BRTs in completing their nonconsumptive needs assessments. The process that the BRTs and the nonconsumptive needs assessment work group is utilizing to complete the nonconsumptive needs assessments is presented in Figure 6-3. The strategy outlines methods for the roundtables to build upon the SWSI 2 attributes, prioritize areas of environmental and recreational importance, and to quantify needs to protect these areas.

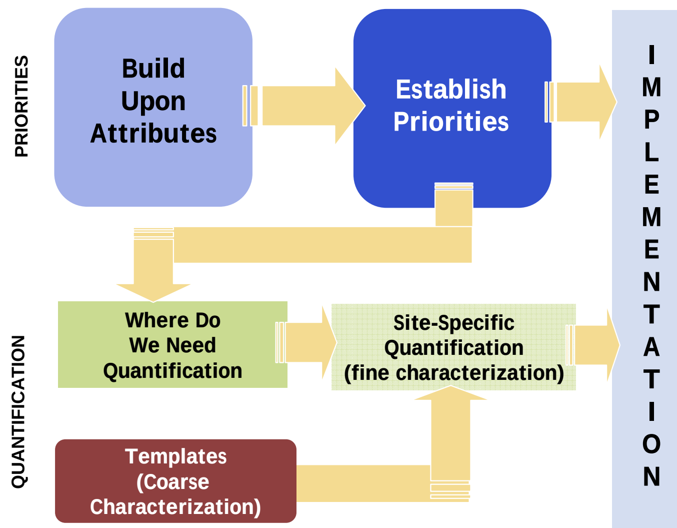


Figure 6-3
Non-consumptive Needs Assessment Overview

The selection process for identifying those attributes has not been determined; it is recommended that they tie back to the vision, goals, and socioeconomic future of the basin.

Based on discussions with the Environment and Recreation TRT, following are recommendations for consideration as the BRTs complete their nonconsumptive needs assessments:

- The nonconsumptive and consumptive needs assessments should be completed concurrently and coordinated. Once completed, the BRTs should use this information together to understand and evaluate tradeoffs that may occur in addressing water needs across the state.

- Each BRT should identify additional attributes that are reflective of local importance in their basins.
- Further work in identifying the density of fish species should be considered as part of the BRT Needs Assessments
- As part of nonconsumptive needs assessments distinguish between areas that have been sampled but no species were present versus areas that have not been sampled.
- For vegetation coverages further identify where CNHP has identified areas with low or no conservation value.
- The GIS attributes and datasets that have been developed as part of SWSI 2 and will be developed as part of the BRT Nonconsumptive Needs Assessments should be continually maintained by the CWCB in cooperation with CDOW.
- Develop a common technical platform for assessing environment and recreation needs is important. This includes making sure the process undertaken provides consistency and comparability within and between the basins.
- BRTs should continue to examine funding options and alternatives.

6.2.4 Addressing the Water Supply Gap TRT

The Gap TRT recommended that the future work should evaluate the water supply alternatives using similar assumptions and the group suggested that a more detailed evaluation of the options be performed. Development of comparable costs would be beneficial since there were differing assumptions on capacity, capital and O&M costs, yields, water rights, delivery locations, water treatment, etc. for each water supply alternative.

The general direction of the Gap TRT was to perform a detailed evaluation of each option using the following assumptions and approach:

- Delivery of similar water quality.
- Common or comparable storage areas should be included for all options.
- Common or comparable termination points should be included for all options.
- There should be a range of water delivery; the suggested range was 100,000 - 175,000 - 250,000 AFY.

The TRT also suggested the following evaluation elements be included:

- Include Capital and O&M costs as net present worth and annualized cost (infrastructure and operation and maintenance) and cost per AF.
- Additional information be added to the matrices that outline some of the initial benefits, impacts, and attributes of the options.
- Information and suggestions regarding base options (options that would be added to the major structural options) be obtained from the BRTs.
- Conservation be considered in developing alternatives.
- The Decision Support System be used to perform additional analysis of supply availability.
- Additional information be included regarding existing storage and infrastructure opportunities.

- Additional information be developed on: storage requirements, miles of tunnels required, river crossings, permitting considerations (i.e., Federal Lands, Wilderness Areas, 1041 considerations, wetlands etc.).
- Refinement and development of critical agricultural needs and solutions.
- Environmental and recreational enhancements.
- Refinement and development of local basin projects and needs in conjunction with the major structural options.

At the time of publishing this report, there has not been a final decision on how and when to proceed with the further definitions and refinements of the seven major structural projects.

The CWCB is working with BRTs, the Interbasin Compact Committee, and other stakeholders to identify the best venue and time to complete additional analysis.

6.3 Path Forward

To be developed by the CWCB Board and Staff.

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Appendix A
Response to Comments on Conservation and Efficiency Draft White Paper

Response to Comments on Section 2 – Conservation and Efficiency Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
1	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/22/2007	PP 2-20 et seq.: Secs 2.5.1, 2.5.2, 2.5.3, etc.: Please consider revision of these sections to first introduce legislative requirements (e.g 05-1254, 04-1365, others) as context for role of state and CWCB, and then expand as per 2.5.2 and 2.5.3. Clearer narrative with more understandable sequence of elements would explain and describe authority and obligations for planning, relation to grants, etc. Put 2.5.5 first?	Edit made.
2	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/22/2007	Please add note on Constitutional general obligations of State and statutory mandates of CWCB, SEO -- basics of why state is involved at least in minimal fashion. Avoid some adverse knee-jerks.	Edit made.
3	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/22/2007	The criteria applied for municipal interests were the narrowest and most myopic possible, including none of the other values and interests that motivate citizens. This should be explicitly noted in the explanation of the results because the discussion was on the one hand, very good, and the quantification and demand hardening work by Peter Mayer, Stu Feinglass, Kelly DiNatale and many others is excellent. But on the other hand, the framing of the issues was very narrow [ignoring $3.8 Billion provided by voters for open space, land preservation and related projects that would indicate voters are not always interested in only the cheapest option, but also options that serve a wider set of goals and desires].	Comment noted.
4	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/22/2007	There is discussion on P 2-25 and following of potential costs of delaying project acquisition, but there are important omissions in ignoring (a) economic benefits of avoiding bonding and interest costs, and (b) equity benefits of better matching of costs and benefits among users of municipal systems.	Additions made to bullet 4: Water conservation can reduce the need for water supply development projects, water treatment plant expansions and other utility infrastructure and reduce financing, operations and maintenance costs.

Response to Comments on Section 2 – Conservation and Efficiency Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
5	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/22/2007	The "elephant in the living room" is the denial of connection between water planning, land use planning, and growth and cost management. This may be comfortable for some officials devoted to the narrowest view of their obligations to citizens, but it is irresponsible at best. The report should note that the issues were framed in a peculiar way, and that the real context and consequences were simply not addressed. That may ave been the choice of some participants on the TRT but the professional obligation of the CWCB and its excellent contractors is, in my opinion, to explicitly note that this was not the only possible approach or framing of the issues.	Comment noted.
6	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/22/2007	Pp 2-26, especially 2.4.3: This discussion most directly shows the narrowing and framing problem. There is no hint of the issues of "right-sizing" of capital facilities, water supplies, and service areas; no hint that most places are far more interested than some Colorado cities in containing their costs of growth, costs of service provision, and long-term quality of life. Real estate values, in the long term, are increased by better management, but apparently the short-term "flip" is the paramount goal for municipal policy in some places.	Comment noted.
7	Bart Miller – Western Resource Advocates	3/26/2007	Page 2-6, right column (middle), includes a bullet question: "What are the legal and water right constraints on the ability to use water that is saved as the result of implementation of conservation and efficiency measures?" Comment: this question was not pursued as a research topic by a subcommittee, not presented in any concrete form to the TRT, and therefore should not be included in the white paper without further input from the TRT.	Edit made.

Response to Comments on Section 2 – Conservation and Efficiency Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
8	Bart Miller – Western Resource Advocates	3/26/2007	Page 2-7, right column (middle), includes a list of "Conservation Measures Evaluated." Comment: the white paper should note that the list noted therein is not an all-inclusive list, but merely by way of example.	Edit made.
9	Bart Miller – Western Resource Advocates	3/26/2007	Page 2-14, right column (near bottom), includes new material starting with "Issues not addressed . . ." Comment: I'd certainly agree that the noted concerns, and many more, can be addressed "via properly designed water rate structures." However, as currently drafted, the white paper speculates about the effects of conservation-oriented rate structures without having made any attempt to study the specific issue through the TRT and makes conclusions that may not be warranted or supported by fact. In short, since the issues raised by this new language were not addressed by the TRT, they should not be included in the white paper.	Partial edit made.
10	Bart Miller – Western Resource Advocates	3/26/2007	Page 2-22, left column (middle), includes new language, including a paragraph that begins: "In order for the state to realize any of the projected water savings . . ." Comment: The including of "any" is inaccurate. For example, the natural replacement of indoor appliances, in particular high efficiency toilets, would happen even in the complete absence of conservation plans. Replacing "any" with "most" would make the sentence accurate	Edit made.

Response to Comments on Section 2 – Conservation and Efficiency Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
11	Bart Miller – Western Resource Advocates	3/26/2007	Page 2-23, right column (toward bottom), includes the assertion that "most TRT members would substantially concur" with the conclusions and recommendations sub-section. Comment: Many of the conclusions and recommendations have been revised and several new provisions added since the draft white paper circulated last year. As a result, it is impossible to tell whether the above statement is accurate. And, because of pressing workloads of the many TRT members who volunteered their time over the past 18 months, silence on this revised draft cannot be implied to be consent. The sentence would be accurate if it read, in its entirety: "These do not represent consensus recommendations of the TRT."	The paragraph was revised to read: The following conclusions and recommendations are made by CWCB staff after review of efforts of the Water Conservation and Efficiency TRT. The primary areas where there is a lack of consensus among TRT members is on the successful implementation of some of the conservation measures, especially turf replacement and the role of water conservation in eliminating the need for structural identified projects and processes that water providers have planned to meet future water demands.
12	Bart Miller – Western Resource Advocates	3/26/2007	Page 2-24, right column (middle), includes new language that replaces the summary of potential savings appearing in the previous white paper draft. Comment: While much of the new language appears to be accurate, it would be useful to include the range of savings potential in the conclusions and recommendations sub-section.	Edit made.
13	Bart Miller – Western Resource Advocates	3/26/2007	Page 2-26, left column (in two places: near top and at #2, near bottom), includes the statement: "There has not been any indication that water providers who achieved future water conservation savings would be willing to perpetually allocate saved water to other water providers." Comment: The topic was not discussed in a substantive way at any TRT meetings, and appears to be an assertion that, even if it were true, shouldn't be included in a consensus-based white paper without first attempting to gather input in a public setting from the TRT members.	This statement in the paper is true with relation to the TRT meetings. Subsequent to the TRT meetings this question was been asked of water providers at the Consumptive Workgroup kickoff meeting. Not a single water provider indicated that they would be willing to perpetually allocate conserved water to other water providers. Denver Water responded that they intend to allocate any conserved water to their strategic planning reserve.

Response to Comments on Section 2 – Conservation and Efficiency Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
14	Bart Miller – Western Resource Advocates	3/26/2007	Page 2-26, left column (middle), includes a paragraph beginning with: "The implementation of M&I conservation will result in some reduction in wastewater and law irrigation return flows." Comment: The paragraph raises a complicated issue that was not discussed in any substantive way during the TRT process. The statements acknowledge cities are legally entitled to conserve and re-use consumable return flows but also imply this is inequitable from the perspective of downstream agricultural users. The topic should be removed from the draft white paper.	Paragraph revised to read: An issue not discussed by the TRT, but identified in the SWSI Report is that the implementation of M&I conservation will result in some reduction in wastewater and lawn irrigation return flows. It is likely that even without additional conservation, M&I water providers will continue to increase their use of legally consumable return flows, whether from lawn irrigation or wastewater effluent. This will inevitably result in reduced supplies to downstream agricultural users who have benefited from these increased flows over the past 40 years.
15	Bart Miller – Western Resource Advocates	3/26/2007	Page 2-26, left column (#2, near bottom), inserts "(subject to pull back)" in the phrase about a portion of conserved water being used for environmental flows. Comment: While it is true that a municipality might chose to enter an agreement that allowed it to "pull back" its water rights in a time of drought (see, page 2-24, left column, #6), it should not be assumed that such a provision would be applied. The parenthetical phrase should be deleted.	Edit made.
16	Bart Miller – Western Resource Advocates	3/26/2007	Page 2-26 right column (#5, bottom), proposes that conservation may create a "significant risk" to delaying water supply development. Comment: The topic (though raised by the CWCB and its contractors at a TRT meeting) was not pursued by a TRT subcommittee nor was it discussed in any substantive way. The potential "risk", if any, would be case-by-case, and dependent on many issues, including geography, conditional water rights, and whether a municipality might actually meet all its future needs through conservation, re-use, and other alternative supplies. As written, #5 should be more accurately re-framed or removed from the draft white paper.	Edits made

Response to Comments on Section 2 – Conservation and Efficiency Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
17	City of Thornton		In Table 2-2 it is not clear what the difference is between "Turf Replacement" and "Rebates for Landscape Retrofits"	Rebates for landscape retrofits are for other landscape changes other than turf replacement.
18	City of Thornton		In Table 2-2 there is no mention of water budgets; i.e. Irvine Ranch and Boulder	Water budgets are included in the following measure: Conservation oriented water rates - increasing block rates, water budgets, excess use surcharges, information oriented billing.
19	City of Thornton		P2-11, second bullet; how will landscape changes lower owner's maintenance costs?	Clarification added: Landscape changes may lower owner's maintenance costs, such as mowing and fertilizer applications and sprinkler maintenance in addition to lower water bills.
20	City of Thornton		P2-12 For some water providers, there is a political aspect to utility rate structures rewarding conservation and steep rate increases for higher use. Elected officials might be concerned about the response from their constituents.	Comment noted.
21	City of Thornton		Table 2-4 Commercial Landscape Audits is repeated. Also, how do landscape changes lower owner's maintenance costs?	Duplicate row deleted. Landscape changes may lower owner's maintenance costs, such as mowing and fertilizer applications and sprinkler maintenance in addition to lower water bills.

Appendix B
Response to Comments on Alternatives to Permanent Agriculture Transfers Draft White Paper

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
1	Dan Smith – Colorado State University	3/26/2007	One positive alternative to permanent transfers can be combined use of the acreage for rainfed (dryland) cropping and upland small game enterprises or fishing.	Added to a bullet in Section 3.6.2.
2	Dan Smith – Colorado State University	3/26/2007	Under the general title of "Issues and conflicts" for several of the alternatives, there is mention of potential negative effects of fallowing in intermittent years on perennial crops such as orchards and forages. I didn't comment at the time. Since then, I have tried to think whether or not any significant injury to perennial forages could occur as a result of random fallowing and I can think of none.	Made a notation in the relevant sections that "The impacts to perennial forages as a result of random fallowing are uncertain."
4	Melinda Kassen – Trout Unlimited	3/26/2007	I worry that this report is too little, too late. So much time has passed, and so many things have happened, that it is too bad that this report will make as little a contribution as it will. I understand that you waited to issue this report because you wanted to issue the three non-Gap TRT reports contemporaneously, but I think that this report, at least, suffered from the delay. It's contribution to the conversation about this issue would have been modest had it been released 10 months ago; now, I'm not sure it adds anything new to the dynamic discussions occurring and the movement being made on things like the Lower Arkansas's Super Ditch/fallowing proposal.	Comment noted.
5	Melinda Kassen – Trout Unlimited	3/26/2007	The delay in the report's release means that other issues are now a part of the conversation regarding the future of agriculture in Colorado. The sale of water to municipalities -- or even the pressure on agriculture to sell water to municipalities -- has always been only one reason for the loss of irrigated acreage in the state. There are many others. The Pueblo Chieftain ran an article on March 11, 2007 about changes in irrigated acreage in the Arkansas Valley over time. The number of irrigated acreage has, in fact, changed dramatically in the last 50 years, for many reasons. That article points out at least two reasons that don't appear to have been mentioned during the TRT process -- upward pressure from the new market for ethanol for energy and downward pressure due to producers' inability to hire non-immigrant labor to work in the fields. While the TRT did not discuss either of these factors, it might still make sense to add information about them, given that the report is coming out in the spring of 2007 instead of the spring of 2006, because otherwise it just looks like the TRT missed important trends.	Issue of changes in irrigated acres will be addressed in consumptive use work group.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
6	Melinda Kassen – Trout Unlimited	3/26/2007	The report should also include the dates of the TRT meetings, rather than simply list Meetings 1, 2 and 3	Meeting dates added.
7	Melinda Kassen – Trout Unlimited	3/26/2007	I appreciate that the economic example of fallowing Ed Harvey initially presented at the last TRT face-to-face meeting in April 2006 has been revamped to answer some of the TRT members' questions. However, the example is so generic at this point that I did not find it especially enlightening.	CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program will provide additional detail on fallowing alternatives.
8	Melinda Kassen – Trout Unlimited	3/26/2007	While the report concedes that the TRT technical subcommittee did not address the water quality question it was assigned, it says that this occurred (or didn't occur) because of time constraints. The report should further clarify that the CWCB chose not to expend additional resources to answer this critical question	Issue can be addressed by consumptive use work group.
9	Melinda Kassen – Trout Unlimited	3/26/2007	In many places in the report (for example, on page 3-1), there is an assumption that the alternative to ag dry up is new structural projects. In light of the potential for conservation discussed in the other TRT report, I believe that it would be more appropriate to say "structural or nonstructural solutions" in virtually every case.	Reference to structural projects deleted.
10	Melinda Kassen – Trout Unlimited	3/26/2007	The language in the report includes sentences like, "It is further recognized that [something, e.g., temporary transfers] may likely be more [something, e.g., costly]" and "[Something] is likely more expensive than [something else]" without the report presenting any factual data to back up the assertion. (See, e.g., sentence beginning on p. 3-2, 2nd column, and p. 3-18, 1st sentence of last bullet)). This type of unsupported allegation weakens the report. If the report is simply repeating a concern some participant had, the report should say so. For example, the report could say instead that "Certain interests expressed concern that ..., but there are not enough real world examples to be able to judge whether the concern is well-founded."	Change made to reflect comment. However, it is important to note that this report relies on CWCB team and feedback from round table members as vetted during the round table process.
11	Melinda Kassen – Trout Unlimited	3/26/2007	While almost all of the evidence of agricultural water transfers used for the report involved M&I suppliers, the report also implicated "self supplied industrial" users, again without providing any examples.	Xcel Energy is a self-supplied industrial user and specific examples are listed in “Case Studies and Reports Utilized.”
12	Melinda Kassen – Trout Unlimited	3/26/2007	Figures 3-3 and 3-4 do not entirely agree with the info in Table 3-6, and the info in Table 3-3 almost certainly must have changed as a result of the well shut downs that occurred last May	Figures 3-3 and 3-4 do not refer to data in Table 3-6. Table 3-3 can be updated as part of consumptive work group.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
13	Melinda Kassen – Trout Unlimited	3/26/2007	The discussion of the Arkansas water bank is a bit misleading without the report stating that the bank has not been used. The discussion of water banks on p. 3-34 should mention that there is one successful, active water bank in Colorado within the Northern Water Conservancy District.	Changes made in report.
14	Melinda Kassen – Trout Unlimited	3/26/2007	Table 3-10 has a bullet about the exercise of property rights as an advantage of traditional agricultural transfers. Certainly, temporary transfers are also exercises of private rights, so this is not, in fact, a distinguishing feature between alternatives.	Change made in Table 3-10.
15	Melinda Kassen – Trout Unlimited	3/26/2007	At the end of section 3-10, the report opines that there are more advantages than drawback to rotational fallowing than permanent dry up. While I may agree with this statement, it is important that the report state explicitly what the goals would be for this conclusion (i.e., where the goals include preservation of the rural agricultural economy and life-style).	Changes made in report.
16	Melinda Kassen – Trout Unlimited	3/26/2007	In Table 3-12, the list of problems includes diametrically opposed conclusions about the long-term commitment of the producer that's required. This table also does not include other impacts that the report discusses elsewhere (e.g., weeds, administrative costs, potentially higher costs to buyer, etc).	Comment noted.
17	Melinda Kassen – Trout Unlimited	3/26/2007	In the example in 3.12.1, it would be useful to include comparative costs for other water supply solutions (conservation, transbasin diversions -- including mitigation, etc).	It was the intent of the original SWSI Report and then the Addressing the Gap TRT to develop comparative analyses of water supply solutions, but this was not accomplished due to concerns of certain interest groups. This may be addressed by the Consumptive Work Group.
18	Melinda Kassen – Trout Unlimited	3/26/2007	In Table 3-17, include the TDS standard to give readers some context for the numbers.	Additional discussion of secondary TDS MCL has been added to text discussing Table 3-17.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
19	Melinda Kassen – Trout Unlimited	3/26/2007	In Table 3-7, for the environmental line, I question several of the assignments of applicability for the options. For example, I would doubt that environmental needs will be met out of water banks during drought years because market prices will be significantly higher during those years which would make it difficult for an entity like the Colorado Water Trust (as opposed, say to the City of Aspen) to compete, although the site-specific nature of these issues may change that dynamic (e.g., giving the City of Aspen an incentive to buy flows to keep the Roaring Fork River wet). Similarly, I wonder how the committee decided that leasebacks would be highly applicable.	The applicability of alternatives to meet drought flows or supplemental base flows for environmental needs, such as water banks or purchase by environmental interests with leasebacks to ag users, were rated based on the ability of the alternative to meet the need, rather than the ability to pay. Several Colorado Water Trust acquisitions and the recent Water Supply Reserve Account grant for the Vail Ditch acquisition are examples of environmental needs being met with competitive water acquisitions.
20	Melinda Kassen – Trout Unlimited	3/26/2007	In Table 3-8, with regard to question #1, I would change the answer for long-term rotational fallowing to "no." and the answer for water banks should include a comment that the existing statute may be too restrictive and/or complicated for use. To make it useful may require change, if the last several years are any indication.	Edits made.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
21	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Page 3-2, Upper right column: "It is further recognized that alternatives that deviate from traditional approaches may likely be more costly… (rest of sentence presumably: and benefit a larger range of interests than municipal rate-payers?) SERIOUS PROBLEM: At one of the TRT meetings, there was a very brief specific discussion of this, by Harold Evans of Greeley, and there was placatory mumbling by Dave Little from Denver, I think, and at the third TRT there was again assertion of the higher cost of alternatives as an aside, BUT NO EVIDENCE WAS EVER PRESENTED. Why this should be accepted baldly and not clearly identified as a supposition is not clear to me. I did present evidence in memos and elsewhere that in fact, avoiding the bonding capital cost of traditional water acquisition, which typically adds a little more than 50% even at lowest rates, for 30 years, may make long-term contracting cheaper. I showed a slide when able to present using info from a no-brainer mortgage calculator on the internet, and cited Barry Cress, Department of Local Affairs, for additional costs of bonding. I think you rendered this well on p 3-23, but that comes up a long ways after this claim of "more expensive". Further, long-term contracting avoids the costs of revegetation as well as any "mitigation" and Cnty Section 1041 expenses that might be incurred. Again, no countering evidence that these savings would not be greater than the expenses from alternatives. So far, to my knowledge and frustrated inquiries on this topic, no city has disclosed its figures or stated that it has made careful cost estimates; compare this state of non-information to the level of information available about agricultural businesses…. UNTIL THERE IS SOME CREDIBLE EVIDENCE FOR THIS CLAIM, IT SHOULD BE CLEARLY LABELLED AS SOMEONE'S OPINION. As for strategic behavior in the competition for water, see Olinger and Plunkett "Turning Water into Gold" series from Denver Post; I have text from the articles in a "Word" ™ file available on request.) Why is it their opinion? One may speculate on the strategy of making one's job easier, the expectation that until one is told to do things differently, traditional is what is wanted, and there has been considerable surprise over my presentation of the fact that $3.4 Billion have been voted in 110 Colorado elections for conservation, open space, and land preservation, by the same constituents whom some would have us believe care only for their water bills…. and the $3.4 Billion does not include any private contributions and memberships, etc etc etc…. (See Conservation Vote, at Trust for Public Land website.) So far, no one has "done the numbers" in public. Do you have evidence of some other sort?	CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program will provide additional detail on fallowing alternatives and address whether alternative transfers will be less costly. M&I providers tend to seek the least costly alternative and traditional transfers have been the least costly as reflected by the comments of M&I TRT members and the actions of the M&I water community. If the underlying value under a rotational fallowing remains with the ag user, it is possible that the ultimate cost to the end user, when acquiring permanent water rights may appreciate at a greater rate than the cost of bonding if the water rights are acquired today. It is uncertain if mitigation or 1041 permits would be required for construction of infrastructure associated with an alternative transfer. This issue can be explored as part of the Consumptive Work Group.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
22	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Ideally, add footnote [to Table 3-6 observing that enterprise budgets are very sensitive to fertilizer and fuel prices, and not intended to be predictive but rather to benchmark outcomes from a large set of specified inputs including prices and sales prices for outputs. This, incidentally, complicates comparisons across years	Additions made to paragraph describing Table 3-6.
23	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Explanation for Fig 3-3 [and Figure 3-4 should be added. Flood irrigation is not more agriculturally productive than sprinkler irrigation. The reason for the higher average assessed valuation is the historical coincidence (in technical terms, not speaking colloquially) of earliest irrigation water rights and some (not all or always) superior soils and locations, now very commonly urban or peri-urban.	Additions made to paragraph describing Figures 3-3 and 3-4
24	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Page 3-14, Lower right column: I would add that there is no known legal authority to require that return flows from location of original use be maintained; I also do not know of any specific rejection of such a claim, so I would not make a very strong statement in a formal way. You might ask for a comment on this from SEO or AG.	Return flows must be maintained in the same timing and location if required to prevent injury to other vested water rights. Additions made.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
25	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Treatment of Interruptible Supply and Rotating Fallowing Alternatives: PERMANENCE is also alleged as a need for municipalities, but although it was claimed, the evidence was only the claims. Beyond the reflex, where does this come from? (1) Realistically, since this is described as a serious problem, one should also note that the lifetime of infrastructural facilities is often far shorter than the durations of these contracts; some water facilities would last longer than a century, but most will not. How serious is a worry about 80 years from now if the intervening period is secured? And, realistically, if a deal is in place for many decades, including the infrastructure, the arrangements around that deal, including the infrastructure for transfer, will make it very likely that an alternative use (the feared lease to someone else, or sale to someone else) would be more costly. And finally, thinking soberly about this, suppose conditions change and City X and Farmer Y have a deal which is about to end, and New User Z appears – perhaps some new technology with high profits, or anything you like. If Z has net economic benefits greater than X and Y can achieve, they are ALL better off if X and Y sell to Z. Obviously, the measure of the economic benefits to X and Y – combined – is partly measured by the cost of any alternatives. If X and Y can sell that specific flow to Z for $N, and buy themselves a replacement for $<N, they keep the difference. If Z offers less than it would cost to replace the flow, then X and Y will not accept. The only complicated part here, which is a step beyond a knee-jerk idea of a very simple contract, is that X and Y must agree to share interests to the extent that Farmer Y will not, at the end of the term, be completely disassociated from City X so that Y could sell to Z for more than X can pay. This can be arranged in a variety of ways. Nothing here is very difficult given a little thought. (2) The right-of-first refusal term as part of a contract is only one of the ways security of interests could be assured. Options include more sophisticated terms concerning ownership of the associated farming or land, buy-outs for both sides in the event of changed circumstances, and other forms of risk allocation. Although the legal framework here forces discussion into terms of leasing or sales, in economic reality these long-term contracts are a form of partnership in joint management and use of a set of resources, as opposed to division of the resources for separate management and use. The true partnership nature of the arrangement actually serves many purposes, because it can draw on the strengths of the different places and parties. And, there is no reason why thoughtful deals cannot include a variety of the goals and purposes now addressed in terms of "mitigation" and rural development, and so forth.	These issues can be addressed by consumptive use work group and CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program. In all forums, M&I water providers have consistently stated that permanence of water rights is a major driving factor in supply planning, given the competition for a limited water rights.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
26	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Treatment of Interruptible Supply and Rotating Fallowing Alternatives: The AGRONOMIC ISSUES AND COSTS: As an early report of research in progress, there are some agronomic issues which should affect these long-term contracts as well as water bank thinking. Specifically, there are probably some changes in crop rotations and farming practices which may reduce total long-term yields in order to achieve higher levels of soil conservation and fertility. It is not clear whether these trade-offs will reduce net economic yields (profit), since many of the current research findings on deficit irrigation, limited irrigation, and advanced farming technique indicate that yield reductions may be outweighed by input cost reductions. In the short-term future, it is likely that switching to the long-term sustainable agronomy and improved crop rotations could impose some financial penalty, particularly if there is a high level of subsidy for conventional corn for biofuels production. The important point is that there is need to acknowledge that there are some uncertainties about short-term and long-term management which presently appear to call for recognizing some additional costs from conservation-oriented rotations which will provide best management within the frameworks of (a) predictable rotating crop management, (b) less predictable interruptible supply, and (c) still-less predictable water banking with short-term rapid transfers. AND, a fair description must acknowledge also that the contracts very likely will involve either financial support directly for new farming techniques, or indirectly support of better farming through the long-term stabilization of income which in turn supports "right-sizing" investments, and optimal farming designs such as the best management practice rotations. Incidentally, these developments are very wide-spread; there is substantial research across the US and internationally on more-economically oriented farming rather than the blind maximand of "more bushels" only. Indeed, dear reader, you will have noted that this means, again, thoughtful contracts and effective sharing of resources is potentially beneficial for all. Cities that invest in farming may be financial partners in the upside as well as the downside, and that can be recognized in many ways.	These issues can be addressed by consumptive use work group and CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
27	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Page 3-20, treatment of Arkansas Water Bank Pilot Program and water banks in general: The description does not squarely address the very important goal met by all of the working water banks in a dozen states (Clifford et al. 2004 – cited in comments; Washington Department of Ecology) – that is reduction of transactions costs.	See bullet in 3.7.3 which states: “If implemented properly and providing that there is the necessary infrastructure, per unit transaction costs can be lower than many alternatives, allowing many small volume transfers to take place. This increases flexibility available to all water users since there is no cost-of-water court barrier, and the time needed to work a deal can be measured in days instead of years.
28	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-21 R: Sec 3.7.4 – There is a great deal of research on limited irrigation and deficit irrigation. Citing Dan's alfalfa work as an example is fine but you should acknowledge that there is much more even just inside Colorado, by other extension and CSU researchers, and the USDA ARS.	Addition made.
29	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Pp 3-21, 3-22: Do not smear limited irrigation with deficit irrigation: limited refers to idealizing the output from a limited (rather than full ET) amount of irrigation, while deficit more narrowly refers to timing irrigation so as to reduce plant growth during vegetative stages but not limiting growth in reproductive stages.	Addition made.
30	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-22: Alfalfa growth reduction resulted (in studies recently reported by Pritchett from various trials including a new series with NCWCD) in increased protein content, with increased sales price due to higher quality. This is not very simple, and there is a lot of interest.	Comment noted.
31	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	[Noted as particularly important by commenter] Example of RFID-MU deal: this example fails to capture the long-term idea, and so eliminates the potential benefits of long-term optimizing and long planning horizons which you rightly note just above the example. Another reason for amending this example is that Ed Harvey overlooks the fact that the up-front set-up/establishment costs are less and less per unit of water as the duration of the arrangement is longer and longer, involving larger and larger volumes of water. The cost-effectiveness of the deal will be changed by duration of the deal. As for the potential benefits of long-term contracts, see your draft as well as the notes above. Although you have paid for this example, it is a sunk cost and the money won't be recovered by failing to fix it up so as to better make your points and better illustrate the idea. So, you might as well get more benefit from the expenditure rather than less.	CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program will provide additional detail on fallowing alternatives.

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32	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-32, Table 3-10. Listing "exercise of property rights" as an advantage of traditional transfers may have some appeal as a flag to wave, but it makes no sense at all. Selling a thing is in some sense exercise one last time of a property right; not selling is an on-going exercise of property rights, too…. Also, please add to column on drawbacks: Loss of amenity value for local attraction of new investment and local quality of life from changed environment. (Move to scenic Dryburg! No lights, no camera, no action, and plenty of dust! Just the place to seduce high-tech high-paying industry – it has nothing to recommend it! But, we're begging for another private penitentiary, so maybe you can have some new neighbors who keep the porch lights on all night…)	 Concept is already incorporated in issues - viability of local community
33	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-33 Table 3-11 "Feasible farmer compensation possible" ??? Perhaps, "Wide variety of financial arrangements possible, including long-term stability and support for optimal farming investment and management".	Edits made in conjunction with other comments.

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34	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	[Noted as particularly important by commenter] P 3-33 Table 3-12, under "remaining problems" – "Sacrifice by farmer to tie up water rights for duration of contract" – this seems needlessly inflammatory. A voluntary contract (no duress, no desperation, no market dominance) is not a "sacrifice"! What the farmer is selling is partial control of the water rights – this is no more a sacrifice than selling them completely, and arguably considerably less, but the emotional term here just colors the idea of commitment to the contract. Also, it is wrong to describe "limited help in serving future growth" as a remaining problem. The whole point of many transfer forms is that they serve different purposes; this is like saying a fork has a remaining problem because it is not a spoon. In case of soup, use a spoon. In case of salad, use a fork. If you start, rather abruptly, to describe each tool as having problems because it is not all tools, you not only mess up the description of each tool, but you also mess up the description of the uses of the set of tools, which you did acknowledge elsewhere. The "set of tools" is in fact a major point about the alternatives, and from the economic perspective, it is a correction to incomplete markets to enable both transferor and transferee to get more of what they want and less of what they don't want. In housing there are rentals and motels and campgrounds and houses of many kinds. There are many kinds of vehicles and wheels. We're trying to fix the market for water uses by expanding the range of choice, and then letting the markets work. Given this context, I would drop the whole "remaining problems" category; the foregoing "issues" is much better (however much one may dislike such vagueries/vagaries).	These issues can be addressed by consumptive use work group and CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program.

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35	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	[Noted as particularly important by commenter] SERIOUS problem: last sentence: "The disadvantages with the ISAs are the increased uncertainty on the part of the farmer and M&I provider" – No – the uncertainty is not any greater than if the water right were sold; it is still just as much water in any year as it would be, neither more nor less. -- "and, since the amount of water available to either the farmer or the buyer is uncertain in any given year, the value of the resource is depreciated in monetary terms." NO! This really is confused. The water right provides what it provides, and the allocation of the transferable fraction is what is being discussed, not the reliability of the water right. Some body drafted this as tired as I am commenting on it. The value is not depreciated by the deal in any terms – the value is being identified by the parties, in terms of value to them, and they are dealing over who gets what in exchange for what. That's what a contract does. If the M&I buyer wants high-reliability senior water rights for constant use, she will buy that. She will look at an interruptible supply contract to fill in some kinds of gaps in some kinds of conditions, and the rights that will be considered will either meet that gap, and there may be a deal, or they won't, and there will not be a deal.	These issues can be addressed by consumptive use work group and CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program. The uncertainty concerns the ability of the end user to know that the interruptible contract is available in perpetuity.

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36	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	[Noted as particularly important by commenter] P 3-34L Describing the set-up costs for a water bank as a problem is not honest unless you also note that a major benefit from water banks is reducing the transactions costs of making a deal for a spot market as long as the bank operates, helping all parties. The net social cost or benefit depends on the amounts spent and the amounts saved, and whether one weights them differently (e.g. state spending is a cost distributed quite widely, and the benefits may be greatest for a group one hopes to benefit – such as farmers or small family farmers, perhaps because the group or the activity provides benefits not directly compensated, as positive externalities in open space, rural economic viability, etc. etc. etc…) The missing point is that the investment in creating a water bank for a spot market pays off in making that spot market possible! Without the water bank, a very large number of trades that both parties would like to make are not possible because they are too expensive. We know this from econ 101, and we also know it from the demonstration of what happens in the Northern Colorado Water Conservancy District – see Howe and Goemans cited above. I'll just attach the file. This is serious; what your draft shows is that whoever wrote this bit really missed a major point, as well putting out a biased and incomplete picture which is not what the TRT agreed to, let alone professionals working in these issues.	Benefit of water bank in reducing transaction costs was added.

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37	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-35 Under "potential impediments", the economics literature is clear on the need for "price discovery" – wide understanding of approximate prices/values is needed for a well-working market. The impediment is actually two parts: first, the secrecy of water deals (compare real estate deals – they're in the newspaper as well as public record in the courthouse), and second, the strategic advantage of misleading sellers, which benefits the relatively very small number of buyers and brokers (see that Olinger and Plunkett stuff for in-your-face examples from here and now; this is not dry theory). Recommended: "Establishment of market may take special efforts to help sellers and buyers learn values in their area." For clarity, I would combine two bullets and say, "Establishment of an institution does not guarantee its use, since problems may arise if any part is unsuitable, so opportunity does not assure acceptance and usefulness." In "potential remedies", "Must understand seller intentions"??? Why? Why seller and not buyer? Might as well say, "Seller must be legally competent to exercise property rights", too. Baffling. REMAINING PROBLEMS category: Some of these are just misunderstandings or potential misuses (the fork or spoon point – what is the tool to do?) and as argued above, the label is just unscientific and unsuitable. The point above about calling commitment to the deal a problem recurs in Table 3-14 calling commitment to reduced water use a problem in contracts to use less water. Having fewer dollars after I spend some is a problem, too – but if I spent them, it was because I thought (at least for a little while) that I wanted the thing instead. I think this is just weird. Similarly, "progress toward underlying goals uncertain" ?? Whose goals? Whose count and whose don't? Better: Relabel these columns "Tool Will Not Address…"	It has become more uncommon that water users are not aware of market values of their water rights.

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38	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Table 3-14 "Raises water costs or reduces net dollars to farmers" – this is incorrect, because the farmer's reason for making this deal is that net dollars are increased from the use of the farm and the water together. If the net were not increased, the farmer would lose money and would not make the deal unless she were misinformed, which is a different problem. Net usually means complete net, and if you means something else, say that. But better not to say this. The rest of this column is not very appealing, either. Your real point, drafter, is that these are technically quite difficult and so are likely to have a higher level of uncertainty about what can be "saved" and legitimately transferred, not least because of the highly variable levels of ET in any crop given weather variations and soil moisture storage and so forth…. Technically, indeed, difficult. The institutional problem is whether the parties want to wrestle with allocating the "savings" from a lower-CU crop and allocating the risk. So far, not done. Further, the state as guardian of other water rights faces the same technical problems in order to assure "no injury" thought increased or unintended consumption. Sooo…. the efforts first made to do this will have to include some suitable level of resolution and risk allocation or they won't make sense and won't be allowed. I'd just say that.	These issues can be addressed by consumptive use work group and CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program.
39	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Table 3-15 In the "remaining problems" column, "Reduces commitment to agriculture long-term" misses the important point that even if there is a long-term lease-back, the technology of farming involved is likely to be "frozen", because without adequate security of water, there will be no financing for investment in new equipment, etc. So the "soft-landing" ending of competitive agriculture problem appears either way, long-term or short-term.	These issues can be addressed by consumptive use work group and CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program.

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40	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-36R first full paragraph. Aside from Brad data, fix use of term "net" to avoid confusion. Net income per acre would normally mean net of all costs, including taxes, etc. (See enter[rise (sic.) budgets, for instance, for how they carefully define "net" for their purposes.) Property tax is due with or without a water deal, so putting it as a cost to water transferees is a lot like putting "farmer's toothpaste" in there, too, since she will probably brush in any case. This paragraph needs re-thinking. Maybe just refer to some of the deals described already as examples that do not limit what is possible.	Correction made to beginning of paragraph.
41	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-36R [O]nce more with feeling, what constitutes an incentive may include risk management – if the deal covers some of the downside risk of farming (as one hopes it would), that could be worth a great deal, and very possibly worth more than losing some of the upside risk. A sharp bargainer would be well aware of that – this is the basic idea of economic stabilization.	These issues can be addressed by consumptive use work group and CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program.
42	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-37, Table 3-16. Please note that "M&I providers" described here are exactly that: the city employees working with what they describes (e.g. Mr. Evans in the TRT) as a very very limited mandate, and not at all reflecting the range of interests of their constituents and employers, as noted above and in the TRT etc etc… One of the most valuable outcomes from this report COULD be helping M&I to increase its own set of recognized interests. City governments, in the context of a state which declines to assert a public interest, and counties which are economically crippled by uncontrolled costs and failure to manage their interests, are about the only moving part here, and we do not want them to overlook the fact that they are busy trashing with one hand what the other hand is trying to preserve. Parties to the transaction are not, in truth, only the people who sign the deed or contract.	Mr. Evans is not an employee of the City of Greeley, but a citizen of the City of Greeley appointed by the City Council to represent the citizens' interests on the City of Greeley Water and Sewer Board. Comment noted.

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43	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	Before going on, I must add the point that I have disagreed, and continue to disagree with the estimates of acreage affected by future water transfers from agriculture. Since this is detailed in other comments to Rick and Kelly, the bare bones only are these: (1) As increasingly junior water rights are transferred, the decreasing reliability means that more rights must be acquired – e.g. a 70% probability of fulfillment times an acre-foot is only 70% as good as a 100% reliable times an acre-foot. With 50% reliability, you need twice as much, and that may mean heading toward twice as many acres being taken out of nominally irrigated status, tax assessment, etc. (2) Adding to this, as the water rights become less reliable, they tend to be used on lower-value crops and/or for less-critical applications – they really can be "supplemental", so that instead of applying 20 inches to an expensive high-investment corn crop with only a 70% reliability of getting the whole 20, and the risk of not getting enough to profit, a rational farmer might put 7 inches on alfalfa, on three times as many irrigated acres. Or, 7 inches on some acres, and 14 on some others…. hedging the best and doing the best to get a profitable crop form the combination of irrigation and precipitation. So, the number of irrigated acres goes up, perhaps quite a bit. The total crop value would not go up as fast as the number of acres, but then, the lower value crops also tend to have much lower costs, so the total farming profits may go up as fast (or not) as the number of acres. The point is that this is not a clear picture and not a flat line of water to acres. Then, add in place-specifics of ditch location and those accidents, soil quality, and soil use history…. not simple. Not likely to be the same as it was in the past, either. Agronomy faculty I have consulted are not able to provide an easy answer on this, so far.	These issues can be addressed by consumptive use work group and CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program.
44	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-37, Sec 3.12 – Good job with combinations and applications. I have no information that would support 1.5 to 2 transferable acre-feet per acre from lower South Platte and Lower Ark, and suspect it will be smaller in order to apply good crop rotations leading into soil-conserving fallow.	Text revised.

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45	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-37, Sec 3.12 - Can you balance the infrastructural needs discussion with anything on the infrastructural needs and costs for buy-and-dry transfers? The really important point is not that either will cost a lot, but how much the difference may be, if one accepts the "no limits, not now, not ever" growth policy. The note "this infrastructure would be needed even in a traditional agricultural transfer were to be implemented…" is pretty well hidden on P 3-40 L, middle of a long paragraph. Might well be a headline instead!	It was the intent of the original SWSI Report and then the Addressing the Gap TRT to develop comparative analyses of water supply solutions, but this was not accomplished due to concerns of certain interest groups. This may be addressed by the Consumptive Work Group.
46	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	A balance problem appears in the water quality discussion, also, on p 3-40. Removal of large amounts from the lower reaches of the South Platte and Arkansas may affect the water quality of remaining water if the salt sources are still making their contributions, but to a lesser volume. This will take some work to estimate; so far, the best data is from Gates and Garcia et al, and the Arkansas Basin studies, and they indicate substantial salt loading from subsurface sources (marine shales leached by high water tables and deep percolation) which are not evenly distributed. If the sources contribute the same loading to reduced surface flows, the probability of imposition of a TMDL is increased, perhaps with downstream states involved. And, the yield reductions from salinity are already substantial; further losses could be aggravated by… (can we finally say this in SWSI? Or are we still pretending there is no such thing as….) reduced flows due to hydrologic effects of climate change.	This issue can be addressed as part of the Consumptive and Non-consumptive Work Groups efforts.

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47	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-41, Sec 3.13.1 Please don't say that agricultural efficiency "is a means to create new water"! There is no new water outside chemistry labs and magma. The intent is to decrease (a) loss to unintended and unwanted leak and seep in conveyance, (b) loss in application, or (c) loss in the E term of evapotranspiration of lower T in change of crop use. SERIOUS POINT: PLEASE distinguish between on-farm and within-ditch efficiency versus basin or watershed efficiency. Overall basin efficiency is very high in Colorado, though on-farm efficiency (of conveyance and application) can be fairly low. The point you acknowledge about return flows and reuses is more important than you imply with your presentation. Who cares? Ultimately, everyone is potentially affected because decreased flows rippling (sorry - couldn't resist) through the water rights also affect the environmental conditions and water quality. It may be uneconomic to invest in controlling on-farm inefficiency and then invest in undoing effects; this is not simple. And, it may be important where ESA issues are already limiting choices. Less critically for the present, it has always been the unenforced law that tail-water waste and such inefficiency is a violation of one's water right (see good Janet Neuman law review article on this, and Hobbs articles.) So, it is possible that a gentle phase-in of the "no waste" doctrine as a policy could solve some of the problems, though this comes with the caution about distinguishing on-farm efficiency and basin-efficiency. This ought to be mentioned. Here is Neuman reference: Neuman, Janet C., 1998, Beneficial Use, Waste and Forfeiture: the Inefficient Search for Efficiency in Western Water Use. 28 Environmental Law 919.	These issues can be examined as part of a joint effort of the Ag Alliance, CWCB and the Colorado Water Resources Research Institute.

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48	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-42, Screening Criteria: 1. compact obligations. There is an open question which sooner or later must be faced: The Arkansas compact is clearly a limit on expansion of consumptive use of water, but it is not clear that it requires no change in technology or kind of use of the water that is available to Colorado. If it were truly as medieval as some have argued, center pivots would not have been allowed in most of the basin (though it does have a far higher proportion of flood and furrow than the South Platte), and new nozzles would be illegal. The notion that the compact limits how the water is used has been overstated; clearly, there is considerable freedom within the limits on the volume required to pass the state line. To the extent that efficiency means (as it should) qualitatively better use in converting water into something else, it is not necessarily the same as expansion or increase of use. Efficiency is an adjective – it refers to conversions, and how much output comes from an input. Increase in consumption is a different idea. If more crop grows from the same water, good. Kansas has no complaint. These things get smeared in practice where there is no support for the technology and effort needed to keep them separate for the agencies that must monitor. Even so, yields have increased, and there has not yet been a complaint that using last year's seed was a violation of the compact since it grew more bushels than the seeds from 1968.	These issues can be examined as part of a joint effort of the Ag Alliance, CWCB and the Colorado Water Resources Research Institute.
49	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-42, Screening Criteria Number 5 – supporting the environment? This is too long a story to undertake here, but this is important and really does need to be addressed in terms of cumulative impacts and thresholds. The goal is to avoid unpleasant surprises, and to retain sufficient environmental resources to avoid some nightmare of abrupt and inequitable imposition of ESA or TMDL or other limits. And, that is a beneficial externality that should be supported by those benefited, which includes about everyone. So, please keep this but expand to explicitly acknowledge provision of beneficial externalities (including all the recreational and amenity values and opportunities) created by "inefficiency" in the system.	These issues can be examined as part of a joint effort of the Ag Alliance, CWCB and the Colorado Water Resources Research Institute.

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50	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-43, Sec. 3.14.3 For the record, I would add a sentence: "Because there are no markets for many of the costs and benefits created by agricultural water use and distribution, many affected interests are neither buyers nor sellers, and many interests are not well understood since there are only limited ways to invest in them or secure them, and political and regulatory approaches have been brought to bear as a partial substitute for normal exchanges."	Concept is already incorporated in the paragraph.
51	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-43, Sec. 3.14-4 I disagree about "less concern" in the urban areas. For example, the vote in favor of establishing the Lower Arkansas Water Conservancy District was stronger in the urban Pueblo County than in the lower Arkansas counties – precisely because of will to preserve water for agriculture in the Valley. Above, I mentioned that $3.4 Billion in Colorado votes for conservation, preservation, open space, and so forth. Your statement is not supported by the evidence I have. You can say that the economic impacts are more or less visible depending on the scale and region of analysis – see Howe and Goemans 2003 – but that is not the same as concern.	Concept is already incorporated in the paragraph.
52	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-44, Sec 3-14.6 Role of the State of Colorado… I again suggest the comment made earlier to SWSI team, describing the variety of potential roles. What is missing from the draft here even if the goal is to save ink is the point that the State has been badly financially hit by the consequences of Compact obligation failures and the ESA problems. Self-defense against such costs is an important state interest. And then, "leveling the playing field" suggests that all the subsidies and market distortions not mentioned are not important. I would prefer simply noting that it has been widely suggested that the State should play a more active role in helping all interests achieve representation in the allocation of this resource, and in allowing markets to include more interests and to work more normally. This would include increased investment in technology of measurement, at the least.	The CWCB South Platte River and Arkansas River basins alternative agriculture water transfer sustainability grant program can address this issue.
53	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-46, table 3-8 Might as well update legal changes to long-term rotating fallowing program; two sections, 37-92-103, 37-92-305(4)(a)(IV).	Addition made to table.

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54	John Wiener –Institute of Behavioral Sciences at University of Colorado – Boulder.	3/18/2007	P 3-46, table 3-8 In row 3 for both Interruptible Supply and Rotating Fallow column, the comments is strange. If seller of the water to be transferred can back out of the deal, it isn't really a deal, is it? The point here is simply that a contract must be enforceable, and adding some overlay on that just confuses things. BETTER: "These contracts will depend on enforceable commitments, so that there is certainty in the transaction." BEST – drop the whole row! It really asks, "is this a good deal if some fool agrees to something that is a bad deal?" Row 4 and Column Reduced Ag Consumptive Use seems unjustified, also. The real issue here is technical verifiability, not ownership.	Edits made. Table was reviewed and agreed upon by majority of TRT participants and row was not deleted.
55	Peter D. Nichols – Trout, Raley, Monaño, Witwer & Freeman, P.C	3/21/2007	P3-2 There is a contradiction between the statement that "future M&I supplies will come from current agricultural uses (i.e. irrigation) to the extent we are unable or unwilling to develop our remaining supplies of unappropriated water" and that "traditional transfers of agricultural waters, since there area property right and as outlined in the SWSI report, are needed to meet the 2030 M&I water needs"	These statements are intended to be complementary. The SWSI report identified that traditional agricultural transfers would continue to be a significant part of future M&I water supply development, in addition to conservation and development of new water supply projects, including new appropriations. To the extent that new water supply projects developing conditional water rights or unappropriated water are not constructed, M&I providers will turn to additional ag transfers.
56	Peter D. Nichols – Trout, Raley, Monaño, Witwer & Freeman, P.C	3/21/2007	P3-15 4th bullet, add " or reservation changes" after "'take-or-pay' payments"	Addition made.
57	Peter D. Nichols – Trout, Raley, Monaño, Witwer & Freeman, P.C	3/21/2007	P3-16 top of right column "Rights to be used for drought recovery might be considerable less senior and still serve the pruposes than righs to be used in very dry years" is unclear	Wording has been changed to read: "Water rights to be used to refill reservoirs drawn down during a drought might be considerably less senior and still serve the purpose of recovering from the impacts a drought than water rights to be used during droughts, which would need to be relatively senior in order to provide for drought yield." The concept is similar to the dry, average and wet year yields outlined in the Super Ditch presentations.
58	Peter D. Nichols – Trout, Raley, Monaño, Witwer & Freeman, P.C	3/21/2007	P3-20 Pricing bullet should include option to allow the parties to negotiate a price.	Addition made.
59	Peter D. Nichols – Trout, Raley, Monaño, Witwer & Freeman, P.C	3/21/2007	P3-20 Note that Colorado's pilot water bank program established in the Arkansas Basin looks like it will be extended. (should replace text about schedule for repeal in 2007)	Program was extended in 2007 legislative session (HB07-1305.) Edit made to text to delete reference to 2007 repeal.

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60	Peter D. Nichols – Trout, Raley, Monaño, Witwer & Freeman, P.C	3/21/2007	Table 3-11 "Feasible farmer compensation possible" is confusing. Include ROFR as part of final bullet in the "Issues with Rotational Fallowing" column	Edits made.
61	Peter D. Nichols – Trout, Raley, Monaño, Witwer & Freeman, P.C	3/21/2007	Table 3-12 "Underlying value rests with farmer" should be in the Potential Advantages column. "Buy-out option in contract" should be lumped with "Contract renewal at buyer option". "Sacrifice by farmer to tie up water rights for duration of contract" should include ROFR. "Possible transition to traditional agricultural transfer?" should be deleted	Edits made.
62	Peter D. Nichols – Trout, Raley, Monaño, Witwer & Freeman, P.C	3/21/2007	P3-34 C-BT operates effectively as a water bank, the largest in the USA. This contradicts the statement that no water bank has been successfully deployed in Colorado.	Edits made.
63	Peter D. Nichols – Trout, Raley, Monaño, Witwer & Freeman, P.C	3/21/2007	Table 3-13 Bullet under Potential Impediments about front-end investment should highlight storage	Edit made to reflect front end arrangement in institutional arrangements and infrastructure.
64	Peter D. Nichols – Trout, Raley, Monaño, Witwer & Freeman, P.C	3/21/2007	Sec 3.13.3 Item 1. The Arkansas should not be eliminated due to compacts; it is more difficult in the Arkansas, but not impossible	Edits made.
65	City of Thornton		P3-2 "… where development is occurring on or near irrigated lands, these agricultural water transfers are an expected outcome". Expected by whom?	Change made to : "In geographic areas where development is occurring on or near irrigated lands, these agricultural water transfers are a potential outcome since these rights can likely be used for M&I purposes for potable use or nonpotable irrigation of the developed lands.
66	City of Thornton		P3-3 Item 3, bullet 2. Where does deep percolation of water happen that does not return to the stream system?	Deep percolation that does not return is the result of flowing to non-tributary groundwater formations.
67	City of Thornton		P3-3 Clearly define "consumptive use" vs. "crop consumptive use". Also, "gross diversions", "systems" are not clearly defined. Reference to "definitions" but it is unclear where these definitions are.	Edits made.
68	City of Thornton		P3-3 Unclear what "minimize the geographic focus" means	Clarification made that intent is to limit the impacts to the local economy.
69	City of Thornton		P3-3 last paragraph of section 3.1. Do all alternatives involve a lessee and lessor? If not, this should be modified.	Lessor and lessee changed to farmer and end user.
70	City of Thornton		P3-7, section 3.4. "Transferred" is not clearly defined, i.e. is this a Water Court transfer or a physical movement of water?	Edits made.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
71	City of Thornton		P3-11, section 3.6, second to last bullet on return flows from transferred water is not clear.	Clarifying language added.
72	City of Thornton		P 3-12, first bullet should include examples of localized socio-economic impacts.	Additions made.
73	City of Thornton		P3-13, section 3.6, 2nd bullet in right column. Conversion of cultivated farm ground to non-cultivated natural grass lands can create habitat	Addition made.
74	City of Thornton		P3-15, Section 3.7.1, 1st bullet would be more useful if impacts that could be avoided were listed.	Addition made.
75	City of Thornton		P3-16 The term "interruptible transfer" and ISA seem to be used interchangeably; is the a difference? If so, define.	Clarifications made in the text. An ISA is a contractual agreement for an interruptible transfer under defined conditions that may occur in the future.
76	City of Thornton		P3-19 final paragraph of section 3.7.2. Is there a practical difference to the local economy between a rotational fallowing program that takes 10% of farm ground out of production vs. the permanent dry-up of 10% of the land in a system?	The net production or agricultural output and the amount of land irrigated annually remains the same under a traditional transfer or rotational fallowing. However, as shown in the rotational fallowing example, it is possible that rotational fallowing may have less localized socio-economic impacts.
77	City of Thornton		P3-21 section 3.7.3 final bullet. "Developing a water bank in a location that does not either have the necessary infrastructure to deliver water to the new demands or where such infrastructure cannot be cost-effectively installed is likely futile" applies to ISA's and rotational fallowing as well.	This is true. However, given that ISA's or rotational fallowing arrangements can be made long-term or permanent, it is possible that infrastructure might be constructed to deliver water to demand areas.
78	City of Thornton		P3-22, section 3.7.4. Another point in the potential issues and conflicts associated with the ability to reduce agricultural CU via modified cropping patterns and irrigation schemes is that there are fewer "inputs" such as seed, fertilizer, fuel etc… acquired in the local economy	Addition made
79	Larry Dirks – Denver Water	4/24/2007	Page 3-11, First sentence, fourth bullet: Rewrite to say "Municipal return flows attributable to the transferred historical consumptive use are fully consumable and can be reused." (One might confuse historic irrigation return flows (not reusable) with municipal return flows.)	Edit made.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
80	Larry Dirks – Denver Water	4/24/2007	Page 3-14, first full bullet: The first sentence is confusing, and I'm not aware of a rule of thumb for storage as stated. You might reword this to say something like "Depending on the seniority of the acquired agricultural water right, storage may be required to carry over average year yield to provide a firm water supply during dry years. No mention is made that additional storage may be required to replace delayed return flows attributable to the transferred water right. You could rewrite this paragraph somewhat like this: The actual amount of agricultural water rights required to provide firm M&I yield is dependent upon the seniority of the right to be acquired and the amount of storage needed or capable of being built. Some irrigation ditches have a variety of priority dates. The amount of storage required to provide an acre-foot of firm yield is dependent on 1) the amount of average year yield that will be carried over to a dry year to supply firm M&I yield, 2) the amount of evaporation and seepage from the reservoir, and 3) the amount of delayed return irrigation flows that must be maintained upon transfer to replicate historic stream conditions. An engineering analysis of the historic use of the ditch and the demands of the M&I user is necessary to examine these factors. Figure 3-5 shows estimated average to firm yield ratios and storage required to produce firm yield for several agricultural ditch systems in the South Platte basin. These were derived... (use rest of paragraph as written).	Modifications and additions made.
81	Larry Dirks – Denver Water	4/24/2007	Page 3-14, bullet under Figure 3-5: The timing, amount and location of return flows must be maintained post transfer. This paragraph should emphasize that storage may be required to replace non-irrigation season return flows since the timing of return flows may NOT be altered by a transfer.	Addition made.

Response to Comments on Section 3 – Alternatives to Permanent Agricultural Dry-Up Technical Roundtable

No.	Individual and/or Organization	Date of Comment	Comment	Response
82	Larry Dirks – Denver Water	4/24/2007	Page 3-15, fourth bullet in Para. 3.7.1: I don't understand how income would be stabilized under this example. If water supplies during a drought are not adequate to produce a crop, it can be inferred this is a junior water right with little or no firm yield. Since there is little or no firm yield, there would be no supply to interrupt and no payment made to the agricultural user.	In dry years, many agricultural water rights have a partial yield, which may be inadequate to produce a full crop yield on the entire irrigated acres. It may not be cost-effective for the farmer to partially irrigate the entire farm or fully irrigate reduced acreage compared to the revenue derived from a lease during those years. An ISA only provides benefit to the end user if there is some amount of transferable yield in the years needed.

Appendix C
Response to Comments on Environment and Recreation Needs Draft White Paper

Responsiveness Summary for Section 4 – Prioritize and Quantify Environment and Recreation Needs Technical Roundtable

No.	Entity	Date	Comment	Response
1	Tom Iseman The Nature Conservancy	3/26/2007	The presentation of the geographic coverages is plagued by poor organization, inconsistent structure, and variable explanatory text.	The document was revised to include a section that specifically discusses Geographic coverages – both availability and source/methods behind specific coverages.
2	Tom Iseman The Nature Conservancy	3/26/2007	***Introduction*: The introduction should provide a better explanation of why the TRT pursued this approach and how it believes these data sets could be applied in considering water supply solutions.	We have revised the text in this section to provide additional background.
3	Tom Iseman The Nature Conservancy	3/26/2007	***Structure:*** This chapter should be structured to provide some guidance to the reader. TNC would suggest the following approach: 4.6 Technical Subcommittee 4.6.1 Geographic Coverages 4.6.1.1 Environmental Individual Coverages 4.6.1.2 Recreational Individual Coverages 4.6.2 Quantification	Substantial changes were made to the organizational structure of the document. An approach similar to what was suggested was adopted.
4	Tom Iseman The Nature Conservancy	3/26/2007	***Individual Coverages*:** First, rather than listing each coverage at the beginning, the report should provide a single table of the various coverages provided. Second, the text describing each coverage should be concise and consistent. TNC suggests two paragraphs for each data set: 1) Description and/or Methodology; and 2) Utility and/or Application. The current text describing the coverages is useful, but often inconsistent and too detailed; TNC suggests including that information as a metadata appendix in the back of the report.	We agree; the revised chapter structure and text incorporates these recommendations.
5	Tom Iseman The Nature Conservancy	3/26/2007	***Gaps:*** At the end of the data sets, the report should identify any data sets that would be useful but were not collected or available for this report.	As part of the Nonconsumptive Needs Assessments, each Basin Roundtable will have the opportunity to add to the data set developed as part of the SWSI 2 efforts.
6	Tom Iseman The Nature Conservancy	3/26/2007	***Maintenance:*** These data sets provide a valuable and unprecedented platform for evaluating the environmental and recreational values of streams. The report should make a recommendation for continued maintenance and updating of the data sets, and it should identify an appropriate institution to serve as a repository and data manager.	This recommendation has been incorporated into recommendations section.
7	Tom Iseman The Nature Conservancy	3/26/2007	COMMENT ON TECHNICAL PRODUCT: The text under *Approaches to Determining Environmental Flow Needs* was culled from a comment letter that TNC sent in October 2003. While TNC still believes those options hold and still seeks to work with the state and other stakeholders on this important issue, TNC regrets that they were unable to make more progress through the two phases of the SWSI.	This section was removed but the tools that could be used to prioritize and quantify environment and recreation needs were left and referred to in the report.

No.	Entity	Date	Comment	Response
8	Tom Iseman The Nature Conservancy	3/26/2007	COMMENT ON TECHNICAL PRODUCT: While TNC agrees that it is useful to consider the potential costs of providing environmental flows at new water projects, they find the 'WATSIT' simulation outdated (recycled from SWSI I) and potentially misleading. The Little Bear Creek simulation is particularly troubling; the simulation seeks to use a TNC-authored approach to characterizing flow needs, but TNC was not consulted in the development of this simulation and we would not advocate the application of this protocol mechanistically. The resulting analysis is likely to exaggerate the potential costs of incorporating environmental flows into a new multi-purpose water project.	Because this information was from the SWSI Report, we have deleted this section from the report. As part of the Nonconsumptive Needs Assessments, quantification at site-specific level will be conducted and these approaches and others can be refined at that time in consultation with The Nature Conservancy and other experts from Colorado State University.
9	Tom Iseman The Nature Conservancy	3/26/2007	COMMENT ON TECHNICAL PRODUCT: TNC would analyze site-specific conditions and local conservation targets (as illuminated by geographic coverages, for example), and they would work with a project proponent and engineers to develop an appropriate target flow regime to address conservation goals within the constraints of hydrology and other project objectives. More apt (and real) examples to illustrate the potential cost of addressing environmental objectives would be Elkhead Reservoir or Flaming Gorge Dam, where environmental flows were addressed alongside other project purposes and incorporated at marginal costs to project proponents or beneficiaries.	See response to comment No. 8.
10	Tom Iseman The Nature Conservancy	3/26/2007	COMMENT ON TECHNICAL PRODUCT: TNC still supports work to better characterize flows needed to sustain the natural and recreational values of rivers and streams, and they recognize the potential costs of incorporating flow enhancements to conserve rivers and streams. TNC would work with the CWCB, CDM consultants, and other stakeholders to advance the collective understanding of this important issue. TNC recommends that this section of the report be reworked to reflect the lack of progress on this issue in SWSI Phase II and to make recommendations for how to address this issue in the future.	See response to comment No. 8.
11	Tom Iseman The Nature Conservancy	3/26/2007	COMMENT ON TECHNICAL PRODUCT: The report should provide more detail on specific funding programs, particularly those managed by the CWCB. The report should describe purpose, eligibility, and application process for the various CWCB programs, and provide a web reference or point of contact for each program. Very simply, a clear articulation (beyond the existing table) of the CWCB programs that are available to fund environment and recreation would be a valuable contribution to ongoing efforts.	The document was re-organized to address this comment.

No.	Entity	Date	Comment	Response
12	Tom Iseman The Nature Conservancy	3/26/2007	COMMENT ON TECHNICAL PRODUCT: TNC suggests some additions to the Elkhead case study, per their October comments, that better reflect the true partnership and environmental benefits for the endangered fish.	The case studies in Section 4.6 were written by TRT members and have not been modified substantially. If further information from these case studies can be used to support the Nonconsumptive Needs Assessment process then it will be incorporated at a later date.
13	Tom Iseman The Nature Conservancy	3/26/2007	COMMENT ON TECHNICAL PRODUCT: TNC also urges the inclusion of case studies on Grand Valley water management and the South Platte Protection Plan; they can help to complete those case studies for inclusion in this report.	TRT members volunteered to write these case studies but they were never completed and sent to CWCB. If further information from these case studies can be used to support the Nonconsumptive Needs Assessment process then it will be incorporated at a later date.
14	Tom Iseman The Nature Conservancy	3/26/2007	EDITORIAL COMMENT: **Section 4.1**, the introduction to this report, should be strengthened to provide more context and to identify the direction and goals of the TRT. In short, the introduction must answer the questions, *why are we working to characterize environmental and recreational values? And what did we do to address this goal?*	The mission for the TRT was established during the first meeting. The reorganized document includes a brief introduction to provide context for the section.
15	Tom Iseman The Nature Conservancy	3/26/2007	EDITORIAL COMMENT: Currently, the introduction states that the purpose of the roundtable is, “to address comments received on the 2004 SWSI report,” or, “to fill gaps identified in the SWSI Report (**p 4-1**).” This statement fails to convey the broader purpose of this work. Colorado’s natural environment is an important resource and amenity to our citizens. This report is intended to enhance our understanding of the environmental and recreational values of rivers, streams, and wetlands in Colorado, so we can better protect and sustain those values as we develop clean water supplies and manage rivers and streams for our future. In service of this goal, TNC pursued three primary tasks in the TRT: 1) to better characterize environmental and recreational values and the water needed to sustain them; 2) to identify legal and financial tools to help protect and sustain our water-dependent environment as we plan for new water supply; and 3) to review existing case studies and identify potential future projects that sustain our rivers and streams. This broader context is important to framing this report for potential readers, especially those outside of the TRT process.	The reorganized document includes a brief introduction to provide context for this report section.

No.	Entity	Date	Comment	Response
16	Tom Iseman The Nature Conservancy	3/26/2007	EDITORIAL COMMENT**: Sections 4.11 (Conclusions) and 4.12 (Recommendations)**, should be enhanced. The conclusions should concisely review the material contained in the report, characterize its potential applications, and openly identify any areas where more work is needed. The current recommendations consist of a laundry list of potential issues and questions, with no specific direction.	The text was revised to address this comment. Since the completion of SWSI Phase 2, the Basin Roundtables are conducting Nonconsumptive Needs Assessments and are using information the SWSI Phase 2 Environment and Recreation TRT.
17	Tom Iseman The Nature Conservancy	3/26/2007	EDITORIAL COMMENT: The recommendations should lay out the most promising direction for future work, focusing on any gaps and specific opportunities. This section can provide important guidance to potential users of this report, especially as we move towards refinement and implementation with the IBC roundtable membership.	The text was revised to address this comment based on the current work by the Basin Roundtables. Since the completion of SWSI Phase 2, the Basin Roundtables are conducting Nonconsumptive Needs Assessments and are using information the SWSI Phase 2 Environment and Recreation TRT.
18	Tom Iseman The Nature Conservancy	3/26/2007	EDITORIAL COMMENT: **Section 4.4**, *Summary of Major Discussion,* emphasizes the major challenges and concludes with an implicit critique of the Technical Roundtable. The list is scattered and redundant and reads like a complaint, and it doesn't reflect the direction that the TRT ultimately pursued. TNC suggests a shorter and clearer list of the challenges, and a conclusion that reflects the direction of the TRT and ultimately the report: "Given these apparent technical challenges, the limitations of time and resources, and the emergence of the IBCC process, the TRT focused on providing useful and objective tools for local and statewide decision-making." This could be linked to the call-out box on page 4-7, which provides a reasonable summary of the tools and work products of the TRT.	The list discussed reflects the diversity of opinions represented by the TRT but has been summarized per this suggestion.
19	Tom Iseman The Nature Conservancy	3/26/2007	***Next Steps*****:** TNC urges the CWCB to make a recommendation to maintain and improve the geographic coverage data sets over time.	This recommendation was added to the Recommendations section.
20	Tom Iseman The Nature Conservancy	3/26/2007	***Next Steps*****:** TNC believes that more work is needed to characterize freshwater-dependent environmental and recreational values. While we've made strides with this TRT, as we acknowledge in the report, we were unable to address several important issues that were of interest to the committee. For example, geographic priorities, flow quantification, and the development specific multi-purpose projects to benefit the environment are areas that call for additional work.	Comment noted; implementation of the Nonconsumptive Needs Assessments strategy will help address this issue.

Responsiveness Summary for Section 4 – Prioritize and Quantify Environment and Recreation Needs Technical Roundtable

No.	Entity	Date	Comment	Response
21	Tom Iseman The Nature Conservancy	3/26/2007	***Next Steps*:** Regardless of the institutional banner for any future work, we would recommend a more substantive inclusion of stakeholders in the development of work product. SWSI phases I and II have made a commendable good-faith effort to bring stakeholders to the table. For the Env/Rec TRT, we met three (or four) times over the course of approximately 18 months, with sporadic phone calls or ad hoc meetings. Stakeholders would eagerly join the discussion in the TRT meetings, but they were largely excluded from drafting the report and the draft product fails to capitalize on their significant technical expertise and willingness to contribute. Future efforts should more fully exploit the significant technical expertise offered by stakeholders, giving willing participants more substantive responsibilities for drafting and developing work product. We recognize there are challenges with managing people who aren't on the payroll and that there may be issues with how roles are distributed. But we're confident that the product would be improved by more integrated and substantive inclusion of stakeholder expertise.	Comment noted; there were several committees that spent significant effort meeting in person and via conference call throughout the process. In addition, several TRT members wrote sections of this report. However, several assignments were made to TRT members that were not completed.
22	Jacob Bornstein Colorado Watershed Network	3/16/2007	***4-12. and Maps*** With regard to the fish species distribution maps mentioned in the Note to Reviewers: a. First and foremost, CWN staff miss the fish pictures and descriptions. b. CWN recommends graying out 10 digit HUC that have been sampled more than once, with no record of the species. c. It also might be helpful to name these maps "recorded <Species x>> distribution. d. We also recommend keeping 10 and 12 digit layers together. e. Lastly, CWN recommends putting the stream layer above the HUC Distribution layers. f. (CWN also recommends putting the CDOW logo at the bottom.)	Pictures of the fish and descriptions have been included in the final deliverable as well as renaming of the maps per comment No. 22 c. In addition, comment No. 22 e. has been resolved with the final deliverable. For comments No. 22 items b. and d., we will attempt to resolve this information with CDOW during the Nonconsumptive Needs Assessment process. For comment No. 22 f., DOW was asked whether they wanted their logo on the maps and they indicated that they did not want their logo on the maps.
23	Jacob Bornstein Colorado Watershed Network	3/16/2007	***4-12. and Maps*** Recreational maps could likely be reduced to two maps, one for kayaking and one for rafting. Although likely out of the scope of the current report, CWN would also like to see a map displaying lakes and reservoirs with heavy boating use.	The recreational maps were reduced to two maps showing kayaking and rafting on a statewide rather than a basin-specific basis. Additional attributes can be added per direction by the Roundtables for their Nonconsumptive Needs Assessments.
24	Jacob Bornstein Colorado Watershed Network	3/16/2007	***4-12. and Maps*** Rare Riparian/Wetland Vascular plants map: The legend on this map could more clearly represent what the dots mean. Specifically what does "L3pts" mean? Why not list G1-G-3 for the ARW Plants; it is not clear that only A rank plants are on the map for ARW G4-G4 Plant Communities.	The legend on the map was revised to reflect the legend on the original CNHP maps provided by TNC.

No.	Entity	Date	Comment	Response
25	Jacob Bornstein Colorado Watershed Network	3/16/2007	***4-12. and Maps*** 303(d) and M&E-Aquatic Life Use maps are accurate but misleading, especially without a methodology section. The TRT probably already knows this, but: there are plenty of streams that are listed for a particular parameter, such as selenium, due to the streams having WQ parameters over the Aquatic Life designated standard. Some of the total miles are provided in the “Status of Water Quality in Colorado-2006: The Update to the 2002 and 2004 305(b) reports” provided by the Water Quality Control Division. For instance, in the Colorado Basin, there are 2,017 miles assessed and not supporting the Aquatic Life Cold, Class 1 standard for that basin, and 554 miles not supporting Aquatic Life Warm, Class 1. “Aquatic Life Use” means that “The designated aquatic life habitat uses are based on stream and ecoregional characteristics that affect the level of diversity expected in the local fish and insect communities.” In other words the fish and bugs themselves have been monitored separate from a specific water quality impairment that can be attributed to the cause of decline. Sometimes this is due to water quantity issues. When there is a water quality impairment that exceeds aquatic life standards, it is used, but may be decoupled from actual known effects on local populations because it is based on toxicology experiments, etc. This is done b/c it is so expensive and time consuming to monitor for fish, habitat, and benthic invertebrates.	The TRT determined that 303(d) listings for aquatic life use based on biological data and sediment listings were most closely related to hydrology of the system and therefore these were the listings that were mapped as part of SWSI Phase 2. The methodology section was revised to explain this in more detail.
26	Jacob Bornstein Colorado Watershed Network	3/16/2007	***4-12. and Maps*** Additional 303(d) and/or M&E list maps: If a map cannot be created for all streams in which there is a parameter in exceedance of the aquatic life standard (as described above), then a map which depicts selenium impaired waters would be helpful. Selenium has one of the largest impacts to fish populations of any parameter.	Additional attributes can be added per direction by the Roundtables for their Nonconsumptive Needs Assessments.
27	Jacob Bornstein Colorado Watershed Network	3/16/2007	***4-12. and Maps*** 303(d) list-Sediment a. Clear Creek (Denver Water Conduit 16 to SP) should also be on the map. (CWN just finished a study with CDOW on the Coors effluent which is attributed to causing this, and the data suggest that it won’t be de-listed for some time.) b. There are some other small tribs that aren’t on the map too, but these are less critical. 7. Monitoring and Eval List –Sediment: CWN recommends double-checking to make sure the following segments on the M&E list for sediment are included: a. Tribs to White-Douglas Creek to Co/UT border b. S. Platte tribs (6 in all) c. S Platte- N. Fork to Chatfield d. N. Platt R. Tribs e. Tribs to the Little Snake	The geographic coverage showing 303(d) listed waters because of sediment was updated to the extent practical

No.	Entity	Date	Comment	Response
28	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-2** Aquatic GAP: a. Aquatic Gap is a modeling tool that looks at environments where a particular fish species has occurred, and then predicts where it is likely to occur. This was not clear in the table. b. Please include "in partnership with CWN" in the organization column. c. FYI. CWN is producing the complete dataset, GIS base layers, and the geodatabases to CDOW in two weeks time. By the end of June, we'll also have four species modeled.	This information was incorporated into Table 4-2
29	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-2** EMAP a. Yes, all the data are fully available b. FYI. The full report is already drafted and currently under review by EPA. c. Please add to the organization column "in partnership with CWQCD, CDOW, and CWN." d. EMAP included approximately 100 sites in Colorado e. EMAP generated Indices of Biological Integrity for fish, periphyton, and macroinvertebreates for Colorado's plains, mountain, and xeric ecoregions.	This information was incorporated into Table 4-2
30	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-2** Other approaches recommended for adding to identifying and prioritizing environmentally sensitive or impaired areas **(">" denotes a column break)** <u>Colorado Data Sharing Network</u> > Colorado Water Quality Monitoring Council (in partnership with CWN and EPA region 8)> Gather wq, habitat, and biological information from across the state into a central database> Go from basin to basin to get data from small generators, will include link to USGS data, database will include all data in STORET, database will include easy querying tools, database will have a map component with data retrieval, a directory of data users and generators will be included, requires minimum meta data equirements. > Could be central locator for statewide environmental information, allow for data gap and overlap assessments to be conducted> Much data still needs to be input in system, Colorado basin already trained, but remaining basins are still being visited, including SP April 17-20, 2007.	The information for the Colorado Data Sharing Network was incorporated into Table 4-2
30a	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-2 (continued); (">" denotes a column break)** <u>River Watch</u>> CWN in partnership with CDOW> largest gatherer of stream WQ baseline data, collects habitat and macroinvertebrate data, volunteer monitoring program, utilizes intense certification training and QA/QC for volunteers> data could be used to create a course statewide characterization of Colorado's watersheds> Volunteer data, statewide scope, station sampling usually monthly for several years.	This information was incorporated into Table 4-2

No.	Entity	Date	Comment	Response
31	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-2** There are several other data sources and methods available for determining environmental/rec needs. These include the Southern Rockies Ecosystem Project (maps with priorities), CNHP's high priority conservation area program, Roadless areas, USGS basin Retrospectives, CDOW recovery and Conservation plans, and many others. Some of the better ones should probably be listed here.	This information was incorporated at the end of Table 4-2.
32	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-5** Additional recommended funding sources available for Environment and Rec Water Development a. Natural Resources Conservation Service: NRCS provides millions of dollars in Colorado every year, much of it for projects that develops water for the benefit of wildlife, water quality, etc. More information for all these programs is available at http://www.co.nrcs.usda.gov/. Specifically the Wetland Reserve Program, Wildlife Habitat Improvement Program, and the Environmental Quality Incentives Program are used for water related issues. b. Partners for Fish and Wildlife: this partnership provides hundreds of thousands of dollars in Colorado for the purpose of restoring wetlands and riparian areas. CWN recommends contacting Rick Schnaderbeck, assistant state coordinator, for more information. His contact info is 719-852-0124, rick_schnaderbeck@fws.gov, PFW, 6120 HWY 15 S., Monte Vista, CO 81144. c. USFSWS>North American Wetlands Conservation Act (NACWA) grants.	This information was incorporated into Table 4-5
33	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-6** Additional recommended funding sources available for Environment and Rec Water Development a. If you are including open space programs that assist with Open space then there are several that should be included. Statewide, these should at least include Ducks Unlimited (High Country Wetlands AND S. Great Plains/Platte River Initiative), CDOW Habitat Stamp, the state sales tax credit program, and the state's provision to allow a sales tax to support County Open Space programs in many counties across the state. CWN could name other programs, but the best source is the Colorado Conservation Trust	This information was incorporated into Table 4-6
34	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-6** With regard to the 319 program, this fund focuses on Nonpoint Source pollution. It does fund BMP construction, and also Watershed Management Plans.	This additional information has been added to the table.
35	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Section 4.8.3:** Conservation Easement: it might be worth noting that landowners are eligible for a state tax credit in Colorado.	This additional information has been added to Table 4-6.

No.	Entity	Date	Comment	Response
36	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-10:** It might be worth noting that CDOW, which holds the most water rights in the state, has water rights in place which are managed to the benefit of wildlife.	Comment noted.
37	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-10:** It would be helpful to bold and grey the far left hand column for clarity's sake.	Comment noted.
38	Jacob Bornstein Colorado Watershed Network	3/16/2007	**Table 4-11**: these are not CWA funded projects, but rather "Projects initiated by local Watershed Groups." Some groups may be offended that their projects, which they personally sought funding for, would be listed here as CWA projects.	The text describing this table has been revised as well as the table name.
39	John Wiener	3/25/2007	**Over-all comment:** The point made on **p 4-49 (no.7)** about the problem of combining the recreational and environmental water demands is correct, but incomplete. This was the logical step in beginning the process of coping with incomplete markets and recognition of non-market water uses, demands, externalities of uses, and water quality impacts. That is hardly a novel idea, but the TRT was unable or unwilling to take a larger view, and so is only at the beginning of a necessary and apparently painful process of taking a sober look at the water issues, not limited to narrow interests. The success of the TRT may well lie in the environmental and state agency interests cooperating to a greater extent in information that will help with conservation/preservation/restoration needs, (addressed elsewhere in previous comments) but this is also a beginning. It will be a valuable contribution if the state agencies are able to work with good information and make it available to the many others interested in issues such as wetland loss and ultimately in the critical problems of cumulative impacts. The talent available within our agencies should be able to express its capacity. The problem of cumulative impacts has been addressed to no apparent interest or avail in comments to SWSI and HB1177 since about 2003, but this TRT may finally have wedged a door open on some of the issues.	Comment noted.
40	John Wiener	3/25/2007	**Headline:** Only some of the non-market and incomplete market issues were addressed, and cumulative impacts in general were ignored, but there is progress in the TRT-associated process of increasing the information sharing and access between the conservation groups and some of the state agency officials whose mandate could be viewed as including long-range planning, cumulative impacts, and biological issues.	Comment noted.

No.	Entity	Date	Comment	Response
41	John Wiener	3/25/2007	**Most obvious omission:** the municipal and local government officials involved in SWSI in general and in this TRT have not represented any of the amenity and quality of life issues which are critical for future attractiveness of rural areas, especially including places that can only retain economic viability by diversification of income sources if not investment and business activity. It has become clear over the SWSI process that local government in Colorado has not widely accepted the basic point about natural resource amenities driving rural growth (previously cited frequently – USDA ERS information is most authoritative; previously cited, often, but see other sources such as Kansas and Nebraska on agricultural diversification), though there are some exceptions here and there.	Comment noted.
42	John Wiener	3/25/2007	The essential problem is thus the familiar one, with only some progress. Earlier allocations (almost always at no charge) of water are now property rights, but 18th and 19th Century understandings, interests, and technology have changed. Therefore, we are in the process of rethinking allocations, and instead of approaching this from a comprehensive view, the emotional loading and the insistence on representing only a narrow interest as a “professional” role continues to dominate discourse. The SWSI team (including CWCB, AG, and CDM staff) did a superb job of seeking a larger dialogue, but was not able to get past all of the old responses. The TRT draft displays the long lists of programs with some conceivable relevance as a response to one set of positions, while the very existence of the discussion is itself the counter-argument in my view.	Comment noted.
43	John Wiener	3/25/2007	A wide range of interests are unrepresented, scientific inquiry is effectively blocked on a great deal of private land (Brook et al. previously cited in biological issues comments), and the debate is of little over-all value. There is some good from the process, from beginning to establish workable relationships, but it is not clear how this TRT can send that forward to the HB1177 Roundtables UNLESS there is a specific effort to explain what did and did not get done. Judging by the literature on collaborative resource management, such discussions can be held, and groups may be able to help other groups, but it takes time and specific effort and perhaps a sense of inevitability and a sense that the outcome can be better than zero-sum.	Comment noted.
44	John Wiener	3/25/2007	The TRT efforts from Taylor Hawes and her group to provide examples, with the support of the CWCB staff, are an important part of the document. But, these instances will continue to seem fortuitous and fragmented until there is a larger context of the reallocation and recognition process and the need for serious discussion rather than role-playing.	Comment noted.

No.	Entity	Date	Comment	Response
45	John Wiener	3/25/2007	The financial issues discussion was, in my opinion, largely gestural because of the refusal to take the whole range of interests seriously and the absence of both municipal and rural amenity values and quality of life now and in the future. The most common means of funding public interests are only noted in regard to special and narrow purposes, and there was no sense of realistically approaching the entire set of interests and exploring making better deals with an eye to the long term. This is indeed alien to Colorado politics, but there is no other way to think seriously about the long-term and creating stability of interests, including the already-allocated property rights.	Comment noted.
46	John Wiener	3/25/2007	The pathological denial of the need to involve land use and land resource management is most likely to be usefully overcome by the involvement of the local and county governments in water allocation and water quality issues, and not only in defense of areas-of-origin. To the extent that these governments are prevented from addressing the underlying issues affecting land and water issues, the private property rights most likely to be badly injured face increasing cumulative pressures which are likely to express themselves in very expensive and unwanted ways. The most-likely threats are ESA issues and the imposition of a TMDL on streams, perhaps from a downstream state's concerns, and perhaps from some combination of these with a new problem.	Comment noted.
47	John Wiener	3/25/2007	The cities on the one hand are seeking cheapest, simplest, right-now traditional water acquisition, while their citizens on the other hand are voting often to reduce the damage the short-sight-is-the-only-sight actions are causing; this has been 110 votes in Colorado for $3.8 billion, so far (Trust for Public Land, "Conservation Vote"), and that includes none of the money privately donated and collected for the whole range of organizations from the Cattlemen's Land Trust to Ducks Unlimited and The Nature Conservancy. Counties are financially reamed by failure to control costs and manage growth (Coupal and Seidl, previously cited, early and often) but they are reluctant to face the future – how about some examples of foresight and constructive engagement? These ought to be solicited as well, and added to the TRT report. There are also counties outside Colorado, and a wealth of resources to consider.	Comment noted.

No.	Entity	Date	Comment	Response
48	John Wiener	3/25/2007	Enormous economic interests are essentially refusing to consider meaningful contributions to the security and maintenance of resources; in particular, the agricultural land and water users are eager to defend their allocations as having a long history (not necessarily applied to Natives), but not making much of an effort to work with local governments and counties to determine how to maximize the future values of both agriculture and other land uses. The recreational industry is remarkably unwilling, judging by the TRT and what I have observed, to take contribution seriously. The TRT draft, for example, cites the unique case of the contribution in which the rafting business contributes $30,000 to the State parks, but the State Parks then commits to spend up to $100,000 (Draft P 4-38)… as noted in earlier comments, the economic interests at stake are considerable, affecting the whole Upper Arkansas economy and quality of life. Is this the same rafting industry that the Draft (4-22) shows having an annual economic impact of $135 Million in 2005?	Comment noted.
49	John Wiener	3/25/2007	The Division of Wildlife has a very interesting report showing the amazing economic contribution from non-consumptive wildlife use and values as well as hunting and fishing (2004 report on 2002 data – it should be cited along with the Audubon supplied value of birding information.) It is Pickton, T., and L. Sikorowski, 2004, The Economic Impacts of Hunting, Fishing, and Wildlife Watching in Colorado. Denver: BBC Research and Division of Wildlife. It would have been useful to have DOW and Parks personnel authorized to do more than observe some of the SWSI meetings.	The recommended reference was incorporated into the revised document.
50	John Wiener	3/25/2007	The skiing business has apparently become the ski-area real estate development business, but it seems unwilling to undertake comprehensive discussions with water interests and has seemed quite reluctant to engage water quality issues on an enforceable basis, but I know there are some examples to the contrary – including some great ones – and they ought to be included in this TRT draft somehow. That industry is selling certain qualities of life, and they are subject to troubles, too.	Comment noted.
51	John Wiener	3/25/2007	The biology of post-agricultural land and water resources is largely unknown, but it seems likely that there is no simple "go away" and that there are few economic opportunities for the rural agricultural areas which are not related in some way to keeping attractive landscapes and some community, and in any case the need for on-the-ground management for any reasonable goals will not go away. Academic contribution to the SWSI process has been entirely voluntary and almost entirely absent (with the exception of this writer being able to use research support to cover travel expenses to meetings to observe and comment.)	Comment noted.

No.	Entity	Date	Comment	Response
52	John Wiener	3/25/2007	In my view, the log-jam breaks when the missing local interests (government and land use) get in the game, role-playing is rehearsed, rites and affirmations of traditional claims and complaints are replayed, enjoyed, and then stopped, and then people start thinking and listening. We have to keep trying or the changes will come from some other source or direction.	Comment noted.
53	John Wiener	3/25/2007	**P 4-10, 4-15**: Given DOW concerns and EPA information missing, can they both be invited to provide a statement for the report? It would be good to let them provide something rather than leave an undesired impression.	Comment noted.
54	John Wiener	3/25/2007	**P 4-14** -- More information on Playa Lakes Joint Venture might be a useful example of cooperation.	The Playa Lakes Joint Venture is summarized in Table 4-2.
55	John Wiener	3/25/2007	**P 4-15** -- In the box on 303(d) list, (far R column, 303(d) row), please add clearer explanation so this makes sense to anyone rather than looking very odd	Bullets for this element in Table 4-2 were revised to increase clarity.
56	John Wiener	3/25/2007	**P 4-24** Might add conservation easements here, and the many Land Trusts.	Comment noted; Several roundtables have recommended that this type of information be added to their attributes for their Nonconsumptive Needs Assessments.
57	John Wiener	3/25/2007	**PP 4-28 – 4-30 et seq**.: It is misleading to list all these programs without also listing or citing some of the information that helps evaluate them and their effectiveness. For example, where are the Trout Unlimited studies, Dry Legacy and Dry Legacy II, as the review of the in-stream flow program? Where is any of the information on the historic losses of wetlands, and current policy to withdraw federal jurisdiction for much of what is left? (Earlier comments, biological issues comments). And where is any information on water quality as related to water volumes and land uses? The historical denial of quality-quantity linkage may finally have developed a crack, but the levee is still there, still facing increasing pressure.	Comment noted.
58	John Wiener	3/25/2007	**P 4-35, Sec. 4.8.5** – And frequently through out the document. We have and use water court to defend water rights from the possibility of injury by changes in the use of other water rights. There is no apparent sense to constantly raising the idea that water rights could be affected if water court fails. If the Dreaded Space Aliens land, water rights could be affected, too, but we don't bother to keep adding "possible alien invasion could affect water rights", so why keep on saying that water rights could be affected when we have a very expensive very secure mechanism all set up and working to handle this?	Comment noted.

Responsiveness Summary for Section 4 – Prioritize and Quantify Environment and Recreation Needs Technical Roundtable

No.	Entity	Date	Comment	Response
59	John Wiener	3/25/2007	**A LAST GENERAL COMMENT:** The SWSI process made some great progress, and yet, confirmed some real frustrations which are becoming an insupportably wasteful vice. The TRT report could be beefed up quite a bit with more examples of useful progress, as noted. But beyond the report itself, I strongly urge the DNR and CWCB to consult with the Basin Roundtables and the TRT memberships on how to retain progress and lessons learned and not have to keep starting again. This was in some ways the best TRT and in some ways the worst. What can take from it about the process?	Comment noted.
60	Steve Glazer	3/26/2007	One of the biggest omissions is the lack of recognition that past water development has caused and is responsible for significant environmental impairment throughout the state. This is evident in the short-shrift offered in the explanation in **Sec. 4.6.4** of the water quality list of impaired waters (Sec. 303 (d) of the Clean Water Act).	Comment noted; the SWSI report discusses impacts to headwaters areas.
61	Steve Glazer	3/26/2007	**(page 4-11)** Although there is some mention of the use of Stream Classifications and Standards on page **4-33**, **Sec. 4.6.4** should offer a thorough explanation of what this list means. It should explain how the state is responsible for the development of remediation, through allocations of loading, to restore the beneficial uses of water deprived by standards being exceeded intended to protect the classified uses. This section needs to be expanded to help the roundtable members better understand the importance of this process and its implications. It should be explained that the purpose of developing the list is to help restore the riparian and aquatic ecological integrity of our rivers.	Text has been modified. Note that CWCB is not responsible for implementing 303(d) list – this is the responsibility of the Colorado Department of Health and Environment.
62	Steve Glazer	3/26/2007	Another omission is the lack of identification of additional existing data sources in **Sec. 4.6.7 (page 4-13)**. Before the basin roundtables can prioritize their environmental needs, they need access to the riparian assessments performed by federal land management agencies, in particular, the Forest Service and BLM. Most if not all river and stream segments crossing federal land have been assessed as either properly functioning, functioning under stress or impaired. Admittedly, it will be a difficult task to accumulate all of this information and put it in a format that is useable to the roundtables, but it is critical information that exists and should be identified in **Sec. 4.6.7.**	Development of additional geographic coverages will be addressed as part of the implementation of the Nonconsumptive Needs Assessments being conducted by the roundtables.

No.	Entity	Date	Comment	Response
63	Steve Glazer	3/26/2007	One of the biggest frustrations with this report is the inference that environmental and recreational mitigation of projects are viewed as enhancements that are not the responsibilities of project sponsors. This is expressed in the examples used on **pages 4-18 and19** to compare alternative analysis of instream flow when evaluating firm yield of future projects. There is no recognition that future projects have the potential to degrade existing properly functioning environments and that "enhancements," in most cases, are really mitigation of past water development impacts or are needed to avoid future impairments. **In Sec. 4.8 (page 4-28)** it is recognized that by excluding environmental needs from firm yield analysis, you end up with delays, cost escalation and litigation. If there were recognition of the value of properly functioning ecosystems, there would be less cost and time delays associated with meeting current and future consumptive needs. Water supply proponents need to recognize the benefits of environmental protection and need to include the cost of that protection when evaluating the benefits of new water development. This report should say that taking into account the cost of protecting the environment will greatly expedite and reduce the overall cost of water development projects. With this recognition, it will make it a lot easier to attract the myriad of supplemental funding opportunities identified in **Sec. 4.7.2**.	The text was revised to highlight concepts raised in comment.
64	Steve Glazer	3/26/2007	The message throughout is that environmental and recreational needs are separate from and are competing with water supply needs and are treated as less important. This message will only cause more conflict as demands continue to increase putting more stress on our limited and finite resources.	The text was revised to highlight concepts raised in comment.
65	Steve Glazer	3/26/2007	There needs to be more discussion about the importance of planning for augmentation in most future development. This could be added to **Sec. 4.8.2** under the Exchange and Substitution Statutes part. Augmentation is needed to protect instream flow rights as well as other senior rights. The lack of sufficient augmentation has caused nothing but trouble, both inter and intra basin and interstate. Recognizing augmentation needs should be included in evaluating firm yield for all projects.	Comment noted.
66	Steve Glazer	3/26/2007	In **Sec. 4.8.3**, in discussing decrees for Piscatorial Use (**page 4-34**), you should mention the second fill of Taylor Reservoir where this concept of using releases from storage to protect instream flows was first developed.	This example was added to the text under "Decrees for Piscatorial Use"

No.	Entity	Date	Comment	Response
67	Steve Glazer	3/26/2007	The draft report asks us to comment on how to address the impact on future development if environmental or recreational “enhancements” (I assume with water rights) are developed. This is an improper question and should be eliminated from the report. The answer is that there is no difference between the impact of an enhancement project and the impact from a water supply project on future development. They will both limit additional future use of water. This is another example of pitting environmental and recreational needs against water supply needs and viewing the former as second-class water needs. Both are legitimate beneficial uses of water. If we are to maintain the prior appropriation doctrine in Colorado, we cannot ask such a loaded question. If we are going to talk about the time when water has to be allocated on a different basis than prior appropriation, then we have to recognize the value of environmental flows and include the cost of that value in considering the compensation needed to reallocate water.	Comment noted.
68	Steve Harris Durango Water	3/13/2007	**Section 4.7 pages 4-21 and 4-22** – This economic data was not considered by the Financial subcommittee. The breakdown from national and regional data is interesting but may have no relationship to SWSI. I think it should be deleted or qualified as being a major guess.	The section was retained but qualifying statements to address this concern were added.
69	Steve Harris Durango Water	3/13/2007	Similar with the Commercial rafting data, we know nothing about how this data is developed and what multipliers are used. The data is from a trade organization attempting to promote their business and the data is likely skewed to show more impact than may actually occur. This data should also be deleted.	The section was retained but qualifying statements to address this concern were added.
70	Steve Harris Durango Water	3/13/2007	**Section 4.7.2** - General perspective for funding E&R. Maybe expand first bullet in section regarding “fully participate”. Presently E&R interests have to use the permitting process to “extort” mitigation, not enhancements, from the developers of a water project. This results in a confrontational situation that is destructive to the broad environmental interests of both parties. If the State had a funding pool to participate in water project development to promote State interests, including E&R and other needs, there would be much more cooperation than confrontation.	The text was revised to better explain meaning of “fully participate."
71	Steve Harris Durango Water	3/13/2007	**Section 4.8 page 4-28** – The description of Federal Reserved Water Rights is not quite right, specially the last sentence. The Federal government in the Winters Doctrine set aside adequate water for the purposes of the reservation. Omit the last sentence and the description is better.	The text was revised.
72	Steve Harris Durango Water	3/13/2007	**Section 4.8.2** – First paragraph - The RICD is not a “program” but a series of water rights that are not interrelated. It is not comparable to the CWCB ISF Program.	The text was revised.

No.	Entity	Date	Comment	Response
73	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**General.** Overall, the report still tries to push the round peg of non-consumptive, in-channel water needs and opportunities into a square hole more appropriate for consumptive water use projects and processes. There is also a disturbing underlying message that non-consumptive water needs and opportunities are somehow less important than other uses of water. I would argue that having a sustainable environment, at least, is critical to the sustainability of all other water uses in this state, and that having a viable recreation-based economy is in the state's current best interest, both in terms of quality of living, and in terms of economic health. After so much time and effort, report's point of view is disappointing, even if it truly reflects the CWCB's current point of view.	Comment noted.
74	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**Maps.** TU agrees that Colorado needs to have maps to show the rivers and streams with environmental and recreational value, along with their current status (flows protected, flows at risk, flows in need of restoration) and, where available, quantifications of the flows that would sustain various values. I appreciate that the roundtable was able to begin this task. However, after so many hours of volunteer time from roundtable members, as well as paid time from the consultants, this report reveals that the CWCB is far from having produced a complete assessment of the values that must be protected and their associated flow levels for the quantity and timing of water necessary to sustain the environment and provide recreational opportunities. This is unfortunate, and I hope that the 1177 nonconsumptive needs assessments will take the information that the roundtable did produce and complete the task. It is also frustrating that the map HUCs are so big and that the maps do not display fish density data. It is my understanding that both of these inadequacies stem from DOW's reluctance to have its own data made public. Again, I hope that we can correct these deficiencies through the 1177 needs assessment process.	Comment noted. Some of the map coverages were updated at the request of other comments. We agree that implementation of the Nonconsumptive Needs Assessment process can help address some of the deficiencies noted.
75	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**Coverages.** Trout Unlimited has a Conservation Success Index under development that creates coverages for native cold-water fishes (including greenback, Rio Grande and Colorado River cutthroat trouts). The CSI is similar in many ways to the Colorado Natural Heritage Program, and TU intends to expand it to wild fisheries once the team has completed the coverages for native trout and salmon. Some of the Colorado fishes' coverages are not as robust as they might be, however, because, as noted above, DOW has not been willing to share data they have for an effort that would be made public. That said, this is another useful data set that roundtables and the IBCC should use going forward.	Comment noted; this coverage could be incorporated into the Nonconsumptive Needs Assessment process.

No.	Entity	Date	Comment	Response
76	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**Methodologies.** First, the text of the discussion should clarify that the Technical Roundtable is not proposing that the state choose a single methodology to apply across the board for calculating the flows necessary to sustain the environmental or provide recreational opportunities. Different tools will be appropriate for different situations. In addition, there is an implicit assumption that R2Cross is "more defensible" than other methodologies. While that *may* have been true 35 years ago, it simply is an unwarranted statement today. There are many methodologies that are not listed in the report, some of which you should add, e.g., Karr's Index of Biologic Integrity. Finally, this section does not seem to have addressed methodologies on how to determine flows for various recreational opportunities (existing or future). Where recreational opportunities are based on birds, or in some cases, fishes that are part of a natural environment and need natural hydrographs, then some of the environmental technologies may be appropriate. Where the recreational opportunities are based on additional – or different – factors, then they will need their own methodologies. It is disappointing that after over five years, and millions of dollars, the CWCB has not spent SWSI resources to seek out these methodologies.	Comments noted; no bias to R2CROSS was stated, it was presented along with other methods in Table 4-2. The discussion on methodologies to determine flows for various recreational opportunities will occur as part of the NCNA process. The text was revised to (a) indicate that the TRT is no recommending that the State choose a single methodology; (b) Karr's IBI was added to Table 4-2.
77	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**Financial Section.** As noted above, the report generally seems too focused on projects, and especially new projects. This tone is most obvious in this section. The subcommittee seems to have missed two basic points. First, with regard to environmental needs, as a result of federal (and perhaps state or county) laws and regulations, project beneficiaries should pay for mitigation to adverse environmental effects of their projects. Second, Colorado needs to assess and protect its environmental water needs not only because it has never done so, but also because many existing water rights have caused damage to environmental values, creating unsustainable situations. Thus, many of the environmental needs that the state faces today are not associated with a new project, but with repairing damage already done from existing projects, a situation that presents special funding circumstances. The section also overlooks many financial tools that could be available in Colorado, for situations where it is not possible to ask project beneficiaries to pay for collateral environmental damage or loss of recreational opportunities. For example, funding is available for stream flow and habitat improvements through various Farm Bill programs.	Comment noted.
78	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**Legal Tools.** The Subcommittee missed reservoir and/or other project **re-operations** as a tool either to satisfy environmental needs or create or sustain recreational opportunities. **Table 4-10**. RICDs are not a CWCB program and should not be represented as such. RICDs are a type of water right that municipals entities may appropriate.	Reservoir re-operation is discussed under voluntary flow management programs and water system re-optimization. Additionally, the RICD column was moved out from under CWCB umbrella.

No.	Entity	Date	Comment	Response
79	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**Table 4-10**. RICDs create or sustain recreational opportunities; the CWCB's instream flow program may accomplish environmental protection. Because the two have separate goals, there is no need to compare the quantities of water involved, any more than it would be appropriate to compare the quantities of water necessary for an acre of irrigated agricultural land to an acre of city.	Table 4-10, flow amount row – comparative reference to RICD removed from both CWCB columns ("CWCB Instream Flow…" and "Dedication of Existing…")
80	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**Table 4-10**. The fact that the CWCB wants to include information in this table about how protecting non-consumptive uses of waters may affect other water users (presumably those using water in traditional, consumptive ways) is one of the many examples of how the CWCB views non-consumptive uses of water as somehow less important than other uses of water. Where non-consumptive uses of water have water rights, those rights affect other water users in the same way that any water other right does. Where non-consumptive uses of water do not have water rights, they are at risk from the exercise of water rights in the same way as any unappropriated use of water is, unless there are governmental permit conditions that trump the water rights system. TU would be more comfortable with this report were CWCB to delete these two lines entirely from the final version – as well as the related text. Failing that, a single notation similar to what's expressed above in this paragraph should be sufficient.	The last two lines of Table 4-10, "Impacts on Junior Rights" and "Impacts on Senior Rights" were removed from the table. Where environment and recreation uses have water rights they will be treated as such and are equal. We must also acknowledge that examining potential flow needs beyond what the current law allows (existing legally available flow) and the implementation of which may contribute to conflict between consumptive and nonconsumptive interests and uses of water. This needs to be considered and the reconciliation of how flows are examined and implemented needs to be resolved to proceed.
81	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**<u>Little Bear Creek Example.</u>** This example is confusing. If the storage to yield ratio for a traditional project is 1:1, and there is over 10,000 acre-feet of available water, but satisfying downstream environmental needs would require 16,000 acre feet of storage out of this project, then the example must be contemplating restoration of a flow-impaired waterway, not just its protection. The example does not make this clear.	See response to comment No. 8.
83	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**<u>Legal Tools.</u>** Because of the time that it has taken to produce this report, another legislative session has come and gone since its initial drafting. As a result two new legal tools exist that have relevance to protecting instream environments: Please add mention of HB 1352 (water quality protection in water court for change of use applications for large water transfers) and HB 1341 (protection against abandonment or lowered historical consumptive use credits when making water available for instream flow protection on a short-term basis).	Information on these new legal tools was incorporated into the Legal Tools section of the document.
84	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**<u>Tarryall Creek Project.</u>** The text does not make clear who the partners are beyond Denver Water (if any).	The Tarryall Creek Project example was revised to provide clarity on partnership involved.

No.	Entity	Date	Comment	Response
85	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**Section 4.10.2.** The introductory language in this section is not clear that the two lists it includes are limited to those projects or programs of two entities and are hardly comprehensive in nature or a systematic approach either to satisfying the state's environmental water needs or creating or sustaining recreational opportunities in Colorado.	Comment noted.
86	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	**Conclusion**. The report seems to assume that the CWCB will continue to play the role of assisting the roundtables in completing their non-consumptive water needs assessments. Given the existence of the IBCC and HB 1400, it is not clear why this should be so, unless and until the legislature authorizes an SWSI Phase 3, something that is notably absent from this year's projects bill.	HB1400 is a CWCB funded program. In addition, CWCB funding is being utilized to assist the roundtables in the work efforts completed by the Nonconsumptive Work Group. In addition, CWCB has approved funding for on-going implementation for Colorado's Water Supply Future.
87	Melinda Kassen Western Water Project Trout Unlimited	3/26/2007	The word "data" is a plural noun.	The word "data" has been reviewed throughout the text and text has been changed accordingly.
88	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**The report suffers in tone and vision.** Repeatedly, the text sends two messages, first that environmental and recreational non-consumptive water uses are secondary to other uses, and second that Colorado can only meet these needs through new projects where water is otherwise available. Given the legacy of ecological damage done over 130 years of water project development to serve important consumptive needs, the notion that new projects alone, whether multi-purpose or not, will conserve, protect and restore the rivers necessary to provide Colorado with a healthy, sustainable system of rivers misses the point. The "paradigm of plumbing" is simply incomplete to solve the challenges of providing water for environmental and recreational water needs and opportunities. In addition, the report is woefully short-sighted to suggest that the existing situation, where little unappropriated water is available for newly valued uses, should limit Colorado in a creative search for water to meet these non-consumptive water uses.	Comment noted.

No.	Entity	Date	Comment	Response
89	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**The report reflects that the TRT did not make the progress many had hoped towards identifying and quantifying Colorado's non-consumptive water needs.** I understand that evaluating non-consumptive water needs is something that Colorado has not done systematically before, and that it is therefore a contentious process, without widespread agreement on which needs are important or how to quantify them. The report reveals how far we have still to travel in this process despite the state having spent four years and significant resources on SWSI. Sadly, one reason this report comes up short is that the CWCB did not take full advantage of the expertise assembled on the TRT. The report also reflects a lack of accomplishment in that it does not answer the questions that TRT members chose to ask at the beginning of their process to guide their work. The report not only fails to acknowledge this, but also misses the opportunity to characterize the TRT's work as a step along a path, rather than a final product.	Comment noted; text revised in selected places to clarify the purpose of this report and next steps. Also, it should be noted that the TRT specifically did not request that quantifying of non-consumptive needs be conducted as part of the SWSI 2 process.
90	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**The report is poorly written and fails to present the good information that the TRT did compile in a useful, meaningful way.** From its awkward title on, the report makes for a confusing read. The organization does not flow; the text uses unfamiliar and unexplained acronyms; and it contains numerous typos. If it is going to serve as a functional tool, it must be reader friendly. Moreover, regarding the best information that the TRT produced – the coverages – the report does not integrate them into the text, does not summarize them well there, and does not lay them out in a way that enhances their utility.	The entire document was re-structured and a thorough technical edit was conducted to improve the flow of information.
91	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**Introduction**. As written, the introduction includes too much and too little. It should highlight the TRT's accomplishments (the coverages), as well as explain what the TRT set out to do, but did not achieve. For example, such a disclaimer would explain which questions remain unanswered (and why), the fact that the TRT did not make as much progress as members had hoped and that the final products do not bring Colorado's understanding of non-consumptive environmental water needs and recreational water opportunities up to the level the state has for most consumptive uses.	The document was significantly restructured and explanatory information was included in various places, especially in the introduction to help provide more context to the overall report.

No.	Entity	Date	Comment	Response
92	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**Coverages**. The maps developed as part of this TRT are without a doubt the process' most useful outcome. Still, they are incomplete. The water quality coverages are odd, in that they show only reaches with poor quality – but not all such reaches. In addition, there are no coverages for the state's wetlands. Also, it appears that the TRT did not obtain much readily available information from federal agencies, who of course, have not been a part of the SWSI process. There are also databases available from NGOs and others that have not been included. There is much better environmental than recreational coverage. Several commenters disparaged the use of commercial data for recreational coverage – given the lack of other available coverages, it is appropriate to use data. In fact, one could easily argue that using such data is no less likely to lead to inaccuracies than it is to use city and county data regarding projected population growth, or Department of Agriculture data regarding the future of irrigated agriculture in Colorado.	The water quality coverages were revised to address this and other related comments. The TRT did not identify wetlands as a coverage to be included in this report. As part of the implementation of the Nonconsumptive Needs Assessment process, additional relevant coverages will be incorporated to the extent that data is available and requested by the roundtables.
93	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**Quantification Methodologies.** The information in the report is incomplete, and in some cases outdated and misleading. Certainly, the R2Cross methodology, which the CWCB uses to establish minimum stream flows is not likely to be the best tool for many of the jobs necessary to quantify environmental and recreational water needs and opportunities. The CWCB's resistance to exploring other methodologies may be one reason that Colorado has made so little progress previously in completing a non-consumptive water needs assessment. The examples in this section are especially unhelpful. One is a misapplication of an existing model (Little Bear Creek), while the other is recycled from SWSI Phase 1 (WatSIT). Both the Elkhead Reservoir Expansion and Flaming Gorge re-operations offer better, real world examples of the true costs of including flow benefits in a project. Finally, the report contains virtually no information about methodologies appropriate to use to quantify recreational water requirements.	Comment noted.
94	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**Financial Tools.** Funding the conservation, protection and restoration of rivers as well as the underpinnings of a robust river recreation economy is an ongoing challenge. This section suffers from a lack of both creativity and explanation. The report lacks any meaningful description of the tools it lists. At the very least, the final report should describe the CWCB programs that are available, including information regarding eligibility requirements, a description of the application process, scope, reference materials and a point of contact. In addition, the list seems focused on financing new water projects and expansions of existing projects, even though the biggest need is often for mitigation where new project funding will not be useful.	A section describing CWCB programs was added to the document. In addition, a source (website) for each tool was provided so that information regarding application, scope, etc. could be obtained if the reader was interested in pursuing.

No.	Entity	Date	Comment	Response
95	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**Legal Tools** – The discussion in this section misses a number of important tools, especially those not tied to a specific statute, such as reservoir re-operations and second fills. The list doesn't mention augmentation plans, which are necessary to protect, if not restore CWCB instream flows. In addition, the report took so long to produce that it now needs updating to reflect new tools that passed the state assembly in 2007. As is the case for the financial tools, more complete information about the nature of these tools would undoubtedly be useful to future readers.	The list of legal tools was generated by and led by a TRT committee.
96	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**Legal Tools** – This section of the report generally bears little relationship to the questions that the TRT initially posed for its legal subcommittee. Certainly, it doesn't answer those questions. Worse, it raises a new question that is highly inappropriate – namely, whether meeting environmental and recreational water needs will adversely affect either the development of additional consumptive uses of water, existing water rights holders, or new, junior, as-of-yet unappropriated water rights. Why has SWSI insisted on asking this question only for environmental and recreational water when any new or changed use of water protected by our water rights system may affect other water users? The fact that the report raises this question is just one of many examples of how the report's approach treats non-consumptive uses of water as less important than consumptive uses.	Comment noted; See response to comment No. 95 that the response to these questions was led by a volunteer committee of the TRT.
97	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**Legal Tools** – The report contains a long explanation of RICDs that includes several important mischaracterizations. First, RICDs are not the be-all and end-all of recreational water needs. Second, RICD water rights are for cities to appropriate and, as such, are not a CWCB program. Moreover, the report compares quantities of water involved for RICD's with the quantities necessary for the CWCB's minimum stream flow program, a comparison that is entirely inappropriate since the two have separate goals.	The text has been revised to indicate that RICD's are not a CWCB program.
98	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**Examples.** Given that there is relatively little new information in this report, the use of examples could have great utility to readers. Yet, several of the examples included are incomplete or misleading (e.g., Wolford Mountain, which could be appropriately illustrative, but only if the final report includes tailored information beyond that in the project brochure) and in other respects, the list and range of examples is sadly under-inclusive. For example, water providers, agencies and NGOs were all involved in crafting the South Platte Protection Plan, which provides significant flow benefits, and there are other examples from the world of endangered species protection.	Comment noted; The list of case studies to prepare and development of the case studies were prepared by TRT members. Not all TRT members who volunteered to prepare a case study provided information.

No.	Entity	Date	Comment	Response
99	Melinda Kassen Western Water Project Trout Unlimited	5/2/2007	**Projects.** This portion of the report is unclear and, as a result, misleading. The list of projects a watershed group wish list. Even were they all built as the groups desire, they do not represent a comprehensive solution to Colorado's unmet environmental and recreational water needs.	The document includes the information provided by the Technical Roundtable; its incorporation was not intended to suggest that they represent a complete or comprehensive solution.
100	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	Perhaps my overriding concern throughout this Section resides in the language and tenor of the report. The report is overwhelmingly written from the traditional perspective, or "paradigm" that regards rivers as nothing more than plumbing for which engineered solutions are the primary response. Engineering is a part of the solution, but for the environmental needs assessment it must be considered in light of the biology, the living element of the riverine environment. The report apparently fails to understand this and seems to dismiss the importance of biology, emphasizing instead the need for engineering, for "projects". An example of this is in the brief and wholly inadequate remark about Riparian-Wetland Habitat Protection in 4.10.1, page 4-43; "Restoration of riparian wetland habitat has aesthetic benefits as well as potential water supply and water quality benefits". That's it. That's all that's said about the importance of Riparian and Wetland habitats in light of "Options for Environment and Recreation Projects". Riparian and wetland habitat are far more important to the biological health and well being of a river than merely providing "benefits" for aesthetics, water supply and water quality. They are vital. Without a healthy integration and connection between the aquatic environment and the adjacent riparian and wetland habitat, the river is dead. It is then truly nothing more than a natural ditch, a sterile open channel pipe in the plumbing. These water needs are real and not something we should merely try to "enhance" if we have the opportunity.	Comment noted.
101	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	Another problem is the constant drum beat in the tone that seems to regard Environmental and Recreational needs as somehow secondary to the needs of Municipal/Industrial and Agricultural water. The needs of environmental and recreational water are just as important, just as valid legally and fully recognized as any of the other more traditional uses. The report constantly raises the loaded question "What are the potential impacts on senior and junior water rights holders if an environmental project is developed? What are the impacts on future uses of water"? These questions are not asked in the same tone of M&I or Ag water. The impacts on senior and junior rights are subject to the same litmus test of Colorado water law as any other legitimate use. The same goes for "impacts" on any future uses. There is not the same emphasis with impacts of M&I or Ag water uses, rights and future development to Environmental or Recreational needs.	Comment noted.

No.	Entity	Date	Comment	Response
102	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	There is also consistent emphasis on the need for "projects (or programs)" that benefit multiple users, and for striving to find "acceptable balance…between competition for the same sources of water with existing uses such as agriculture and M&I". This is an important need and a very valid concern. But it must also apply to future projects and programs to develop Ag and M&I water regarding their impacts on existing uses for environmental and recreational water. There is also nothing substantial on non-project recreational or environmental programs.	Comment noted.
103	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	In **Section 4.5** the statement is made that the TRT's "work is an important first step to build on the initial 2004 SWSI report." Unfortunately there was not very much to build on. As stated at the beginning the TRT "indicated that the initial work under SWSI did not fully address all non-consumptive water needs". This report continues in that vein. The report advances the effort a bit, still falls short. The following statement that "Ultimately, the process of quantifying non-consumptive water needs is iterative and will take significant time and resources" is among the most accurate made.	Comment noted.
104	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	Listing the various methodologies for assessing environmental and recreational needs along with the maps and "coverages" is a start. More work needs to be done in this area and is planned for with the Non-Consumptive Use Needs assessment work to be done through the Basin Roundtables and the IBCC. Among the methodologies discussed perhaps the most inadequate is the one used by the CWCB for the establishment of minimum in-stream flows. The R2CROSS method is good, when used appropriately, to establish a basis for quantifying a basic hydrologic condition. It starts to breakdown when a single section is used for establishing such conditions over a long reach of river. It is also inadequate for establishing a need and connection with the adjacent riparian and wetland habitats. Other methodologies discussed such as the ones applied by Audubon, TNC, CDOW and CNHP are better suited.	Comment noted.
105	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	**Section 4.4,** Methodology for Recreation Coverages" is inadequate. More detail, sources and other "methodologies" need to be used or developed for an honest and realistic assessment of Recreational needs.	Implementation of the Nonconsumptive Needs Assessment process will move forward the need to develop a methodology for assessing recreational needs.

No.	Entity	Date	Comment	Response
106	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	The development of WatSIT with the TNC's RVA methodology is interesting; however it still appears to be primarily project and plumbing driven. Mitigation of environmental and recreational impacts caused by an M&I or Ag water supply project does not constitute an environmental or recreational project or program, nor does it constitute an evaluation or quantification of actual need. Quantifying "firm yields associated with streamflow time series as functions of total reservoir storage and reservoir operating constraints" and "setting instream environmental flow targets in the context of water supply alternatives analysis" may be an important part of the overall picture, but it is not all there is to assessing environmental needs. Not by a long shot.	See response to comment No. 8.
107	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	Another problem here is the implication, as stated in Alternative B of the second example (**page 4-20**) that the only consideration for any real environmental needs must be based on "legally available flows". While this is a valid part of the equation, it should not be used as the starting point of an honest needs assessment, whether it's for project mitigation or not.	See response to comment No. 8.
108	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	We need to develop a Non-Consumptive and environmental needs assessment methodology and approach that identifies the *actual need* for a healthy and fully functional riverine community. We need to quantify and *qualify* the real biological needs for flow regime. This must include flows, seasonal variations and fluctuations, periodic flooding, water quality and temperatures, etc. The picture of a healthy river system has to be accurately determined first. That is Point A. Then we can start to work on how we are going to reach Points B or C or D. This is the process where we need to evaluate and balance the real biologic needs with the "firm yield" and "legally available flows" and set "targets in the context of water supply alternatives analysis." Starting solely from the perspective of engineered plumbing, using what water might be left over for mitigation as a foundation for assessment and analysis cheats any real non-consumptive needs assessment. No one would expect a farmer or city planner to start from a truncated concept of what their actual needs may be, and we shouldn't expect such for environmental or recreational needs. Granted, in most cases there will not be the native flows historically available to a river, nor does there need to be. How we treat our rivers, whether to conserve, protect or restore free flowing reaches or to mitigate the impacts from other multi use projects, must start from an honest understanding of the true needs, both hydrologic and biologic.	Comment noted. Implementation of the Nonconsumptive Needs Assessment Process will help address the issues raised here.

No.	Entity	Date	Comment	Response
109	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	**Leading into Section 4.7** with the comment about the simulations showing the potential costs of environmental and recreational "options" may be significant and that "While the benefits realized from environmental and recreational options are clear, to date there is no clearly accepted or widely implemented mechanism for in these types of flow enhancement projects" is another example of the down casting tenor and language of the report towards environmental and recreational needs. By presenting these mitigation simulations as the primary example of environmental and recreational projects or programs and then referring to them as "options" for flow enhancement leaves the impression that these very legitimate, recognized beneficial needs are somehow secondary and less important than more traditional uses such as M&I or Ag. That is patently unfair, unwarranted and un-necessary. The statement itself may be true about cost and funding sources, but the implication that these "options" are perhaps cost prohibitive in the development of Colorado's future water needs and perhaps expendable is not.	Comment noted.
110	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	This tenor tends to follow through with the rest of **Section 4.7**. The Section starts out by recognizing the value of Colorado's rivers, reservoirs, mountains, climate and opportunities for recreation as a primary driver for our rapid growth. The focus of the subcommittee however seems a bit skewed with an emphasis on funding for environmental and recreational needs as a part of "multi-purpose projects". While this is important, we also need to find funding mechanisms for environmental and recreational needs, programs and projects by themselves. Impacts, mitigations and being a secondary "option" for water development projects are not the only funding possibilities for Environmental and Recreational needs.	Comment noted.
111	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	The apparent ability to fund environmental and recreational needs is hardly encouraging. Yes, funding may be limited in some cases, but I don't not believe that it is quite so potentially difficult as **Section 4.7** seems to suggest. New and creative sources must be found and developed and I believe they will. Environmental and Recreational water needs are an increasingly valuable part of our lives. Just as we created ways to fund piped potable water and treated waste water, we as a society will find ways to pay for what we value and want to protect in environmental and recreational needs. This is the 21st century, not the 19th. Values and needs have evolved and we need to recognize that.	This challenge was discussed in detail by the TRT
112	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	One source of information on the economic impacts that needs to be included is the Colorado Data Book from the Colorado Office of Economic Development and International Trade. This is an excellent source of information, as are other sources not mentioned such as economic reports by the CDOW and the American Sportfishing Association.	This information was included in the SWSI Report (2004).

No.	Entity	Date	Comment	Response
113	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	My earlier comments about language and tenor apply most fully to **Section 4.8**. Environmental and Recreational needs, and rights, are fully recognized, just as valid, just as important and just as needed as any of the more traditional rights. They are just as subject to existing Colorado water law and custom as any other. The consistent attempts by the CWCB as well as the overall tenor of this report to relegate these legitimate rights to some sort of second class status really need to stop. "What are the impacts for future uses of water?" No different than the future impacts of uses by proposed trans-basin diversions, projects and other consumptive needs on the environmental and recreational uses. What are the impacts on Senior and Junior rights? The same as any other legitimate beneficial use, development and need for water. The CWCB and the SWSI team need to start asking these questions of every use and stop singling out and denigrating by implication the Non-Consumptive uses needs as "options" and "enhancements".	Comment noted.
114	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	I was a bit surprised by the comment that "Federal Reserved water rights are legally recognized flows that provide protection for instream values associated with national dedication." These rights only have value when recognized as valid and when allowed to be provided in sufficient amounts. Neither of these values have been very warmly embraced, to say the least, by the State of Colorado in the past.	Sentence removed as part of a previous comment.
115	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	The report proudly discusses the CWCB in-stream flow program and has a rather lengthy discussion of RICD's. The current CWCB however is openly hostile to both In-Stream flow rights acquisition and RICD's, opposing or restricting any that have come up over the past few years. I'm sorry, but 390 cfs and 3,600 acre feet of protected flows, over 30 years and the entire state, is not much water, nor much to be proud of when contrasted with the high value given these uses by the public.	Comment noted.
116	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	I am also surprised at the omission of State and Local regulatory mechanisms for protection of Environmental and Recreational flows in **Table 4-10.** Maybe I missed it, but for water quality (dilution flows, impaired streams, storm water discharge) and environmental needs these regulatory tools are very important. 1041 authority is a huge tool for those counties that adopt it, and totally ignored in this report.	Water quality low flow analyses are conducted by the Colorado Department of Health and Environment and are not included in this discussion. A discussion on 1041 has been included in the text.
117	Ken Neubecker Western Water Project Trout Unlimited	3/25/2007	We need to move beyond the paradigm of plumbing. We need to establish quantities and priorities, but in the context or real needs, values and the qualitative aspects of the river environment and recreational setting. Until we do that I am afraid that SWSI will continue to miss the point of what environmental and recreational needs are.	Comment noted.

No.	Entity	Date	Comment	Response
118	M. Patrick Wells, P.E. Colorado Springs Utilities	3/23/2007	**General Comment.** Please have a technical editor perform one or more reviews of the document before it goes final. There are several places in the text that have minor grammatical or word usage errors which decrease readability and/or cause confusion. In addition, there are some words that the spell checking software may not have caught, but should be replaced with a more appropriate word. As an example, on **Page 4-9**, in the last sentence of the paragraph discussing instream flow appropriations, the word "addition" should be replaced with the word "additional". Also, the second word on **Page 4-9** should probably be "where" instead of "with".	A thorough review of the text will be conducted prior to final production. The specific examples have been changed in the text.
119	M. Patrick Wells, P.E. Colorado Springs Utilities	3/23/2007	**General Comment:** Several of the smaller tables, particularly those that are embedded within the text, are so simplified that they are actually somewhat confusing. Recommend adding footnotes to these smaller tables to include data sources, acronyms, and other relevant information to make these tables more "stand alone" and easier to understand. An example of this is in the table under **Item #2 on Page 4-38**. The IF acronym should be defined to improve readability for a non-technical reader of the text.	The document was reviewed and additional explanatory information was added where appropriate to increase understanding.
120	M. Patrick Wells, P.E. Colorado Springs Utilities	3/23/2007	**Page 4-8.** The text mentions that the coverages will be contained in an ArcReader project that will be available for download for use as a management tool. Several organizations and agencies currently use ArcGIS for spatial mapping and data analysis. It would be EXTREMELY useful for these coverages to be posted as individual shapefiles, or as a comprehensive geodatabase that could be downloaded from the CWCB website (similar to what is available through the Colorado Decision Support System). This would allow various stakeholders to overlay the SWSI data layers with their various data layers, allowing these stakeholders to make more informed decisions. The ability to share and overlay data is essential to improving understanding of complex issues and will most likely lead to increased communication and collaboration between various organizations, agencies, and stakeholders within each of the basins.	Comment noted. This recommendation will be evaluated as part of the implementation of the Nonconsumptive Needs Assessment strategy.
121	M. Patrick Wells, P.E. Colorado Springs Utilities	3/23/2007	**Page 4-27.** Last sentence in the paragraph under the heading "Other Funding Sources". Replace the word "on" with the word "through". Right now the sentence implies that there is a "fee on a tax", which is incorrect.	Text has been revised.
122	M. Patrick Wells, P.E. Colorado Springs Utilities	3/23/2007	**Page 4-27**. Under the bullet titled "Beneficiaries". Replace the word "feel" with the word "realize" or delete the word "feel".	Text has been revised.

No.	Entity	Date	Comment	Response
123	M. Patrick Wells, P.E. Colorado Springs Utilities	3/23/2007	**Section 4.8.** This section provides an impressive inventory of legal mechanisms and tools for addressing and protecting environmental and recreational needs. Where possible, I would appreciate more detail on each of the relevant regulations and programs. I think that adding an additional 1 to 2 paragraphs for each of the regulation/program descriptions would be extremely helpful and would give groups such as the Basin Roundtables a more useful, comprehensive summary and understanding of regulations and programs that influence environmental/recreational needs. Perhaps as an alternative, it might be useful to include website addresses where individuals and groups can obtain more information on each of the regulations/programs described in this section.	Funding program websites were added to provide additional resource information to the reader
124	M. Patrick Wells, P.E. Colorado Springs Utilities	3/23/2007	**Table 4-10.** It may be close to impossible to identify and discuss potential impacts to junior and senior water rights as rows in a table, given the complexity and differing viewpoints on the water rights/mechanisms being discussed. Would it be possible to fashion potential impacts to junior and senior water rights in a more narrative fashion in the text? I thought that the document did a good job "walking the fine line" in the Recommendations section of the report because several comments were captured regarding the various issues and challenges associated with quantifying environmental/recreational needs without the perception of "taking a side" or making judgments on the comments/opinions. I think a balance could be struck between interests on "both sides of the fence" by fashioning **Section 4.8.5** to be more similar "format-wise" to **Section 4.12**.	This table was revised to eliminate this discussion.
125	Taylor Hawes, CRWCD	3/26/2007	I am concerned that this report will fall short of people's expectations, and that the substance of the report will be therefore be dismissed. My recommendation would be to include a disclaimer of sorts in the very beginning of the report. This report and the TRT's work were merely steps in a very long road and the report should acknowledge that – upfront, not in the conclusion. I think the disclaimer should include a discussion about how environment and recreation interests often conflict with each other and mean different things to different people, which is why it was difficult to tackle both issues in less than a year (4-5 meetings). In the big scheme of things, this issue is relatively new and the environment and recreation interests are not going to "catch up" to traditional uses but you should make clear that this is the beginning of the process, not the end.	Comment noted; the revised document provides additional text in the introduction and conclusions that better describe where we are in the process.

No.	Entity	Date	Comment	Response
126	Taylor Hawes, CRWCD	3/26/2007	There is also the matter of the political reality of this issue. In recent years, the CWCB has a reputation (rightly or wrongly) of contesting environmental and recreational uses and this report may fuel that fire. For example, you bring up the questions that the TRT was going to answer, but we didn't answer those questions. I think there should be an explanation why that happened. If you are not sure why it happened, I would be happy to discuss my perceptions about why it happened. Ultimately, I recommend trying to manage expectations about this report and lay out the long term plan early in the report, not in the conclusion.	Comment noted. The document has been reorganized and the introduction has been revised to address some of the comments noted here.
127	Taylor Hawes, CRWCD	3/26/2007	The report is not very well written, which makes it very confusing and difficult to follow in sections. In particular, the technical section was incredibly confusing and I had to read some of the examples several times to even understand them.	Comment noted. The revised document has been significantly re-structured and technically edited to improve flow of information.
128	Taylor Hawes, CRWCD	3/26/2007	Generally, the paragraphs in the legal section are written using acronyms that have never been spelled out. They should be spelled out somewhere. Sometimes complete sentences are used and sometimes there are fragmented sentences. The legal tool summaries should be consistent.	Comment noted. The revised document was technically edited to address concerns.
129	Taylor Hawes, CRWCD	3/26/2007	For additional editorial comments see scanned document.	Edits have been made throughout the document to incorporate and reflect these comments.
130	Taylor Hawes, CRWCD	3/26/2007	303(d) List (page 4-11). This section didn't make sense to me. Why would we only list segments for aquatic life AND sediment? Shouldn't we list all segments that are not meeting standards for aquatic life and recreational use? (Are there any segments not meeting rec. standards?) The mapped segments could footnote the parameter(s) that is(are) not being met.	Methodology for this section has been further explained in the revised document.
131	Taylor Hawes, CRWCD	3/26/2007	**Page 4-12: second paragraph after bullets of section 4.6.5:** Last sentence is awkward.	Text revised.
132	Taylor Hawes, CRWCD	3/26/2007	**Table 4-2 (page 4-15)**. UpCo Minimum Flows. This is not accurately summarized. First, UPCO included minimum, maximum and optimum flows – not just minimum flows as implied by the "approach name." The Table includes a comments section that states that the UpCo approach "look[s] only slightly more stringent than the CWCB instream flows." This is an over-generalization. It all depends on the need. The recreational needs included flows for kayak and rafting. Those flows were significantly different than the CWCB flows. The table also ignores the maximum flows. "Stringent" is an odd word choice.	UpCo row in Table 4-2 was revised.
133	Taylor Hawes, CRWCD	3/26/2007	**Table 4-2 (Page 4-17).** Why is Geomorphology/Sediment Transport row empty?	Row was deleted.

No.	Entity	Date	Comment	Response
134	Taylor Hawes, CRWCD	3/26/2007	**Page 4-18/paragraph above Table 4-3 – paragraph describes WatSIT flows –** NOTE: why isn't this summarized in table?	See response to comment No. 8.
135	Taylor Hawes, CRWCD	3/26/2007	**Section 4.7.1/third paragraph/third sentence:** Is permanent the correct word choice?	Text was revised.
136	Taylor Hawes, CRWCD	3/26/2007	**Page 4-26** – The report discusses Sales Tax and includes Trust Funds in that section. I think sales tax and trust funds should be separate discussions. All the funding mechanisms should be discussed as stand alone elements that could be matched up with other options and specific projects.	Text was revised per comment.
137	Taylor Hawes, CRWCD	3/26/2007	**Page 4-28** – The introduction to the legal section needs some more work. I think it is important to explain why we didn't answer the questions presented. That is part of the report's problem generally: the questions are presented but never answered. The reader will be expecting answers and will be confused when they are not answered. The fact that the questions were not answered highlights the problem this group had in agreeing on what the right questions should be. Part of the disclaimer in the introduction should explain why the group shifted its course. Additionally, see comments on scanned document for this page.	The document as a whole and this section in particular was restructured so that explanation could be provided as to why group shifted its course.
138	Taylor Hawes, CRWCD	3/26/2007	**Page 4-30/the Did You Know? Box –** this is disjointed. I like the idea but what about a box that lists the various ways the CWCB can acquire ISF rights.	Comment noted.
139	Taylor Hawes, CRWCD	3/26/2007	**Page 4-31 & 32.** The section on RICDs needs to be pared down. See my attached pages. It seems unnecessarily long for purposes of the report. The reader will stop reading. It also needs an introduction discussing how RICDs came about. The CWCB didn't receive requests. I suggested some language in the report.	Section was revised and shortened.
140	Taylor Hawes, CRWCD	3/26/2007	**Page 4-33** – The legislature has adopted HB 1132 (water quality in a change case) and HB 1012 (loans to the CWCB). These should be included.	These tools have been added.
141	Taylor Hawes, CRWCD	3/26/2007	P**age 4-35** Response to Note to Reviewers: My thinking has always been that all the tools must operate within the framework of the water rights system. Junior rights cannot impact senior rights. I think you could either include a disclaimer about this right after the question OR go ahead and put it in the table saying each option doesn't impact senior rights.	Comment noted and table has been revised.
142	Taylor Hawes, CRWCD	3/26/2007	**Table 4-10:** if you include Impact on Junior Rights and Impact on Senior Rights, I would like to review.	Impacts on Junior and Senior Rights has been removed from the table.

Responsiveness Summary for Section 4 – Prioritize and Quantify Environment and Recreation Needs Technical Roundtable

No.	Entity	Date	Comment	Response
143	Taylor Hawes, CRWCD	3/26/2007	**Pages 4-41 thru 43.** Please see the attached pages. I made quite a few changes on my case studies. The Wolford one reads like a brochure (which it was) and needs to be tailored to suit the tone of the report. I tried, but it needs even more help.	Text was revised as appropriate.
144	Taylor Hawes, CRWCD	3/26/2007	**Page 4-44/bulleted list:** What's up with the boxes?	The boxes are actually dashes. The dashes changed to boxes when the word document was converted to a pdf. This problem will be fixed prior to final document production.
145	Taylor Hawes, CRWCD	3/26/2007	**Page 4-47**. My understanding of **Table 4-12** is that the listed projects were provided by the Colorado Watershed Assembly, rather than being their proposed projects.	The text and table title have been revised.
146	Taylor Hawes, CRWCD	3/26/2007	The conclusion is a good start at providing some context for the report but should be upfront, not only in the conclusion. It could be tightened up too.	A technical edit of the report was completed which revised the text and provided more context in the introduction.

Appendix D
ArcReader Application – Environmental and Recreational GIS Coverages

Introduction & Application Contents

The ArcReader mapping application allows a user to view, navigate, and print ArcGIS maps. In this manner GIS data can be shared between users whether or not they have professional mapping applications available for their use. The SWSI Phase 2 ArcReader mapping application includes the following map layers (coverages):

- CWCB Instream Flow
  - CWCB Instream Flow Water Rights (where availability may have had a role in appropriation)
  - CWCB Natural Lake Level Water Rights
  - CWCB Instream Flow Water Rights
- Environmental Coverages
  - Boreal Toad Distrubution
  - Audubon Important Bird Areas
  - Colorado Natural Heritage Program – Riparian/Wetland Plants and Plant Communities
  - Federally Listed Critical Habitat
  - Water Quality Control Division Monitoring and Evaluation List
  - Water Quality Control Division 303(d) List
  - Colorado Pikeminnow Distribution
  - Humpback Chub Distribution
  - Razorback Sucker Distribution
  - Bonytail Chub Distribution
  - Greenback Cutthroat Trout Distribution
  - Arkansas Darter Distribution
  - Flannelmouth Sucker Distribution
  - Bluehead Sucker Distribution
  - Roundtail Chub Distribution
  - Colorado River Cutthroat Trout Distribution
  - Rio Grande Cutthroat Trout Distribution
- Recreational Coverages
  - Gold Medal Fisheries (both streams and lakes)
  - Southwest Paddler Kayaking
  - American Whitewater Rafting
- Colorado Roads
  - Roads
  - Major Colorado Roads
- Colorado Hydrology Data
  - Colorado Hydrology (major streams and rivers)
  - Hydrologic Network (most streams and rivers)
- Cities
- Counties
- Basins
- Colorado Relief

These coverages are also included as Figures 4-3 through 4-28 in Section 4 of this report as statewide maps. However, the ArcReader application allows the user to navigate to areas relevant to their interest and then print maps based on the most appropriate scale.

Application Use

The following sections explain how to install and start-up the ArcReader program and how to use some of its key features. For more detailed instructions an ArcReader tutorial is available from ESRI at: http://webhelp.esri.com/arcgisdesktop/9.2/pdf/ArcReader_Tutorial.pdf.

Installation and Start-up:

1. Insert CD into the CD-ROM drive.

2. If the ArcReader application has not been installed, click on the "Install ArcReader 9.2 (Click here!)" link. When the dialogue box opens click on "Run" and follow all subsequent instructions.

3. If ArcReader has already been installed simply click on the "SWSI_PHASEII_ArcReader.pmf" to start the application. If a dialogue box pops up simply click on the "open" button.

Key Features & Their Use

There are four key areas in the ArcReader application that will be discussed here: (1) the Table of Contents; (2) the Map Tool Bar; (3) the Data Toolbar (only the extent, identify, and find buttons); and, (4) the Map Display. More detail on other areas such as the measuring tool and swipe button can be found in the ArcReader tutorial identified above.

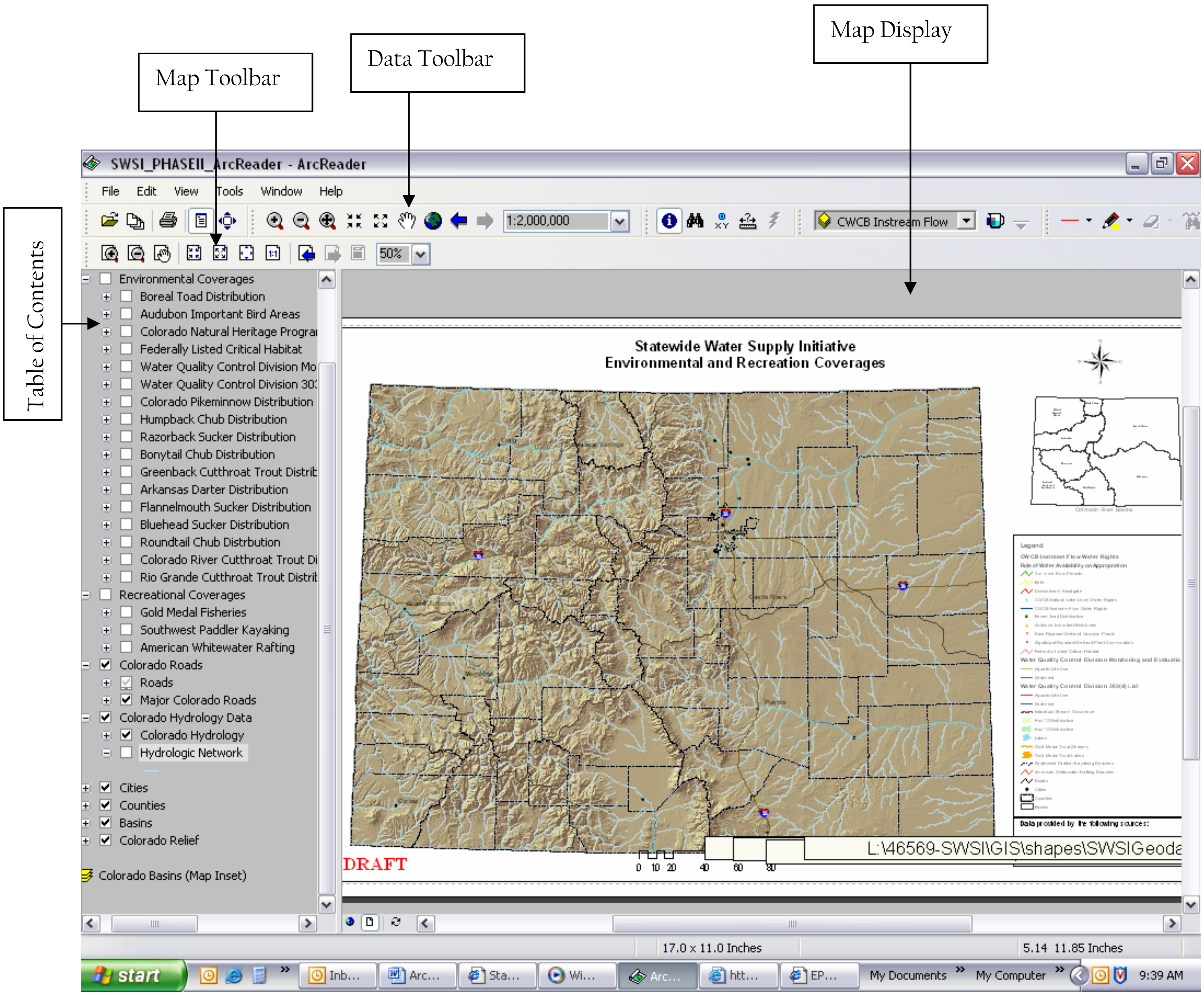

Table of Contents

The Table of Contents allows the user to turn map layers on and off by checking and unchecking the boxes. Important things to remember include:

1. The Table of Contents includes major and minor map layers. For instance Recreational Coverages as shown below is a major map layer while the Gold Medal Fisheries, Southwest Paddler Kayaking, and American Whitewater Rafting are minor layers.

   - Recreational Coverages
     - Gold Medal Fisheries (both streams and lakes)
     - Southwest Paddler Kayaking
     - American Whitewater Rafting

   In order to turn on a minor map layer the major map layer must also be selected.

2. Additionally, layers will be drawn on the map in the order they appear on the Table of Contents. For example if the distribution of two fish overlap whichever fish is listed first in the Table of Contents will be drawn over the second fish.

Map Toolbar

The Map Toolbar allows the user to change the extent of the map layout. Most of the Map Toolbar buttons such as "zoom in", "zoom out", and "pan" are self-explanatory. The exact function of each button is depicted by placing the mouse arrow over the toolbar button. The important thing to remember about this toolbar is that it alters the entire printable map layout, not just the data layers.

Data Toolbar

The Data Toolbar allows the user to manipulate and query the data layers. Buttons on the Data Toolbar include various zoom and pan functions, an identify button, and a find button among others.

Zoom and Pan Buttons

The zoom and pan buttons allow the user to change the extent and position of the data layers. As with the Map Toolbar, the zoom and pan buttons on the Data Toolbar are self-explanatory and their exact functions are depicted by placing the mouse cursor over the toolbar button. The important thing to remember about the zoom and pan buttons on the Data Toolbar is that they alter the extent on the data layers only, not the entire printable map.

Identify Button

The Identify Button allows the user to see which features can be found at a specific location. This button also allows the user to explore the aspects of each feature. For instance if you want to identify all streams and rivers in the Steamboat Springs area and their characteristics: (1) simply click on the Identify Button; (2) either make sure the Colorado Hydrology data layer is selected in the Table of Contents or select the Colorado Hydrology data layer in the Identify Dialogue Box; and, (3) highlight the appropriate area on the map. The Identify Dialogue Box will then list each stream and river in the selected area. Once this has been accomplished the user can select each stream or river listed in the Identify Dialogue Box to display the aspects of each stream and river including length and stream order.

Find Button

The Find Button can be used to help pinpoint a specific location or feature. Once the Find Button is selected the Find Dialogue Box will open. Within the Find Dialogue Box locations/features can be searched by choosing either the Features, Places, or Addresses tab. The simplest way to search in the SWSI Phase II ArcReader application is by selecting the Features Tab. This allows the user to search for a location/feature based upon specific data layers. To find a location simply type the location/feature name in the "Find" Box, then select the appropriate layer from the "In" Box (or select "Visible Layers" or "All Layers") and click the "Find" Button in the dialogue box. The bottom of the Find Dialogue Box will then display all found values. By right-clicking on a found value the user can flash, zoom, or pan to the location/feature.

Map Display

The Map Display shows the data layers and their extent, as well as the print layout. It is important to note that the data layers portion of the print layout can be moved around within the printable extent of the page. Therefore, the Map Display should be checked prior to printing to ensure that the page layout is correct.

Printing

Printing maps from ArcReader is similar to printing documents from most other applications. There is a shortcut print button next to the Data Toolbar or the user can access the Print and Page Setup dialogue boxes from the "File" menu. Some important things to remember include:

1. The map has been set up to print 8.5X11 landscape. The page setup dialogue box will allow the user to alter these parameters.

2. There are two views available in ArcReader, the data view and the layout view. The bottom left corner of the Map Display has buttons to access either view. Before printing the user should check the layout view to make sure the correct data will be printed.

Appendix E
CWCB Instream Flow Filing Tabulations

Colorado Water Conservation Board

Instream Flow Tabulation - Streams

Water Division 1

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
1-94CW260	Bear Creek	Upper South Platte	Jefferson	confl Swede Gulch in SE NW S36 T4S R71W 6PM	Harriman Ditch in NE NW S2 T5S R70W 6PM	8.20	Evergreen Morrison	15 (04/1 - 10/15) 7 (10/16 - 03/31)	9/13/1994
1-89CW205	Big Thompson River	Big Thompson	Larimer	confl NFK Big Thompson River at lat 40 25 56N long 105 20 18W	Idylwild Pipeline diversion at lat 40 25 44N long 105 18 42W	1.50	Drake	50 (05/1 - 10/31) 20 (11/1 - 04/30)	11/14/1989
1-89CW206	Big Thompson River	Big Thompson	Larimer	Loveland Powerplant outfall at lat 40 25 13N long 105 16 52W	Dille Tunnel diversion at lat 40 25 06N long 105 14 36W	2.50	Drake Masonville	50 (05/1 - 10/31) 20 (11/1 - 04/30)	11/14/1989
1-94CW246	Cherry Creek	Middle South Platte-Cherry Creek	Douglas	confl unnamed tributary in NW SE S25 T8S R66W 6PM	John Jones Ditch in SW SE S10 T8S R66W 6PM	4.50	Castle Rock South Russellville Gulch	7 (03/1 - 04/30) 3.5 (05/1 - 06/15) 1.5 (06/16 - 10/31) 3.5 (11/1 - 02/29)	12/22/1994
1-86CW342	Lefthand Creek	St. Vrain	Boulder	confl James Creek at lat 40 06 08N long 105 20 29W	Lake Ditch diversion in NE NE S23 T2N R71W 6PM	3.70	Boulder Lyons	7 (04/1 - 4/30) 14 (05/1 - 7/31) 7 (08/1 - 9/30) 3 (10/1 - 3/31)	9/5/1986
1-85CW433	Lone Pine Creek	Cache la Poudre	Larimer	confl NF and SF Lone Pine in lat 40 47 16N long 105 26 26W	hdgt Burnham & Emerson D in lat 40 47 02N long 105 19 40W	8.50	Haystack Gulch Livermore Mountain	3.5 (01/1 - 12/31)	11/8/1985

Instream Flow Tabulation - Water Division 1

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
1-87CW278	South St Vrain Creek	St. Vrain	Boulder	confl Middle St Vrain Creek at lat 40 10 03N long 105 23 46W	hdgate of Longmont Diversion in SE NW S19 T3N R70W 6PM	9.10	Lyons Raymond	20 (04/1 - 09/30) 12 (10/1 - 11/30) 7 (12/1 - 03/31)	12/11/1987

Totals for Water Division 1

Total # of Stream Miles = **38**

Total # of Appropriations = **7**

(Totals do not include donated/acquired water

Instream Flow Tabulation - Water Division 2

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
2-00CW105	Fourmile Creek	Upper Arkansas	Fremont	confl Felch Creek at lat 38 32 35N long 105 13 13W	Canon Heights Diversion Structure lat 38 31 44N long 105 12 59W	1.20	Cooper Mountain	9.5 (04/15 - 10/14) 5 (10/15 - 04/14)	1/26/2000
2-98CW150	Graneros Creek	Upper Arkansas	Pueblo	headwaters in the vincinity of lat 37 52 59N long 105 01 22W	Evergreen Ditch in SE NW S1 T68W R25S 6PM	5.40	Rye San Isabel	0.5 (03/15 - 04/30) 1.25 (05/1 - 08/14) 0.5 (08/15 - 11/30) 0.3 (12/1 - 03/14)	5/11/1998
2-82CW138	Grape Creek		Fremont Custer	DeWeese Resevoir outlet in NE SE S20 T21S R72W 6PM	DeWeese - Dye ditch hdgt in S1 T19S R71W 6PM	24.50	Curley Peak Iron Mountain Royal Gorge Westcliffe	8 (10-1 - 4-30) 16 (5-1 - 9-30)	6/3/1982
2-98CW154	Greenhorn Creek	Huerfano Upper Arkansas	Pueblo	headwaters in vincinity of lat 37 56 26N long 105 03 40W	Highline Ditch in SW NE S36 T24S R68W 6PM	6.80	Rye San Isabel	1.5 (03/15 - 04/30) 4.75 (05/1 - 07/14) 1.5 (07/15 - 11/14) 0.85 (11/15 - 03/14)	5/11/1998
2-98CW148	Greenhorn Creek	Upper Arkansas	Pueblo Custer	Highline Ditch in SW NE S36 T24S R68W 6PM	Hicklin A Ditch in NE NE S26 T24S R67W 6PM	6.30	Colorado City Rye Southwest Pueblo	2.25 (04/1 - 06/30) 1.25 (07/1 - 03/31)	5/11/1998
2-82CW145	Greenleaf Creek	Arkansas	Custer	confl North & South Forks at lat 38 10 27N long 105 36 12W	headgate Schaeller D No 1 in S30 T21S R73W 6PM	2.00	Beckwith Mountain	1 (01/1 - 12/31)	6/3/1982
2-82CW149	Hudson Creek		Custer	from headwaters in lat 37 57 02N long 105 30 46W	Daemgen Ditch hdgt in S18 T24S R72W 6PM	2.00	Beck Mountain Crestone Peak	1.5 (10-1 - 9-30)	6/3/1982
2-82CW151	North Brush Creek	Arkansas	Custer	confl S Branch N Brush Creek at lat 38 12 58N long 105 40 16W	headgate T Balman #1 Ditch in SE NE S14 T46N R12E	4.50	Beckwith Mountain Electric Peak	1.5 (01/1 - 12/31)	6/3/1982

Instream Flow Tabulation - Water Division 2

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
2-77W4659	North Fork South Arkansas River	Arkansas	Chaffee	confl McCoy Creek at lat 38 35 38N long 106 14 57W	headgate North Fork Ditch in S34 T50N R7E NMPM	6.00	Maysville	10 (01/1 - 12/31)	11/15/1977
2-82CW152	Spruce Creek	Arkansas	Custer	headwaters in vicinity of lat 38 13 57N long 105 41 09W	headgate of Lemaster Ditch in NE SW S9 T46N R12E	3.10	Cotopaxi Electric Peak	1.5 (01/1 - 12/31)	6/3/1982

Totals for Water Division 2

Total # of Stream Miles = **61.8**

Total # of Appropriations = **10**

(Totals do not include donated/acquired water

Instream Flow Tabulation - Water Division 3

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
3-94CW054	Bennett Creek	Rio Grande headwaters	Mineral	headwaters at lat 37 52 23N long 107 04 31W	Bennett Creek Diversion Struct at lat 37 50 12N long 107 07 35W	4.40	Bristol Head Hermit Lakes	1.5 (04/1 - 10/15) 0.5 (10/16 - 3/31)	3/9/1994
3-94CW042	Big Spring Creek	San Luis Creek	Saguache Alamosa	1.4 mi d/s of Indian Spring at lat 37 45 14N long 105 38 27W	headgate Los Ojos Ditch at lat 37 44 07N long 105 40 04W	2.35	Medano Ranch Sand Camp	6 (01/1 - 12/31)	11/3/1994
3-03CW036	Eaglebrook Creek	San Luis Creek	Saguache	Forest Service boundary at lat 38 20 28N long 105 57 16W	McFarland Ditch A&B at lat 38 20 02N long 105 57 53W	1.00	Bushnell Peak	0.75 (05/15 - 10/31) 0.5 (11/01 - 11/30) 0.35 (12/01 - 05/14)	1/22/2003
3-03CW039	Garner Creek	San Luis Creek	Saguache	USFS QP 53G4 at lat 38 10 53N long 105 47 24W	Garner Creek Ditch at lat 38 10 25N long 105 48 32W	1.20	Valley View Hot Springs	1.9 (05/01 - 09/14) 0.6 (09/15 - 04/30)	1/22/2003
3-03CW040	La Garita Creek	San Luis Creek	Saguache	Sentry Box Dam site at lat 37 48 53N long 106 19 37W	headgate Biedell Ditch #10 at lat 37 48 55N long 106 17 03W	2.00	Twin Mountains	3.5 (05/01 - 10/31) 2.1 (11/01 - 04/30)	1/22/2003
3-76W3648	La Jara Creek	Alamosa-Trinchera	Conejos	outlet La Jara Res in S29 T35N R6E NMPM	headgate Pino Real Ditch in NE S10 T34N R7E NMPM	16.00	La Jara Canyon Vicente Canyon	5 (01/1 - 12/31)	11/17/1976
03/3/A-020	Raspberry Creek		Saguache	National Forest boundary lat 38 20 29N long 105 56 31W	headgate Prairie Dog Ditch lat 38 19 24N long 105 56 45W	1.80	Bushnell Peak	0.8 (05/15 - 09/30) 0.3 (10/01 - 05/14)	
3-82CW208	Saguache Creek	Saguache Creek	Saguache	confl Sheep Creek in SE SW S20 T45N R5E	headgate Star Ditch in SE NW S32 T45N R7E	19.90	Lake Mountain Lake Mountain NE Laughlin Gulch Saguache Trickle Mountain	8 (05/1 - 09/30) 5 (10/1 - 04/30)	10/7/1982

Instream Flow Tabulation - Water Division 3

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
3-94CW053	Woodfern Creek	Rio Grande headwaters	Mineral	headwaters at lat 37 42 16N long 107 07 41W	Woodfern Ditch in NW NW S15 T40N R2W	3.30	Little Squaw Creek Workman Creek	1.25 (04/16 - 4/30) 2.25 (05/1 - 6/30) 1.25 (07/1 - 8/31) 0.4 (09/1 - 4/15)	3/9/1994

Totals for Water Division 3

Total # of Stream Miles = **51.95**

Total # of Appropriations = **9**

(Totals do not include donated/acquired water

Instream Flow Tabulation - Water Division 4

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
4-80CW134	Alder Creek	Tomichi Creek	Gunnison	headwaters in SE NE S32 T51N R3E NMPM	headgate Sutton No 1 D in NE NE S12 T49N R2E NMPM	8.90	Crystal Creek Parlin	5 (01/1 - 12/31)	3/17/1980
4-84CW439	Beaver Creek	San Miguel	San Miguel	headwaters in vicinity of lat 37 49 57N long 108 11 43W	Gurley Ditch diversion at lat 37 52 55N long 108 09 33W	4.60	Beaver Park Groundhog Mountain	1.5 (01/1 - 12/31)	7/13/1984
4-02CW262	Big Blue Creek	Upper Gunnison	Gunnison	confl Failes Creek at lat 38 14 55N long 107 24 23W	headgate Big Blue Ditch at lat 38 20 45N long 107 25 16W	7.50	Lost Lake Sheep Mountain	11.3 (05/01 - 10/31) 10.4 (11/01 - 04/30)	1/23/2002
4-02CW264	Blue Creek	Lower Dolores	Mesa	confl Calamity Creek at lat 38 32 06N long 108 50 02W	headgate Tom Watkins Ditch at lat 38 32 12N long 108 52 27W	3.00	Calamity Mesa	1 (03/15 - 04/14) 3.5 (04/15 - 05/14) 1 (05/15 - 06/14) 0.5 (06/15 - 03/14)	1/23/2002
4-83CW229	Brush Creek	East-Taylor	Gunnison	confl West Brush Creek at lat 38 54 01N long 106 52 50W	Jarvis Ditch headgate at lat 38 53 19N long 106 53 50W	1.40	Gothic	12 (05/1 - 09/30) 7 (10/1 - 04/30)	6/3/1982
4-02CW265	Butcher Creek	San Miguel	San Miguel	headwaters at lat 37 57 16N long 107 48 43W	Brewery Pipeline diversion at lat 37 56 40N long 107 49 12W	0.90	Telluride	0.65 (05/15 - 07/31) 0.2 (08/01 - 05/14)	1/23/2002
4-80CW105	Castle Creek	Upper Gunnison	Gunnison	confl N & S Castle Creeks at lat 38 45 36N long 107 07 11W	headgate Acme Ditch at lat 38 46 08N long 107 04 20W	3.10	Mount Axtell	7 (01/1 - 12/31)	3/17/1980
4-84CW420	Cow Creek	Uncompahgre	Ouray	confl Wildhorse Creek at lat 38 03 19N long 107 34 25W	diversion near Forest boundary at lat 38 08 25N long 107 38 16W	7.00	Ouray Wetterhorn Peak	18 (04/1 - 07/31) 5 (08/1 - 03/31)	5/4/1984
4-98CW232	Devils Creek	Upper Gunnison	Hinsdale	headwaters in vicinity of lat 38 07 24N long 107 12 51W	hdgt. Steele Ditch in SE SE S24 T45N R4W	3.50	Alpine Plateau Powderhorn Lakes	0.75 (01/1 - 12/31)	1/29/1998

Instream Flow Tabulation - Water Division 4

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
4-84CW440	East Beaver Creek	San Miguel	San Miguel	headwaters in vicinity of lat 37 51 46N long 108 07 18W	Gurley Ditch diversion at lat 37 53 23N long 108 09 10W	4.80	Dolores Peak Groundhog Mountain	2.5 (01/1 - 12/31)	7/13/1984
4-84CW424	East Fork Dallas Creek	Uncompahgre	Ouray	confl Wilson Creek at lat 38 02 34N long 107 48 24W	Doc Wade diversion in SW SW S1 T44N R9W	3.70	Mount Sneffels	10 (03/1 - 09/30) 5 (10/1 - 02/29)	5/4/1984
4-05CW250	Escalante Creek	Lower Gunnison	Mesa	confl EF & MF Escalante Crks at lat 38 34 55N long 108 24 21W	headgate Knob Hill Ditch at lat 38 37 34N long 108 23 48W	3.90	Escalante Forks Kelso Point	3.2 (03/01 - 03/31) 11.5 (04/01 - 06/14) 3.2 (06/15 - 07/31) 1.3 (08/01 - 02/28)	1/25/2005
4-05CW251	Escalante Creek	Lower Gunnison	Montrose Mesa Delta	confl NF Escalante Creek at lat 38 37 57N long 108 23 30W	hdgt Captain H.A. Smith Ditch at lat 38 40 47N long 108 18 41W	6.40	Escalante Forks Kelso Point	4 (03/01 - 03/31) 8.2 (04/01 - 06/14) 4 (06/15 - 07/31) 1.5 (08/01 - 02/28)	1/25/2005
4-80CW091	Farris Creek	East-Taylor	Gunnison	headwaters in vicinity of lat 38 52 56N long 106 49 57W	headgate Meads No. 3 Ditch at lat 38 51 46N long 106 53 30W	3.90	Cement Mountain Crested Butte Pearl Pass	5 (01/1 - 12/31)	3/17/1980
4-80CW135	Gold Creek	Tomichi Creek	Gunnison	headwaters in NE SW S7 T51N R4E NMPM	headgate Tarkington Ditch in SW SE S23 T50N R3E	9.00	Fairview Peak Pitkin	7 (01/1 - 12/31)	3/17/1980
4-84CW396	Little Cimarron River	Upper Gunnison	Montrose Hinsdale Gunnison	headwaters in vicinity of lat 38 07 00N long 107 26 58W	Butte Ditch in NE NW S13 T47N R6W NMPM	16.40	Lost Lake Sheep Mountain Uncompahgre Peak	2 (01/1 - 12/31)	5/4/1984
4-04CW158	Little Dolores River	Little Dolores	Mesa	confl Bieser Creek at lat 38 59 13N long 108 54 48W	hdgt Upper Saxbury Ditch at lat 39 00 28N long 108 56 12W	2.50	Bieser Creek Sieber Canyon	2.4 (04/01 - 07/31) 1.6 (08/01 - 10/31) 1 (11/01 - 03/31)	1/28/2004

Instream Flow Tabulation - Water Division 4

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
02/4/B-013	Mesa Creek		Montrose	confluence North & South Fork Mesa Creek lat 38 27 10N long 108 49 00W	Mesa Creek Ditch lat 38 27 03N long 108 49 17W	0.30	Red Canyon	6.1 (04/01 - 06/14) 1.75 (06/15 - 10/31) 3.2 (11/01 - 03/31)	
4-02CW273	Mill Creek	San Miguel	San Miguel	headwaters in vicinity of lat 37 58 36N long 107 48 02W	diversion at lat 37 57 44N long 107 49 27W	2.00	Telluride	6.7 (05/01 - 07/14) 2.4 (07/15 - 11/30) 1.9 (12/01 - 04/30)	1/23/2002
4-80CW136	No Name Creek	Tomichi Creek	Gunnison	headwaters in vicinity of lat 38 31 08N long 106 21 10W	headgate Means Bros No 10 D at lat 38 29 19N long 106 24 39W	4.50	Garfield Sargents Whitepine	2 (01/1 - 12/31)	3/17/1980
06/04/A-002	North Fork Escalante Creek	Lower Gunnison	Mesa	Points Creek lat 38 35 05N long 108 35 03W	Sawtell Ditch lat 38 36 40N long 108 28 27W	6.60	Escalante Forks Kelso Point Snipe Mountain	3.7 (4/1 - 6/14) 0.6 (6/15 - 3/31)	
4-02CW274	North Fork Mesa Creek	Lower Dolores	Montrose Mesa	confl Long Canyon at lat 38 33 51N long 108 44 41W	headgate Cedar Tree Ditch at lat 38 29 45N long 108 47 38W	5.90	Calamity Mesa Red Canyon Uncompahgre Butte	1.9 (03/01 - 03/31) 2.75 (04/01 - 05/31) 0.5 (06/01 - 02/29)	1/23/2002
4-98CW217	Razor Creek	Tomichi Creek	Saguache	confl Prosser Creek in SE SE S31 T48N R3E NMPM	Balch Ditch headgate in SE SE S30 T48N R3E NMPM	1.20	Houston Gulch Razor Creek Dome	1.5 (04/15 - 10/31) 0.75 (11/1 - 04/14)	5/11/1998
4-92CW172	Road Beaver Creek	Upper Gunnison	Saguache Gunnison	headwaters at lat 38 13 25N long 106 59 04W	headgate Beaver Creek Ditch at lat 38 14 06N long 107 02 01W	5.70	Rock Creek Park Rudolph Hill	1.6 (05/01 - 09/30) 0.6 (10/1 - 04/30)	11/9/1992
4-92CW173	Rock Creek	Upper Gunnison	Saguache Hinsdale	headwaters in vicinity of lat 38 13 16N long 106 53 53W	headgate JW Brown Ditch at lat 38 07 46N long 107 00 47W	13.70	Rock Creek Park Rudolph Hill	3 (05/1 - 9/30) 0.75 (10/1 - 4/30)	11/9/1992

Instream Flow Tabulation - Water Division 4

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
04/4/A-012	Roubideau Creek	Lower Gunnison	Montrose Delta	Potter Creek lat 38 38 18N long 108 11 40W	Ditch lat 38 40 18N long 108 09 09W		Camel Back Roubideau		
05/04/A-007	South Fork Smith Fork	North Fork Gunnison	Gunnison	headwaters lat 38 40 20N long 107 24 30W	Saddle Mountain Ditch lat 38 43 24N long 107 28 04W	5.50	Mount Guero	4.1 (03/15 - 04/14) 6.4 (04/15 - 07/31) 3 (08/01 - 11/14) 2.4 (11/15 - 03/14)	
02/4/B-022	Specie Creek		San Miguel	headwaters lat 37 56 32N long 108 04 53W	headgate Hughes Ditch lat 37 57 27N long 108 04 57W	1.10	Little Cone		
4-92CW174	Spring Creek	Upper Gunnison	Saguache Hinsdale	headwaters at lat 37 57 39N long 106 56 48W	headgate Creede Trail Ditch at lat 38 03 53N long 107 00 07W	8.40	Mineral Mountain San Luis Peak Stewart Peak	8 (05/01 - 09/30) 3 (10/1 - 4/30)	11/9/1992
4-05CW245A	Spring Creek	Upper Gunnison	Gunnison	spring outlet at lat 39 01 55N long 107 18 57W	hdgt Downing Ditch at lat 39 01 55N long 107 19 40W	0.80	Chair Mountain	2.7 (04/15 - 08/14) 0.8 (08/15 - 10/14) 0.5 (10/15 - 04/14)	1/23/2002
4-05CW245B (enlargement)	Spring Creek	Upper Gunnison	Gunnison	spring outlet at lat 39 01 55N long 107 18 57W	hdgt Downing Ditch at lat 39 01 55N long 107 19 40W	0.80	Chair Mountain	1.9 (08/15 - 10/14) 2.2 (10/15 - 04/14)	5/25/2005
4-04CW163	Spring Creek	Uncompahgre	Ouray Montrose	confl E & M Fks Spring Creek at lat 38 19 49N long 107 59 53W	hdgt Kenton Ditch at lat 38 23 23N long 107 56 47W	5.50	Government Springs Montrose West	5.3 (04/01 - 06/15) 2.6 (06/16 - 07/31) 0.9 (08/01 - 03/31)	1/28/2004
04/4/A-003	Tabequache Creek	San Miguel	Montrose	Fortyseven Creek lat 38 22 09N long 108 31 03W	Skees Ditch Headgate lat 38 21 38N long 108 33 09W	2.70	Nucla		
4-98CW223	Trout Creek	Upper Gunnison	Hinsdale Gunnison	headwaters in vicinity of lat 38 08 36N long 107 11 42W	Johnson Ditch headgate in NW NE S19 T46N R3W NMPM	7.90	Powderhorn Lakes	1.25 (05/1 - 10/31) 0.75 (11/1 - 04/30)	5/11/1998

Instream Flow Tabulation - Water Division 4

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
4-04CW164	West Antelope Creek	Upper Gunnison	Gunnison	headwaters in vicinity of lat 38 39 45N long 107 03 23W	Dooley Antelope Ditch at lat 38 34 48N long 106 58 51W	7.80	Gunnison McIntosh Mountain Squirrel Creek	1.1 (01/15 - 03/31) 1.65 (04/01 - 08/31) 1.2 (09/01 - 01/14)	1/28/2004
4-84CW441	West Beaver Creek	San Miguel	San Miguel	headwaters in vicinity of lat 37 50 54N long 108 13 19W	W Beaver Highline Ditch hdgt at lat 37 54 23N long 108 11 32W	4.50	Beaver Park Groundhog Mountain	1.5 (01/1 - 12/31)	7/13/1984
4-84CW423	West Fork Dallas Creek	Uncompahgre	Ouray	headwaters in vicinity of lat 38 01 35N long 107 51 53W	Burkhart Eddy diversion in NE SE S34 T45N R9W	6.30	Mount Sneffels Ridgway	2.5 (01/1 - 12/31)	5/4/1984
4-92CW175	Willow Creek	Upper Gunnison	Saguache Hinsdale Gunnison	outlet Rainbow Lake at lat 38 38 03N long 107 10 40W	headgate Alfred Ditch at lat 38 30 12N long 107 07 12W	10.00	McIntosh Mountain Rock Creek Park West Elk Peak	1.5 (05/1 - 09/30) 0.75 (10/1 - 04/30)	11/9/1992

Totals for Water Division 4

Total # of Stream Miles = 191.7

Total # of Appropriations = 38

(Totals do not include donated/acquired water

Instream Flow Tabulation - Water Division 5

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
5-80CW118	Abrams Creek	Eagle	Grand	headwaters in SE SE S25 T5S R85W 6PM	diversion in SE SW S9 T5S R84W 6PM	4.30	Eagle The Seven Hermits	0.5 (01/1 - 12/31)	3/17/1980
5-85CW644	Acorn Creek	Blue	Summit	headwaters near lat 39 44 18N long 106 04 02W	diversion near lat 39 45 45N long 106 06 45W	3.50	Dillon Squaw Creek Ute Peak	1 (01/1 - 12/31)	11/8/1985
5-90CW313	Cabin Creek	Colorado headwaters	Grand	headwaters at natural lake at lat 40 00 33N long 105 42 02W	Denver Water Board diversion at lat 39 59 12N long 105 44 32W	3.50	East Portal Monarch Lake	2 (04/1 - 04/30) 4.5 (05/1 - 08/31) 2 (09/1 - 10/31) 0.75 (11/1 - 03/31)	11/27/1990
5-03CW264	Canyon Creek	Colorado Headwaters-Plateau	Garfield	confl Johnson Creek lat 39 42 28N long 107 23 11W	headgate Baxter Ditch #1 lat 39 37 49N long 107 26 50W	7.50	Adams Lake	13.5 (04/15 - 05/14) 24.1 (05/15 - 07/14) 13.5 (07/15 - 08/14) 9.4 (08/15 - 04/14)	1/22/2003
5-95CW289	Castle Creek	Colorado headwaters	Eagle	confl unnamed tributary at lat 39 48 08N long 106 51 25W	Castle Creek Ditch in SW NE S29 T2S R84W 6PM	4.60	Castle Peak	1.75 (04/1 - 07/31) 1 (08/1 - 08/31) 0.5 (09/1 - 03/31)	11/6/1995
5-97CW273 (enlargement)	Cattle Creek	Roaring Fork	Garfield	confl Coulter Creek in SW NW S8 T7S R87W 6PM	confl Park Ditch in SW NW S7 T7S R87W 6PM	3.50	Carbondale Cattle Creek	2 (05/1 - 10/31)	9/22/1997
5-03CW267	Cottonwood Creek	Colorado Headwaters-Plateau	Eagle	confl Slaughter Sprg Glch at lat 39 32 11N long 107 02 15W	headgate Anderson Ditch at lat 39 34 02N long 107 02 09W	2.20	Cottonwood Pass	1.7 (05/01 - 10/31) 1.3 (11/01 - 04/30)	1/22/2003
5-03CW271	East Canyon Creek	Colorado Headwaters-Plateau	Garfield	confl Keyser Creek at lat 39 38 11N long 107 24 21W	Keyser Creek Ditch at lat 39 37 16N long 107 25 05W	1.30	Adams Lake Storm King Mountain	12 (05/01 - 07/31) 3.8 (08/01 - 04/30)	1/22/2003

Instream Flow Tabulation - Water Division 5

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
5-90CW289	Fraser River	Colorado headwaters	Grand	headwaters in vicinity of lat 39 48 10N long 105 45 33W	Fraser River Diversion Dam at lat 39 51 43N long 105 44 57W	4.90	Berthoud Pass Empire	6 (04/15 - 09/30) 2.5 (10/1 - 04/14)	11/27/1990
5-90CW282	Hamilton Creek	Colorado headwaters	Grand	headwaters in vicinity of lat 40 00 35N long 105 42 24W	Denver Water Board diversion at lat 39 59 50N long 105 44 40W	2.70	East Portal Monarch Lake	3 (05/15 - 08/14) 0.35 (08/15 - 05/14)	11/27/1990
5-03CW268	Horse Creek	Colorado Headwaters-Plateau	Eagle	outlet Horse Lake at lat 39 49 51N long 107 05 56W	headgate Horse Cr Ditch at lat 39 45 43N long 107 01 45W	6.80	Sugarloaf Mountain	0.95 (04/01 - 08/31) 0.5 (09/01 - 03/31)	1/22/2003
5-90CW283	Iron Creek	Colorado headwaters	Grand	headwaters at natural lake at lat 39 51 10N long 105 57 17W	Denver Water Board diversion at lat 39 51 38N long 105 54 28W	2.50	Byers Peak	2.5 (04/15 - 08/31) 1 (09/1 - 10/31) 0.5 (11/1 - 04/1)	11/27/1990
5-90CW286	Jim Creek	Colorado headwaters	Grand	headwaters in vicinity of lat 39 50 25N long 105 42 19W	diversion structure at lat 39 52 52N long 105 44 29W	4.20	East Portal Empire	4 (04/15 - 09/30) 1.5 (10/1 - 11/30) 1 (12/1 - 04/14)	11/27/1990
5-90CW310	Meadow Creek	Colorado headwaters	Grand	outlet Meadow Creek Reservoir in NE NE S14 T1N R75W 6PM	Vail Irr Sys Headgate #1 in NE SE S16 T1N R75W 6PM	2.10	Strawberry Lake	3.5 (05/1 - 09/30) 1.5 (10/1 - 04/30)	11/27/1990
5-85CW637	Mesa Creek	Colorado Headwaters-Plateau	Mesa	confl unnamed tributary in SW SE S27 T11S R96W 6PM	headgate Mesa Creek Ditch in SW SE S16 T11S R96W 6PM	3.00	Lands End Mesa Skyway	2.5 (01/1 - 12/31)	11/8/1985
5-85CW637A	Mesa Creek	Colorado Headwaters-Plateau	Mesa	confl Big Beaver Creek in SE SW S8 T11S R96W 6PM	headgate Mason & Eddy in NE SE S30 T10S R96W 6PM	4.60	Lands End Mesa Skyway	2.5 (01/1 - 12/31)	11/8/1985

Instream Flow Tabulation - Water Division 5

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
5-90CW288	Middle Fork Ranch Creek	Colorado headwaters	Grand	headwaters at Deadman Lake at lat 39 55 13N long 105 41 32W	Denver Water Board diversion in NW SW S25 T1S R75W 6PM	2.60	East Portal	3.5 (05/1 - 08/14) 1.5 (08/15 - 10/31) 0.5 (11/1 - 03/31)	11/27/1990
5-98CW305	Muddy Creek	Colorado headwaters	Grand	outlet Wolford Mtn Reserv in SW NE S25 T2N R81W 6PM	hdgte Deberard Ditch in NE SE S7 T1N R80W 6PM	9.00	Hinman Reservoir Kremmling	70 (05/1 - 05/14) 105 (05/15 - 06/30) 70 (07/1 - 07/14) 20 (07/15 - 04/30)	7/13/1998
5-87CW276	North Fork Colorado River	Colorado headwaters	Grand	confl with Onahu Creek in SW NE S24 T4N R76W 6PM	hdgt Redtop Valley Ditch at lat 40 15 06N long 105 52 02W	5.30	Grand Lake	18 (05/1 - 09/30) 10 (10/1 - 04/30)	10/2/1987
5-90CW280	Pole Creek	Colorado headwaters	Grand	headwaters in NW NW S14 T1S R77W 6PM	Gehman-Just headgate in SW SE S5 T1S R76W 6PM	2.50	Bottle Pass	1.5 (04/1 - 08/31) 0.5 (09/1 - 03/31)	11/27/1990
5-87CW273	Prince Creek	Roaring Fork	Pitkin	headwaters in SW SW S8 T9S R87W 6PM	headgate Mt. Sopris Ditch at lat 39 20 52N long 107 10 00W	6.20	Mount Sopris	1 (01/1 - 12/31)	10/2/1987
5-90CW290	Ranch Creek	Colorado headwaters	Grand	headwaters at Pumphouse Lake at lat 39 55 34N long 105 41 25W	Denver Water Board diversion in SE SW S24 T1S R75W 6PM	2.80	East Portal	4 (04/15 - 08/14) 1.5 (08/15 - 09/30) 0.5 (10/1 - 04/14)	11/27/1990
5-95CW286	Red Dirt Creek	Colorado headwaters	Eagle	confl EF & WF Red Dirt Ck in NE NE S3 T3S R86W 6PM	Wilson and Doll Ditch in NW SE S12 T3S R86W 6PM	2.60	Burns South Sugarloaf Mountain	3 (04/1 - 07/31) 1.75 (08/1 - 10/31) 1 (11/1 - 03/31)	11/6/1995
5-03CW265	Salt Creek	Eagle	Eagle	confl Kelly Creek at lat 39 35 07N long 106 41 37W	headgate Hashberger Ditch at lat 39 35 06N long 106 42 02W	0.40	Fulford	0.75 (01/01 - 12/31)	1/22/2003
5-89CW185	Sheep Creek	Colorado headwaters	Eagle	confl E & W Fks Sheep Ck in SW NW S19 T3S R86W 6PM	hdgt Allen Ditch in SE NE S25 T3S R87W 6PM	1.00	Sugarloaf Mountain	1.5 (04/1 - 09/30) 0.75 (10/1 - 03/31)	7/11/1989

Instream Flow Tabulation - Water Division 5

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
5-89CW182	South Fork Derby Creek	Colorado headwaters	Eagle	headwaters at lat 39 55 04N long 107 10 08W	hdgt South Derby Ditch in SE NW S8 T2S R86W 6PM	6.50	Dome Peak Trappers Lake	4.5 (04/1 - 09/30) 2 (10/1 - 03/31)	7/11/1989
5-90CW291	South Fork Ranch Creek	Colorado headwaters	Grand	headwaters in vicinity of lat 39 52 59N long 105 42 27W	Denver Water Board diversion in SE NW S35 T1S R75W 6PM	3.40	East Portal	3.5 (05/1 - 08/14) 1 (08/15 - 10/31) 0.5 (11/1 - 03/31)	11/27/1990
5-03CW272	Spring Creek	Eagle	Eagle	headwater springs at lat 39 35 49N long 106 53 51W	headgate Best Ditch at lat 39 36 23N long 106 54 40W	1.00	Suicide Mountain	0.35 (01/01 - 12/31)	1/22/2003
5-90CW303	St Louis Creek	Colorado headwaters	Grand	headwaters in vicinity of lat 39 48 27N long 105 57 20W	Denver Water Board diversion at lat 39 51 09N long 105 54 34W	4.70	Byers Peak	6 (05/15 - 09/15) 2.5 (09/16 - 05/14)	11/27/1990
5-90CW316	St Louis Creek	Colorado headwaters	Grand	confl King Creek at lat 39 54 52N long 105 52 27W	Tyron ditch diversion in NW NE S19 T1S R75W 6PM	4.20	Fraser	6 (05/15 - 09/15) 3.5 (09/16 - 05/14)	11/27/1990
5-85CW651	Stillwater Creek	Colorado headwaters	Grand	headwaters in the vicinity of lat 40 16 25N long 105 59 20W	headgate Redtop Valley Ditch in SE NW S22 T3N R76W 6PM	8.20	Bowen Mountain Trail Mountain	3 (01/1 - 12/31)	11/8/1985
5-85CW648	Straight Creek	Blue	Summit	headwaters in vicinity of lat 39 41 37N long 105 55 42W	diversion in SW NW S4 T5S R77W 6PM	6.90	Dillon Loveland Pass	2.5 (01/1 - 12/31)	11/8/1985
5-90CW295	Strawberry Creek	Colorado headwaters	Grand	confl unnamed tributary in SW NE S5 T1N R75W 6PM	Vail Irr Sys Headgate #2 at lat 40 04 24N long 105 51 25W	3.60	Granby Strawberry Lake	2 (04/15 - 09/30) 1 (10/1 - 04/14)	11/27/1990
5-85CW629	Supply Creek	Colorado headwaters	Grand	confl N & M Supply Creek at lat 40 16 25N long 105 52 46W	hdgt Redtop Valley Ditch in SE SW S2 T3N R76W 6PM	1.80	Bowen Mountain Shadow Mountain	3 (01/1 - 12/31)	11/8/1985

Instream Flow Tabulation - Water Division 5

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
5-03CW273	Thomas Creek	Roaring Fork	Pitkin	outlet St John Reservoir at lat 39 19 00N long 107 09 46W	headgate Lewis Ditch at lat 39 20 05N long 107 11 03W	1.80	Mount Sopris	1.5 (05/01 - 07/31) 0.5 (08/01 - 04/30)	1/22/2003
5-03CW275	Thompson Creek	Roaring Fork	Pitkin	confl N & S Thompson Cr at lat 39 18 49N long 107 15 33W	hdgt Northside Thompson D at lat 39 19 56N long 107 13 08W	2.80	Mount Sopris Stony Ridge	12.4 (04/01 - 07/14) 4.3 (07/15 - 03/31)	1/22/2003
5-90CW292	Vasquez Creek	Colorado headwaters	Grand	headwaters at Vasquez Lake at lat 39 48 19N long 105 53 14W	Denver Water Board diversion at lat 39 51 56N long 105 49 12W	6.80	Berthoud Pass Byers Peak	2.5 (01/1 - 12/31)	11/27/1990
5-90CW318	Vasquez Creek	Colorado headwaters	Grand	Denver Water Board diversion at lat 39 51 56N long 105 49 12W	Grand County diversion in SW NE S5 T2S R75W 6PM	3.10	Berthoud Pass Fraser	6 (05/15 - 09/15) 3 (09/16 - 05/14)	11/27/1990

Totals for Water Division 5

Total # of Stream Miles = 148.4

Total # of Appropriations = 37

(Totals do not include donated/acquired water

Instream Flow Tabulation - Water Division 6

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
6-81CW295	Arapaho Creek	North Platte headwaters	Jackson	confl MF & SF Arapaho Creek at lat 40 24 55N long 106 23 22W	headgate Eureka Ditch at lat 40 26 10N long 106 24 29W	2.00	Spicer Peak	8 (01/1 - 12/31)	12/3/1981
6-92CW075	Beaver Creek	Upper Green-Flaming Gorge Reservoir	Moffat	Utah-Colorado Stateline in SW SW S24 T11N R104W 6PM	confl Jarvee Ditch in SW SE S12 T10N R104W	4.70	Swallow Canyon Willow Creek Butte	3.25 (04/1 - 08/31) 2 (09/1 - 03/31)	9/16/1992
6-81CW297	Colorado Creek	North Platte headwaters	Jackson	headwaters in vicinity of lat 40 26 20N long 106 38 28W	headgate Moraine Ditch at lat 40 28 14N long 106 35 47W	4.10	Mount Werner Rabbit Ears Peak	3 (01/1 - 12/31)	12/3/1981
6-92CW049	East Branch	North Platte headwaters	Jackson	headwaters at SE SE S5 T4N R78W 6PM	headgate School Section Ditch at lat 40 23 40N long 106 07 48W	5.20	Parkview Mountain Rand	2.5 (04/1 - 09/30) 1 (10/1 - 03/31)	5/8/1992
6-77W1285	Hinman Creek	Upper Yampa	Routt	confl Farwell Creek at lat 40 49 53N long 106 48 48W	headgate Sunnyside Ditch in SW SW S4 T9N R84W 6PM	5.50	Farwell Mountain	4 (01/1 - 12/31)	9/23/1977
6-92CW074	Illinois River	North Platte headwaters	Jackson	headwaters at lat 40 22 27N long 105 56 57W	headgate Park Ditch at lat 40 24 27N long 106 02 42W	7.00	Bowen Mountain Jack Creek Ranch Mount Richthofen	3 (04/1 - 10/31) 1.5 (11/1 - 03/31)	5/8/1992
6-92CW052	Jack Creek	North Platte headwaters	Jackson	headwaters at lat 40 23 21N long 105 56 26W	headgate Teller Ditch at lat 40 25 30N long 106 02 15W	8.40	Jack Creek Ranch Mount Richthofen	8.5 (05/1 - 08/15) 4 (08/16 - 10/31) 2 (11/1 - 04/30)	5/8/1992
6-81CW298	Little Grizzly Creek	North Platte headwaters	Jackson	headwaters in vicinity of lat 40 32 54N long 106 39 10W	headgate Jennie Ditch at lat 40 33 21N long 106 36 21W	3.10	Buffalo Pass Teal Lake	4 (01/1 - 12/31)	12/3/1981
6-81CW299	Norris Creek	North Platte headwaters	Jackson	headwaters in vicinity of lat 40 39 34N long 106 40 30W	headgate Roaring Ditch in NE SW S14 T8N R82W 6PM	6.30	Mount Ethel Pitchpine Mountain	7 (01/1 - 12/31)	12/3/1981

Instream Flow Tabulation - Water Division 6

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date
6-92CW053	Rock Creek (Little Willow Ck)	North Platte headwaters	Jackson	headwaters at lat 40 21 33N long 106 16 34W	headgate Darcy Ditch at lat 40 23 30N long 106 15 08W	3.10	Buffalo Peak Hyannis Peak	1 (04/1 - 10/31) 0.5 (11/1 - 03/31)	5/8/1992
6-92CW055	South Fork Canadian River	North Platte headwaters	Jackson	Jewel Lake at lat 40 36 02N long 105 56 18W	headgate Bradfield Ditch at lat 40 35 37N long 105 59 47W	4.00	Clark Peak	2 (04/16 - 08/31) 1 (09/1 - 10/31) 0.5 (11/1 - 04/15)	5/8/1992
6-77W1386	South Fork Little Snake River	Little Snake	Routt	National Forest boundary in S1 T10N R87W 6PM	headgate Assman Ditch No 1 in SW SE S29 T12N R86W 6PM	6.60	Shield Mountain	4 (01/1 - 12/31)	9/23/1977
6-92CW056	South Fork Michigan River	North Platte headwaters	Jackson	confl Silver Creek at lat 40 28 54N long 106 00 26W	headgate Mason Ditch at lat 40 30 19N long 106 01 29W	2.10	Gould Jack Creek Ranch	18 (05/1 - 8/15) 8.5 (08/16 - 10/31) 4.5 (11/1 - 04/30)	5/8/1992
6-79CW102	Walton Creek	Upper Yampa	Routt	USGS gage at lat 40 24 28N long 106 47 12W	headgate Walton Creek Ditch in SE NE S10 T5N R84W 6PM	0.20	Steamboat Springs	16 (01/1 - 12/31)	3/14/1979
6-92CW057	Willow Creek	North Platte headwaters	Jackson	headwaters at lat 40 20 16N long 106 14 09W	headgate Wycoff Ditch at lat 40 23 43N long 106 10 57W	5.90	Parkview Mountain Rand	5 (04/1 - 10/31) 2.75 (11/1 - 03/31)	5/8/1992

Totals for Water Division 6

Total # of Stream Miles = **68.2**

Total # of Appropriations = **15**

(Totals do not include donated/acquired water

Instream Flow Tabulation - Water Division 7

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Approp Date
7-84CW294	Bear Creek	Upper Dolores	Montezuma	headwaters in vicinity of lat 37 26 56N long 108 03 32W	Bear Creek Ditch headgate in SE NW S9 T38N R12W NMPM	12.20	La Plata Orphan Butte Wallace Ranch	8 (01/1 - 12/31)	7/13/1984
7-83CW089	Cascade Creek	Animas	San Juan La Plata	headwaters in vicinity of lat 37 46 02N long 107 50 04W	Cascade Canal diversion at lat 37 40 01N long 107 49 18W	8.10	Engineer Mountain Ophir	15 (01/1 - 12/31)	5/5/1983
7-84CW281	Hermosa Creek	Animas	La Plata	confl Clear Creek at lat 37 29 11N long 107 53 11W	Hermosa Ditch headgate at lat 37 25 05N long 107 50 36W	6.50	Hermosa Monument Hill	37 (04/1 - 09/30) 22 (10/1 - 03/31)	7/13/1984
7-84CW270	La Plata River	La Plata	La Plata	outlet of Upper Lake at lat 37 27 24N long 108 02 04W	Hay Gulch Irrigation Ditch at lat 37 17 09N long 108 02 22W	13.80	Hesperus La Plata	9 (01/1 - 12/31)	7/13/1984
7-84CW269	Middle Mancos River	Mancos	Montezuma	headwaters in vicinity of lat 37 25 08N long 108 08 22W	Weber Reservoir Inlet Ditch in SE SE S5 T36N R12W	3.60	Rampart Hills	3 (01/1 - 12/31)	7/13/1984
7-80CW039	Turkey Creek	Upper San Juan	Mineral Archuleta	Turkey Creek Lake at lat 37 28 42N long 107 00 53W	headgate Snowball Ditch in S5 T36N R1W NMPM	12.50	Jackson Mountain Pagosa Peak Saddle Mountain	4 (01/1 - 12/31)	1/30/1980
7-84CW266	West Mancos River	Mancos	Montezuma	confl NF & SF West Mancos at lat 37 27 24N long 108 08 46W	Jackson Ditch diversion at lat 37 25 56N long 108 14 09W	6.40	Rampart Hills	4 (01/1 - 12/31)	7/13/1984
06/07/A-017	Yellowjacket Canyon Creek	Mc Elmo Creek-Yellowjacket Canyon Creek	Montezuma	Sandstone Canyon lat 37 21 00N long 108 59 47W	Ismay Ditch lat 37 25 09N long 108 54 01W	10.64	Bowdish Canyon Negro Canyon	2.1 (1/01 - 12/31)	

Totals for Water Division 7

Total # of Stream Miles = **73.74**

Total # of Appropriations = **8**

(Totals do not include donated/acquired water

Case Number	Stream	Watershed	County	Upper Terminus	Lower Terminus	Length (miles)	USGS QUADS	Amount(dates) (CFS)	Appro p Date

Report Totals

Total # of Stream Miles = **633.79**

Total # of Appropriations = **124**

(Totals do not include donated/acquired water

stream_name	water_division	water_district	segment_id	segment_order	cwcb_case_display	intent_to_appropriate_date	segment_length	donated	enlargement	donated_right	donation_type	lt_description	ut_description	lower_terminus_location	upper_terminus_location	phase_number	add_date	modify_date	amount	beg_period	end_period
Anthracite Creek	4	40	05/04/A-001		05/04/A-001		8	FALSE	FALSE			Coal Creek	Ruby Anthracite Creek	lat 38 55 37N long 107 20 27W	lat 38 57 16N long 107 12 47W	2		1/0/1900	17	08/15	03/31
Anthracite Creek	4	40	05/04/A-001		05/04/A-001		8	FALSE	FALSE			Coal Creek	Ruby Anthracite Creek	lat 38 55 37N long 107 20 27W	lat 38 57 16N long 107 12 47W	2		1/0/1900	39	07/15	08/14
Anthracite Creek	4	40	05/04/A-001		05/04/A-001		8	FALSE	FALSE			Coal Creek	Ruby Anthracite Creek	lat 38 55 37N long 107 20 27W	lat 38 57 16N long 107 12 47W	2		1/0/1900	54	04/01	07/14
Beaver Creek	4	59	4-98CW236	1	4-98CW236	1/29/1998	9	FALSE	FALSE			confl West Beaver Creek at	headwaters in vicinity of	lat 38 37 28N long 107 05 03W	lat 38 41 13N long 107 11 20W	5			2	12/15	04/14
Beaver Creek	4	59	4-98CW236	1	4-98CW236	1/29/1998	9	FALSE	FALSE			confl West Beaver Creek at	headwaters in vicinity of	lat 38 37 28N long 107 05 03W	lat 38 41 13N long 107 11 20W	5			2.5	10/1	12/14
Beaver Creek	4	59	4-98CW236	1	4-98CW236	1/29/1998	9	FALSE	FALSE			confl West Beaver Creek at	headwaters in vicinity of	lat 38 37 28N long 107 05 03W	lat 38 41 13N long 107 11 20W	5			5.25	04/15	09/30
Beaver Creek	4	59	4-98CW237	2	4-98CW237	1/29/1998	9.9	FALSE	FALSE			confl Gunnison River at	confl West Beaver Creek at	lat 38 29 40N long 107 01 51W	lat 38 37 28N long 107 05 02W	5			1.5	11/15	03/31
Beaver Creek	4	59	4-98CW237	2	4-98CW237	1/29/1998	9.9	FALSE	FALSE			confl Gunnison River at	confl West Beaver Creek at	lat 38 29 40N long 107 01 51W	lat 38 37 28N long 107 05 02W	5			2.5	04/1	04/30
Beaver Creek	4	59	4-98CW237	2	4-98CW237	1/29/1998	9.9	FALSE	FALSE			confl Gunnison River at	confl West Beaver Creek at	lat 38 29 40N long 107 01 51W	lat 38 37 28N long 107 05 02W	5			2.5	08/1	11/14
Beaver Creek	4	59	4-98CW237	2	4-98CW237	1/29/1998	9.9	FALSE	FALSE			confl Gunnison River at	confl West Beaver Creek at	lat 38 29 40N long 107 01 51W	lat 38 37 28N long 107 05 02W	5			7.25	05/1	07/31
Beaver Creek	6	44	6-92CW077	1	6-92CW077	9/16/1992	8.5	FALSE	FALSE			confl South Fork Williams Fork at	outlet of unnamed lake at	lat 40 16 22N long 107 26 02W	lat 40 12 21N long 107 18 46W	5			1	11/16	02/29
Beaver Creek	6	44	6-92CW077	1	6-92CW077	9/16/1992	8.5	FALSE	FALSE			confl South Fork Williams Fork at	outlet of unnamed lake at	lat 40 16 22N long 107 26 02W	lat 40 12 21N long 107 18 46W	5			1.5	03/1	03/31
Beaver Creek	6	44	6-92CW077	1	6-92CW077	9/16/1992	8.5	FALSE	FALSE			confl South Fork Williams Fork at	outlet of unnamed lake at	lat 40 16 22N long 107 26 02W	lat 40 12 21N long 107 18 46W	5			1.5	08/1	11/15
Beaver Creek	6	44	6-92CW077	1	6-92CW077	9/16/1992	8.5	FALSE	FALSE			confl South Fork Williams Fork at	outlet of unnamed lake at	lat 40 16 22N long 107 26 02W	lat 40 12 21N long 107 18 46W	5			3	04/1	07/31
Birdseye Gulch	2	11	04/2/A-001	1	2-04CW079	1/28/2004	3.4	FALSE	FALSE			confl East Fork Arkansas River at	headwaters in vicinity of	lat 39 18 39N long 106 13 39W	lat 39 16 32N long 106 11 55W	4		1/10/2006	0.800000012	01/01	04/30
Birdseye Gulch	2	11	04/2/A-001	1	2-04CW079	1/28/2004	3.4	FALSE	FALSE			confl East Fork Arkansas River at	headwaters in vicinity of	lat 39 18 39N long 106 13 39W	lat 39 16 32N long 106 11 55W	4		1/10/2006	0.899999976	10/15	12/31
Birdseye Gulch	2	11	04/2/A-001	1	2-04CW079	1/28/2004	3.4	FALSE	FALSE			confl East Fork Arkansas River at	headwaters in vicinity of	lat 39 18 39N long 106 13 39W	lat 39 16 32N long 106 11 55W	4		1/10/2006	1.600000024	05/01	10/14
Blue Creek	4	63	02/4/B-008	3	4-02CW263	1/23/2002	8.8	FALSE	FALSE			confl Calamity Creek at	confl Massey Branch at	lat 38 32 06N long 108 50 02W	lat 38 36 50N long 108 44 29W	4		2/16/2006	0.5	06/15	03/14
Blue Creek	4	63	02/4/B-008	3	4-02CW263	1/23/2002	8.8	FALSE	FALSE			confl Calamity Creek at	confl Massey Branch at	lat 38 32 06N long 108 50 02W	lat 38 36 50N long 108 44 29W	4		2/16/2006	2.099999905	03/15	04/14
Blue Creek	4	63	02/4/B-008	3	4-02CW263	1/23/2002	8.8	FALSE	FALSE			confl Calamity Creek at	confl Massey Branch at	lat 38 32 06N long 108 50 02W	lat 38 36 50N long 108 44 29W	4		2/16/2006	2.099999905	05/15	06/14
Blue Creek	4	63	02/4/B-008	3	4-02CW263	1/23/2002	8.8	FALSE	FALSE			confl Calamity Creek at	confl Massey Branch at	lat 38 32 06N long 108 50 02W	lat 38 36 50N long 108 44 29W	4		2/16/2006	5.5	04/15	05/14
Blue Creek	4	63	02/4/B-009	4	4-02CW264	1/23/2002	3	FALSE	FALSE			headgate Tom Watkins Ditch at	confl Calamity Creek at	lat 38 32 12N long 108 52 27W	lat 38 32 06N long 108 50 02W	4		2/16/2006	0.5	06/15	03/14
Blue Creek	4	63	02/4/B-009	4	4-02CW264	1/23/2002	3	FALSE	FALSE			headgate Tom Watkins Ditch at	confl Calamity Creek at	lat 38 32 12N long 108 52 27W	lat 38 32 06N long 108 50 02W	4		2/16/2006	1	03/15	04/14
Blue Creek	4	63	02/4/B-009	4	4-02CW264	1/23/2002	3	FALSE	FALSE			headgate Tom Watkins Ditch at	confl Calamity Creek at	lat 38 32 12N long 108 52 27W	lat 38 32 06N long 108 50 02W	4		2/16/2006	1	05/15	06/14
Blue Creek	4	63	02/4/B-009	4	4-02CW264	1/23/2002	3	FALSE	FALSE			headgate Tom Watkins Ditch at	confl Calamity Creek at	lat 38 32 12N long 108 52 27W	lat 38 32 06N long 108 50 02W	4		2/16/2006	3.5	04/15	05/14
Blue River	5	36	5-87CW294	6	5-87CW294	10/2/1987	2	FALSE	FALSE			confl Willow Creek in	confl Straight Creek in	NE NW S1 T5S R78W 6PM	SE SE S12 T5S R78W 6PM	5			50	10/1	04/30
Blue River	5	36	5-87CW294	6	5-87CW294	10/2/1987	2	FALSE	FALSE			confl Willow Creek in	confl Straight Creek in	NE NW S1 T5S R78W 6PM	SE SE S12 T5S R78W 6PM	5			52	08/1	09/30
Blue River	5	36	5-87CW294	6	5-87CW294	10/2/1987	2	FALSE	FALSE			confl Willow Creek in	confl Straight Creek in	NE NW S1 T5S R78W 6PM	SE SE S12 T5S R78W 6PM	5			55	05/1	07/31
Blue River	5	36	5-87CW296	8	5-87CW296	10/2/1987	1.6	FALSE	FALSE			confl Boulder Creek in	confl Rock Creek in	NE NW S4 T4S R78W 6PM	NW NE S9 T4S R78W 6PM	5			67	11/1	03/31
Blue River	5	36	5-87CW296	8	5-87CW296	10/2/1987	1.6	FALSE	FALSE			confl Boulder Creek in	confl Rock Creek in	NE NW S4 T4S R78W 6PM	NW NE S9 T4S R78W 6PM	5			78	10/1	10/31
Blue River	5	36	5-87CW296	8	5-87CW296	10/2/1987	1.6	FALSE	FALSE			confl Boulder Creek in	confl Rock Creek in	NE NW S4 T4S R78W 6PM	NW NE S9 T4S R78W 6PM	5			90	04/1	04/30
Blue River	5	36	5-87CW296	8	5-87CW296	10/2/1987	1.6	FALSE	FALSE			confl Boulder Creek in	confl Rock Creek in	NE NW S4 T4S R78W 6PM	NW NE S9 T4S R78W 6PM	5			90	09/1	09/30
Blue River	5	36	5-87CW296	8	5-87CW296	10/2/1987	1.6	FALSE	FALSE			confl Boulder Creek in	confl Rock Creek in	NE NW S4 T4S R78W 6PM	NW NE S9 T4S R78W 6PM	5			115	05/1	08/31
Blue River	5	36	5-87CW297	9	5-87CW297	10/2/1987	4.2	FALSE	FALSE			confl Slate Creek in	confl Boulder Creek in	NE NE S19 T3S R78W 6PM	NE NW S4 T4S R78W 6PM	5			70	11/1	02/29
Blue River	5	36	5-87CW297	9	5-87CW297	10/2/1987	4.2	FALSE	FALSE			confl Slate Creek in	confl Boulder Creek in	NE NE S19 T3S R78W 6PM	NE NW S4 T4S R78W 6PM	5			78	03/1	03/31
Blue River	5	36	5-87CW297	9	5-87CW297	10/2/1987	4.2	FALSE	FALSE			confl Slate Creek in	confl Boulder Creek in	NE NE S19 T3S R78W 6PM	NE NW S4 T4S R78W 6PM	5			90	04/1	04/30
Blue River	5	36	5-87CW297	9	5-87CW297	10/2/1987	4.2	FALSE	FALSE			confl Slate Creek in	confl Boulder Creek in	NE NE S19 T3S R78W 6PM	NE NW S4 T4S R78W 6PM	5			90	09/1	10/31
Blue River	5	36	5-87CW297	9	5-87CW297	10/2/1987	4.2	FALSE	FALSE			confl Slate Creek in	confl Boulder Creek in	NE NE S19 T3S R78W 6PM	NE NW S4 T4S R78W 6PM	5			125	05/1	08/31
Blue River	5	36	5-87CW298	10	5-87CW298	10/2/1987	6.9	FALSE	FALSE			inlet Green Mtn Res @ Doig Gulch in	confl Slate Creek in	SE NW S34 T2S R79W 6PM	NE NE S19 T3S R78W 6PM	5			85	12/1	02/29
Blue River	5	36	5-87CW298	10	5-87CW298	10/2/1987	6.9	FALSE	FALSE			inlet Green Mtn Res @ Doig Gulch in	confl Slate Creek in	SE NW S34 T2S R79W 6PM	NE NE S19 T3S R78W 6PM	5			90	10/1	11/30
Blue River	5	36	5-87CW298	10	5-87CW298	10/2/1987	6.9	FALSE	FALSE			inlet Green Mtn Res @ Doig Gulch in	confl Slate Creek in	SE NW S34 T2S R79W 6PM	NE NE S19 T3S R78W 6PM	5			90	3/1	4/30
Blue River	5	36	5-87CW298	10	5-87CW298	10/2/1987	6.9	FALSE	FALSE			inlet Green Mtn Res @ Doig Gulch in	confl Slate Creek in	SE NW S34 T2S R79W 6PM	NE NE S19 T3S R78W 6PM	5			125	05/1	09/30
Boswell Gulch	2	11	2-98CW163	1	2-98CW163	5/11/1998	3.7	FALSE	FALSE			Twin Lakes Reservoir in	headwaters in the vicinity of	NE NW S30 T11S R80W 6PM	lat 39 01 36N long 106 22 48W	4			0.349999994	02/15	04/14
Boswell Gulch	2	11	2-98CW163	1	2-98CW163	5/11/1998	3.7	FALSE	FALSE			Twin Lakes Reservoir in	headwaters in the vicinity of	NE NW S30 T11S R80W 6PM	lat 39 01 36N long 106 22 48W	4			0.5	04/15	05/14
Boswell Gulch	2	11	2-98CW163	1	2-98CW163	5/11/1998	3.7	FALSE	FALSE			Twin Lakes Reservoir in	headwaters in the vicinity of	NE NW S30 T11S R80W 6PM	lat 39 01 36N long 106 22 48W	4			0.5	10/15	02/14
Boswell Gulch	2	11	2-98CW163	1	2-98CW163	5/11/1998	3.7	FALSE	FALSE			Twin Lakes Reservoir in	headwaters in the vicinity of	NE NW S30 T11S R80W 6PM	lat 39 01 36N long 106 22 48W	4			1.5	05/15	10/14
Brook Creek	3	25	03/3/A-002	2	03/3/A-002		2	FALSE	FALSE			BLM boundary	Forest Service boundary	lat 38 18 45N long 105 56 15W	lat 38 19 42N long 105 55 02W	1			0.550000012	10/15	05/14
Brook Creek	3	25	03/3/A-002	2	03/3/A-002		2	FALSE	FALSE			BLM boundary	Forest Service boundary	lat 38 18 45N long 105 56 15W	lat 38 19 42N long 105 55 02W	1			1.200000048	07/01	10/14
Brook Creek	3	25	03/3/A-002	2	03/3/A-002		2	FALSE	FALSE			BLM boundary	Forest Service boundary	lat 38 18 45N long 105 56 15W	lat 38 19 42N long 105 55 02W	1			1.5	05/15	06/30
Cabin Creek	5	51	5-90CW312	2	5-90CW312	11/27/1990	2.7	FALSE	FALSE			confl Ranch Creek in	Denver Water Board diversion at	NW SE S9 T1S R75W 6PM	lat 39 59 12N long 105 44 32W	5			0.75	11/1	03/31
Cabin Creek	5	51	5-90CW312	2	5-90CW312	11/27/1990	2.7	FALSE	FALSE			confl Ranch Creek in	Denver Water Board diversion at	NW SE S9 T1S R75W 6PM	lat 39 59 12N long 105 44 32W	5			2	04/1	05/31
Cabin Creek	5	51	5-90CW312	2	5-90CW312	11/27/1990	2.7	FALSE	FALSE			confl Ranch Creek in	Denver Water Board diversion at	NW SE S9 T1S R75W 6PM	lat 39 59 12N long 105 44 32W	5			2	08/1	10/31
Cabin Creek	5	51	5-90CW312	2	5-90CW312	11/27/1990	2.7	FALSE	FALSE			confl Ranch Creek in	Denver Water Board diversion at	NW SE S9 T1S R75W 6PM	lat 39 59 12N long 105 44 32W	5			5	06/1	07/31
Cabin Creek	5	51	5-90CW313	1	5-90CW313	11/27/1990	3.5	FALSE	FALSE			Denver Water Board diversion at	headwaters at natural lake at	lat 39 59 12N long 105 44 32W	lat 40 00 33N long 105 42 02W	5			0.75	11/1	03/31
Cabin Creek	5	51	5-90CW313	1	5-90CW313	11/27/1990	3.5	FALSE	FALSE			Denver Water Board diversion at	headwaters at natural lake at	lat 39 59 12N long 105 44 32W	lat 40 00 33N long 105 42 02W	5			2	04/1	04/30
Cabin Creek	5	51	5-90CW313	1	5-90CW313	11/27/1990	3.5	FALSE	FALSE			Denver Water Board diversion at	headwaters at natural lake at	lat 39 59 12N long 105 44 32W	lat 40 00 33N long 105 42 02W	5			2	09/1	10/31
Cabin Creek	5	51	5-90CW313	1	5-90CW313	11/27/1990	3.5	FALSE	FALSE			Denver Water Board diversion at	headwaters at natural lake at	lat 39 59 12N long 105 44 32W	lat 40 00 33N long 105 42 02W	5			4.5	05/1	08/31
Cache Creek	2	11	2-98CW164	2	2-98CW164	1/29/1998	4.4	FALSE	FALSE			confl Arkansas River in	confl unnamed tributary at	SE SW S31 T11S R79W 6PM	lat 39 02 04N long 106 20 10W	4			1	12/1	04/30
Cache Creek	2	11	2-98CW164	2	2-98CW164	1/29/1998	4.4	FALSE	FALSE			confl Arkansas River in	confl unnamed tributary at	SE SW S31 T11S R79W 6PM	lat 39 02 04N long 106 20 10W	4			1.5	10/15	11/30
Cache Creek	2	11	2-98CW164	2	2-98CW164	1/29/1998	4.4	FALSE	FALSE			confl Arkansas River in	confl unnamed tributary at	SE SW S31 T11S R79W 6PM	lat 39 02 04N long 106 20 10W	4			3	05/1	10/14
Canyon Creek	5	39	03/5/A-008	2	5-03CW264	1/22/2003	7.5	FALSE	FALSE			headgate Baxter Ditch #1	confl Johnson Creek	lat 39 37 49N long 107 26 50W	lat 39 42 28N long 107 23 11W	4			9.399999619	08/15	04/14
Canyon Creek	5	39	03/5/A-008	2	5-03CW264	1/22/2003	7.5	FALSE	FALSE			headgate Baxter Ditch #1	confl Johnson Creek	lat 39 37 49N long 107 26 50W	lat 39 42 28N long 107 23 11W	4			13.5	04/15	05/14
Canyon Creek	5	39	03/5/A-008	2	5-03CW264	1/22/2003	7.5	FALSE	FALSE			headgate Baxter Ditch #1	confl Johnson Creek	lat 39 37 49N long 107 26 50W	lat 39 42 28N long 107 23 11W	4			13.5	07/15	08/14
Canyon Creek	5	39	03/5/A-008	2	5-03CW264	1/22/2003	7.5	FALSE	FALSE			headgate Baxter Ditch #1	confl Johnson Creek	lat 39 37 49N long 107 26 50W	lat 39 42 28N long 107 23 11W	4			24.10000038	05/15	07/14
Carr Creek	5	70	5-95CW288	1	5-95CW288	11/6/1995	14.2	FALSE	FALSE			confl Roan Creek in	headwaters at	NW NE S29 T6S R99W 6PM	lat 39 38 38N long 108 37 32W	5			0.5	11/1	03/31
Carr Creek	5	70	5-95CW288	1	5-95CW288	11/6/1995	14.2	FALSE	FALSE			confl Roan Creek in	headwaters at	NW NE S29 T6S R99W 6PM	lat 39 38 38N long 108 37 32W	5			1	09/1	10/31
Carr Creek	5	70	5-95CW288	1	5-95CW288	11/6/1995	14.2	FALSE	FALSE			confl Roan Creek in	headwaters at	NW NE S29 T6S R99W 6PM	lat 39 38 38N long 108 37 32W	5			2	04/1	08/31
Cascade Creek	1	4	1-89CW208	1	1-89CW208	11/14/1989	2.4	FALSE	FALSE			confl Buckhorn Creek in	headwaters in	NW SE S15 T7N R72W 6PM	NW SW S26 T7N R72W 6PM	5			0.25	11/1	04/30
Cascade Creek	1	4	1-89CW208	1	1-89CW208	11/14/1989	2.4	FALSE	FALSE			confl Buckhorn Creek in	headwaters in	NW SE S15 T7N R72W 6PM	NW SW S26 T7N R72W 6PM	5			0.5	09/1	10/31
Cascade Creek	1	4	1-89CW208	1	1-89CW208	11/14/1989	2.4	FALSE	FALSE			confl Buckhorn Creek in	headwaters in	NW SE S15 T7N R72W 6PM	NW SW S26 T7N R72W 6PM	5			1	05/1	08/31
Castle Creek	5	38	5-95CW289	1	5-95CW289	11/6/1995	4.6	FALSE	FALSE			Castle Creek Ditch in	confl unnamed tributary at	SW NE S29 T2S R84W 6PM	lat 39 48 08N long 106 51 25W	5			0.5	09/1	03/31
Castle Creek	5	38	5-95CW289	1	5-95CW289	11/6/1995	4.6	FALSE	FALSE			Castle Creek Ditch in	confl unnamed tributary at	SW NE S29 T2S R84W 6PM	lat 39 48 08N long 106 51 25W	5			1	08/1	08/31
Castle Creek	5	38	5-95CW289	1	5-95CW289	11/6/1995	4.6	FALSE	FALSE			Castle Creek Ditch in	confl unnamed tributary at	SW NE S29 T2S R84W 6PM	lat 39 48 08N long 106 51 25W	5			1.75	04/1	07/31
Cherry Creek	1	8	1-94CW246	1	1-94CW246	12/22/1994	4.5	FALSE	FALSE			John Jones Ditch in	confl unnamed tributary in	SW SE S10 T8S R66W 6PM	NW SE S25 T8S R66W 6PM	5			1.5	06/16	10/31
Cherry Creek	1	8	1-94CW246	1	1-94CW246	12/22/1994	4.5	FALSE	FALSE			John Jones Ditch in	confl unnamed tributary in	SW SE S10 T8S R66W 6PM	NW SE S25 T8S R66W 6PM	5			3.5	05/1	06/15
Cherry Creek	1	8	1-94CW246	1	1-94CW246	12/22/1994	4.5	FALSE	FALSE			John Jones Ditch in	confl unnamed tributary in	SW SE S10 T8S R66W 6PM	NW SE S25 T8S R66W 6PM	5			3.5	11/1	02/29
Cherry Creek	1	8	1-94CW246	1	1-94CW246	12/22/1994	4.5	FALSE	FALSE			John Jones Ditch in	confl unnamed tributary in	SW SE S10 T8S R66W 6PM	NW SE S25 T8S R66W 6PM	5			7	03/1	04/30
Coal Creek	4	40	05/04/A-010		05/04/A-010		4.8	FALSE	FALSE			Anthracite Creek	Little Gunnison Creek	lat 38 55 37N long 107 20 27W	lat 38 51 47N long 107 19 41W	2		1/0/1900	18	11/15	02/14
Coal Creek	4	40	05/04/A-010		05/04/A-010		4.8	FALSE	FALSE			Anthracite Creek	Little Gunnison Creek	lat 38 55 37N long 107 20 27W	lat 38 51 47N long 107 19 41W	2		1/0/1900	21	02/15	03/31
Coal Creek	4	40	05/04/A-010		05/04/A-010		4.8	FALSE	FALSE			Anthracite Creek	Little Gunnison Creek	lat 38 55 37N long 107 20 27W	lat 38 51 47N long 107 19 41W	2		1/0/1900	21	07/15	11/14
Coal Creek	4	40	05/04/A-010		05/04/A-010		4.8	FALSE	FALSE			Anthracite Creek	Little Gunnison Creek	lat 38 55 37N long 107 20 27W	lat 38 51 47N long 107 19 41W	2		1/0/1900	39	04/01	07/14
Cornet Creek	4	60	05/04/A-013	1	4-05CW148	1/25/2005	3.9	FALSE	FALSE			confl San Miguel River at	headwaters at	lat 37 56 33N long 107 50 08W	lat 37 57 41N long 107 47 31W	4		2/22/2006	0.850000024	08/01	04/30
Cornet Creek	4	60	05/04/A-013	1	4-05CW148	1/25/2005	3.9	FALSE	FALSE			confl San Miguel River at	headwaters at	lat 37 56 33N long 107 50 08W	lat 37 57 41N long 107 47 31W	4		2/22/2006	3.5	05/01	05/31
Cornet Creek	4	60	05/04/A-013	1	4-05CW148	1/25/2005	3.9	FALSE	FALSE			confl San Miguel River at	headwaters at	lat 37 56 33N long 107 50 08W	lat 37 57 41N long 107 47 31W	4		2/22/2006	3.5	07/01	07/31
Cornet Creek	4	60	05/04/A-013	1	4-05CW148	1/25/2005	3.9	FALSE	FALSE			confl San Miguel River at	headwaters at	lat 37 56 33N long 107 50 08W	lat 37 57 41N long 107 47 31W	4		2/22/2006	9	06/01	06/30
Cree Creek	2	11	2-98CW165	2	2-98CW165	5/11/1998	3.5	FALSE	FALSE			confl South Arkansas River at	confl unnamed tributary at	lat 38 32 26N long 106 13 30W	lat 38 34 03N long 106 15 59W	5			0.5	11/15	04/30
Cree Creek	2	11	2-98CW165	2	2-98CW165	5/11/1998	3.5	FALSE	FALSE			confl South Arkansas River at	confl unnamed tributary at	lat 38 32 26N long 106 13 30W	lat 38 34 03N long 106 15 59W	5			1	09/1	11/14
Cree Creek	2	11	2-98CW165	2	2-98CW165	5/11/1998	3.5	FALSE	FALSE			confl South Arkansas River at	confl unnamed tributary at	lat 38 32 26N long 106 13 30W	lat 38 34 03N long 106 15 59W	5			2.5	05/1	08/31
Crooked Creek	5	51	5-90CW296	4	5-90CW296	11/27/1990	1.1	FALSE	FALSE			confl Fraser River in	confl Pole Creek in	NW SE S36 T1N R76W 6PM	SE NE S2 T1S R76W 6PM	5			2.75	10/1	04/14
Crooked Creek	5	51	5-90CW296	4	5-90CW296	11/27/1990	1.1	FALSE	FALSE			confl Fraser River in	confl Pole Creek in	NW SE S36 T1N R76W 6PM	SE NE S2 T1S R76W 6PM	5			4	08/15	09/30
Crooked Creek	5	51	5-90CW296	4	5-90CW296	11/27/1990	1.1	FALSE	FALSE			confl Fraser River in	confl Pole Creek in	NW SE S36 T1N R76W 6PM	SE NE S2 T1S R76W 6PM	5			8	04/15	08/14
Currant Creek	2	12	04/2/A-006	2	2-04CW081	1/28/2004	6.9	FALSE	FALSE			confl Mill Gulch at	confl Thirtyone Mile Creek at	lat 38 39 50N long 105 29 39W	lat 38 44 07N long 105 32 16W	4		1/10/2006	1	11/01	03/31
Currant Creek	2	12	04/2/A-006	2	2-04CW081	1/28/2004	6.9	FALSE	FALSE			confl Mill Gulch at	confl Thirtyone Mile Creek at	lat 38 39 50N long 105 29 39W	lat 38 44 07N long 105 32 16W	4		1/10/2006	1.5	07/15	10/31
Currant Creek	2	12	04/2/A-006	2	2-04CW081	1/28/2004	6.9	FALSE	FALSE			confl Mill Gulch at	confl Thirtyone Mile Creek at	lat 38 39 50N long 105 29 39W	lat 38 44 07N long 105 32 16W	4		1/10/2006	1.899999976	04/01	07/14
Deer Beaver Creek	4	62	4-98CW233	1	4-98CW233	5/11/1998	4.2	FALSE	FALSE			confl South Beaver Creek at	headwaters in the vicinity of	lat 38 18 46N long 106 55 59W	lat 38 16 16N long 106 53 30W	5		2/22/2006	0.400000006	10/15	03/31
Deer Beaver Creek	4	62	4-98CW233	1	4-98CW233	5/11/1998	4.2	FALSE	FALSE			confl South Beaver Creek at	headwaters in the vicinity of	lat 38 18 46N long 106 55 59W	lat 38 16 16N long 106 53 30W	5		2/22/2006	0.75	04/1	04/30
Deer Beaver Creek	4	62	4-98CW233	1	4-98CW233	5/11/1998	4.2	FALSE	FALSE			confl South Beaver Creek at	headwaters in the vicinity of	lat 38 18 46N long 106 55 59W	lat 38 16 16N long 106 53 30W	5		2/22/2006	1	09/1	10/14

stream_name	water_division	water_district	segment_id	segment_order	cwcb_case_display	intent_to_appropriate_date	segment_length	donated	enlargement	donated_right	donation_type	lt_description	ut_description	lower_terminus_location	upper_terminus_location	phase_number	add_date	modify_date	amount	beg_period	end_period
Deer Beaver Creek	4	62	4-98CW233	1	4-98CW233	5/11/1998	4.2	FALSE	FALSE			confl South Beaver Creek at	headwaters in the vicinity of	lat 38 18 46N long 106 55 59W	lat 38 16 16N long 106 53 30W	5		2/22/2006	1.5	05/1	08/31
Deer Creek	1	7	1-98CW464	1	1-98CW464	1/29/1998	2.3	FALSE	FALSE			confl Ralston Creek	headwaters in	NW NE S28 T2S R71W 6PM	NW NE S19 T2S R71W 6PM	5			0.300000012	08/15	04/14
Deer Creek	1	7	1-98CW464	1	1-98CW464	1/29/1998	2.3	FALSE	FALSE			confl Ralston Creek	headwaters in	NW NE S28 T2S R71W 6PM	NW NE S19 T2S R71W 6PM	5			0.5	07/15	08/14
Deer Creek	1	7	1-98CW464	1	1-98CW464	1/29/1998	2.3	FALSE	FALSE			confl Ralston Creek	headwaters in	NW NE S28 T2S R71W 6PM	NW NE S19 T2S R71W 6PM	5			1	04/15	07/14
Dorsey Creek	3	25	03/3/A-005	2	3-03CW035	1/22/2003	1.2	FALSE	FALSE			confl San Luis Creek at	Forest Service boundary at	lat 38 25 08N long 106 03 20W	lat 38 25 15N long 106 02 08W	4		1/11/2006	0.25	07/15	10/31
Dorsey Creek	3	25	03/3/A-005	2	3-03CW035	1/22/2003	1.2	FALSE	FALSE			confl San Luis Creek at	Forest Service boundary at	lat 38 25 08N long 106 03 20W	lat 38 25 15N long 106 02 08W	4		1/11/2006	0.349999994	06/01	07/14
Dorsey Creek	3	25	03/3/A-005	2	3-03CW035	1/22/2003	1.2	FALSE	FALSE			confl San Luis Creek at	Forest Service boundary at	lat 38 25 08N long 106 03 20W	lat 38 25 15N long 106 02 08W	4		1/11/2006	0.349999994	11/01	04/30
Dorsey Creek	3	25	03/3/A-005	2	3-03CW035	1/22/2003	1.2	FALSE	FALSE			confl San Luis Creek at	Forest Service boundary at	lat 38 25 08N long 106 03 20W	lat 38 25 15N long 106 02 08W	4		1/11/2006	0.800000012	05/01	05/31
Dry Creek	4	41	05/04/A-014		4-05CW150	1/25/2005	10.3	FALSE	FALSE			Project canal & siphon at	confl E & W Forks Dry Creek at	lat 38 32 48N long 108 02 59W	lat 38 26 13N long 108 05 01W	4		5/4/2006	1.200000048	08/01	02/29
Dry Creek	4	41	05/04/A-014		4-05CW150	1/25/2005	10.3	FALSE	FALSE			Project canal & siphon at	confl E & W Forks Dry Creek at	lat 38 32 48N long 108 02 59W	lat 38 26 13N long 108 05 01W	4		5/4/2006	3	03/01	03/31
Dry Creek	4	41	05/04/A-014		4-05CW150	1/25/2005	10.3	FALSE	FALSE			Project canal & siphon at	confl E & W Forks Dry Creek at	lat 38 32 48N long 108 02 59W	lat 38 26 13N long 108 05 01W	4		5/4/2006	3	06/15	07/31
Dry Creek	4	41	05/04/A-014		4-05CW150	1/25/2005	10.3	FALSE	FALSE			Project canal & siphon at	confl E & W Forks Dry Creek at	lat 38 32 48N long 108 02 59W	lat 38 26 13N long 108 05 01W	4		5/4/2006	7.300000191	04/01	06/14
Dyke Creek	4	40	04/4/A-022	1	4-04CW157	1/28/2004	5.2	FALSE	FALSE			Bell Ranch Div #1 at	outlet unnamed Lake at	lat 39 06 46N long 107 35 05W	lat 39 06 10N long 107 39 59W	4		5/4/2006	1	11/01	04/30
Dyke Creek	4	40	04/4/A-022	1	4-04CW157	1/28/2004	5.2	FALSE	FALSE			Bell Ranch Div #1 at	outlet unnamed Lake at	lat 39 06 46N long 107 35 05W	lat 39 06 10N long 107 39 59W	4		5/4/2006	1.5	08/16	10/31
Dyke Creek	4	40	04/4/A-022	1	4-04CW157	1/28/2004	5.2	FALSE	FALSE			Bell Ranch Div #1 at	outlet unnamed Lake at	lat 39 06 46N long 107 35 05W	lat 39 06 10N long 107 39 59W	4		5/4/2006	3.200000048	05/01	08/15
Eaglebrook Creek	3	25	03/3/A-007	2	3-03CW036	1/22/2003	1	FALSE	FALSE			McFarland Ditch A&B at	Forest Service boundary at	lat 38 20 02N long 105 57 53W	lat 38 20 28N long 105 57 16W	4		2/16/2006	0.349999994	12/01	05/14
Eaglebrook Creek	3	25	03/3/A-007	2	3-03CW036	1/22/2003	1	FALSE	FALSE			McFarland Ditch A&B at	Forest Service boundary at	lat 38 20 02N long 105 57 53W	lat 38 20 28N long 105 57 16W	4		2/16/2006	0.5	11/01	11/30
Eaglebrook Creek	3	25	03/3/A-007	2	3-03CW036	1/22/2003	1	FALSE	FALSE			McFarland Ditch A&B at	Forest Service boundary at	lat 38 20 02N long 105 57 53W	lat 38 20 28N long 105 57 16W	4		2/16/2006	0.75	05/15	10/31
East Fork Dry Creek	4	41	05/04/A-015		4-05CW151	1/25/2005	10	FALSE	FALSE			confl West Fork Dry Creek at	confl Beaver Dams Creek at	lat 38 26 13N long 108 05 00W	lat 38 19 41N long 108 05 28W	4		5/4/2006	0.600000024	08/01	02/29
East Fork Dry Creek	4	41	05/04/A-015		4-05CW151	1/25/2005	10	FALSE	FALSE			confl West Fork Dry Creek at	confl Beaver Dams Creek at	lat 38 26 13N long 108 05 00W	lat 38 19 41N long 108 05 28W	4		5/4/2006	1.600000024	03/01	03/31
East Fork Dry Creek	4	41	05/04/A-015		4-05CW151	1/25/2005	10	FALSE	FALSE			confl West Fork Dry Creek at	confl Beaver Dams Creek at	lat 38 26 13N long 108 05 00W	lat 38 19 41N long 108 05 28W	4		5/4/2006	1.600000024	06/15	07/31
East Fork Dry Creek	4	41	05/04/A-015		4-05CW151	1/25/2005	10	FALSE	FALSE			confl West Fork Dry Creek at	confl Beaver Dams Creek at	lat 38 26 13N long 108 05 00W	lat 38 19 41N long 108 05 28W	4		5/4/2006	3.599999905	04/01	06/14
East Fork Escalante Creek	4	40	05/04/A-024		4-05CW152	1/25/2005	9.8	FALSE	FALSE			confl Middle Fk Escalante Creek at	headwaters in vicinity of	lat 38 34 55N long 108 24 21W	lat 38 28 32N long 108 29 17W	4		5/4/2006	1.100000024	08/01	02/29
East Fork Escalante Creek	4	40	05/04/A-024		4-05CW152	1/25/2005	9.8	FALSE	FALSE			confl Middle Fk Escalante Creek at	headwaters in vicinity of	lat 38 34 55N long 108 24 21W	lat 38 28 32N long 108 29 17W	4		5/4/2006	2.5	03/01	03/31
East Fork Escalante Creek	4	40	05/04/A-024		4-05CW152	1/25/2005	9.8	FALSE	FALSE			confl Middle Fk Escalante Creek at	headwaters in vicinity of	lat 38 34 55N long 108 24 21W	lat 38 28 32N long 108 29 17W	4		5/4/2006	2.700000048	06/15	07/31
East Fork Escalante Creek	4	40	05/04/A-024		4-05CW152	1/25/2005	9.8	FALSE	FALSE			confl Middle Fk Escalante Creek at	headwaters in vicinity of	lat 38 34 55N long 108 24 21W	lat 38 28 32N long 108 29 17W	4		5/4/2006	3.900000095	04/01	06/14
East Fork Little Blue Creek	4	62	4-98CW245	2	4-98CW245	5/11/1998	8	FALSE	FALSE			confl Little Blue Creek in	spring in	SW SE S23 T48N R5W NMPM	SE NW S29 T47N R4W NMPM	5			0.300000012	11/1	03/31
East Fork Little Blue Creek	4	62	4-98CW245	2	4-98CW245	5/11/1998	8	FALSE	FALSE			confl Little Blue Creek in	spring in	SW SE S23 T48N R5W NMPM	SE NW S29 T47N R4W NMPM	5			0.600000024	04/1	04/30
East Fork Little Blue Creek	4	62	4-98CW245	2	4-98CW245	5/11/1998	8	FALSE	FALSE			confl Little Blue Creek in	spring in	SW SE S23 T48N R5W NMPM	SE NW S29 T47N R4W NMPM	5			0.600000024	08/1	10/31
East Fork Little Blue Creek	4	62	4-98CW245	2	4-98CW245	5/11/1998	8	FALSE	FALSE			confl Little Blue Creek in	spring in	SW SE S23 T48N R5W NMPM	SE NW S29 T47N R4W NMPM	5			1.649999976	05/1	07/31
East Fork Parachute Creek	5	39	00/5/A-001	1	5-00CW135	1/26/2000	2.2	FALSE	FALSE			confl Second Anvil Creek at	JQS & Golden Castle Glchs at	lat 39 34 05N long 107 56 52W	lat 39 35 08N long 107 54 55W	5		5/17/2006	0.200000003	09/1	03/14
East Fork Parachute Creek	5	39	00/5/A-001	1	5-00CW135	1/26/2000	2.2	FALSE	FALSE			confl Second Anvil Creek at	JQS & Golden Castle Glchs at	lat 39 34 05N long 107 56 52W	lat 39 35 08N long 107 54 55W	5		5/17/2006	0.400000006	03/15	04/14
East Fork Parachute Creek	5	39	00/5/A-001	1	5-00CW135	1/26/2000	2.2	FALSE	FALSE			confl Second Anvil Creek at	JQS & Golden Castle Glchs at	lat 39 34 05N long 107 56 52W	lat 39 35 08N long 107 54 55W	5		5/17/2006	0.600000024	07/1	08/31
East Fork Parachute Creek	5	39	00/5/A-001	1	5-00CW135	1/26/2000	2.2	FALSE	FALSE			confl Second Anvil Creek at	JQS & Golden Castle Glchs at	lat 39 34 05N long 107 56 52W	lat 39 35 08N long 107 54 55W	5		5/17/2006	1.899999976	04/15	06/30
East Fork Parachute Creek	5	39	00/5/A-004	2	5-00CW134	1/26/2000	1.9	FALSE	FALSE			confl First Anvil Creek at	confl Second Anvil Creek at	lat 39 33 20N long 107 58 45W	lat 39 34 05N long 107 56 52W	5		5/17/2006	0.5	09/1	03/14
East Fork Parachute Creek	5	39	00/5/A-004	2	5-00CW134	1/26/2000	1.9	FALSE	FALSE			confl First Anvil Creek at	confl Second Anvil Creek at	lat 39 33 20N long 107 58 45W	lat 39 34 05N long 107 56 52W	5		5/17/2006	0.800000012	03/15	04/14
East Fork Parachute Creek	5	39	00/5/A-004	2	5-00CW134	1/26/2000	1.9	FALSE	FALSE			confl First Anvil Creek at	confl Second Anvil Creek at	lat 39 33 20N long 107 58 45W	lat 39 34 05N long 107 56 52W	5		5/17/2006	1.200000048	07/1	08/31
East Fork Parachute Creek	5	39	00/5/A-004	2	5-00CW134	1/26/2000	1.9	FALSE	FALSE			confl First Anvil Creek at	confl Second Anvil Creek at	lat 39 33 20N long 107 58 45W	lat 39 34 05N long 107 56 52W	5		5/17/2006	2.400000095	04/15	06/30
East Fork Parachute Creek	5	39	00/5/A-006	3	5-00CW133	1/26/2000	2.1	FALSE	FALSE			confl Bull Gulch at	confl First Anvil Creek at	lat 39 33 48N long 108 00 51W	lat 39 33 20N long 107 58 45W	5		5/17/2006	0.800000012	09/01	03/14
East Fork Parachute Creek	5	39	00/5/A-006	3	5-00CW133	1/26/2000	2.1	FALSE	FALSE			confl Bull Gulch at	confl First Anvil Creek at	lat 39 33 48N long 108 00 51W	lat 39 33 20N long 107 58 45W	5		5/17/2006	1.299999952	03/15	04/14
East Fork Parachute Creek	5	39	00/5/A-006	3	5-00CW133	1/26/2000	2.1	FALSE	FALSE			confl Bull Gulch at	confl First Anvil Creek at	lat 39 33 48N long 108 00 51W	lat 39 33 20N long 107 58 45W	5		5/17/2006	2	07/01	08/31
East Fork Parachute Creek	5	39	00/5/A-006	3	5-00CW133	1/26/2000	2.1	FALSE	FALSE			confl Bull Gulch at	confl First Anvil Creek at	lat 39 33 48N long 108 00 51W	lat 39 33 20N long 107 58 45W	5		5/17/2006	5	04/15	06/30
East Middle Creek	3	26	3-95CW034	1	3-95CW034	5/22/1995	5.8	FALSE	FALSE			confl Middle Creek at	headwaters in vicinity of	lat 38 17 24N long 106 18 11W	lat 38 19 17N long 106 13 34W	5			1.5	10/16	4/14
East Middle Creek	3	26	3-95CW034	1	3-95CW034	5/22/1995	5.8	FALSE	FALSE			confl Middle Creek at	headwaters in vicinity of	lat 38 17 24N long 106 18 11W	lat 38 19 17N long 106 13 34W	5			3	08/1	10/15
East Middle Creek	3	26	3-95CW034	1	3-95CW034	5/22/1995	5.8	FALSE	FALSE			confl Middle Creek at	headwaters in vicinity of	lat 38 17 24N long 106 18 11W	lat 38 19 17N long 106 13 34W	5			5	04/15	7/31
East Middle Fork Parachute Creek	5	39	00/5/A-008	1	5-00CW129	1/26/2000	1.7	FALSE	FALSE			confl Corral Gulch at	confl Northwater & Trappers Cr at	lat 39 37 11N long 108 02 22W	lat 39 37 20N long 108 00 42W	5		5/17/2006	0.5	10/15	03/14
East Middle Fork Parachute Creek	5	39	00/5/A-008	1	5-00CW129	1/26/2000	1.7	FALSE	FALSE			confl Corral Gulch at	confl Northwater & Trappers Cr at	lat 39 37 11N long 108 02 22W	lat 39 37 20N long 108 00 42W	5		5/17/2006	0.899999976	09/01	10/14
East Middle Fork Parachute Creek	5	39	00/5/A-008	1	5-00CW129	1/26/2000	1.7	FALSE	FALSE			confl Corral Gulch at	confl Northwater & Trappers Cr at	lat 39 37 11N long 108 02 22W	lat 39 37 20N long 108 00 42W	5		5/17/2006	1	03/15	04/14
East Middle Fork Parachute Creek	5	39	00/5/A-008	1	5-00CW129	1/26/2000	1.7	FALSE	FALSE			confl Corral Gulch at	confl Northwater & Trappers Cr at	lat 39 37 11N long 108 02 22W	lat 39 37 20N long 108 00 42W	5		5/17/2006	1.600000024	07/01	08/31
East Middle Fork Parachute Creek	5	39	00/5/A-008	1	5-00CW129	1/26/2000	1.7	FALSE	FALSE			confl Corral Gulch at	confl Northwater & Trappers Cr at	lat 39 37 11N long 108 02 22W	lat 39 37 20N long 108 00 42W	5		5/17/2006	5.699999809	04/15	06/30
Echo Canyon Creek	2	12	04/2/A-014	1	04/2/A-014		3.5	FALSE	FALSE			Arkansas River	Headwaters	lat 38 26 33N long 105 32 17W	lat 38 29 05N long 105 32 58W	2			0.699999988	12/01	03/31
Echo Canyon Creek	2	12	04/2/A-014	1	04/2/A-014		3.5	FALSE	FALSE			Arkansas River	Headwaters	lat 38 26 33N long 105 32 17W	lat 38 29 05N long 105 32 58W	2			0.800000012	06/01	11/30
Echo Canyon Creek	2	12	04/2/A-014	1	04/2/A-014		3.5	FALSE	FALSE			Arkansas River	Headwaters	lat 38 26 33N long 105 32 17W	lat 38 29 05N long 105 32 58W	2			1.200000048	04/01	05/31
Eider Creek	4	60	02/4/A-005	1	4-02CW267	1/23/2002	2.5	FALSE	FALSE			State Highway 145 at	headwaters at	lat 37 56 56N long 107 50 56W	lat 37 58 58N long 107 50 39W	4		2/22/2006	0.850000024	12/15	03/14
Eider Creek	4	60	02/4/A-005	1	4-02CW267	1/23/2002	2.5	FALSE	FALSE			State Highway 145 at	headwaters at	lat 37 56 56N long 107 50 56W	lat 37 58 58N long 107 50 39W	4		2/22/2006	1	03/15	05/14
Eider Creek	4	60	02/4/A-005	1	4-02CW267	1/23/2002	2.5	FALSE	FALSE			State Highway 145 at	headwaters at	lat 37 56 56N long 107 50 56W	lat 37 58 58N long 107 50 39W	4		2/22/2006	1	07/15	12/14
Eider Creek	4	60	02/4/A-005	1	4-02CW267	1/23/2002	2.5	FALSE	FALSE			State Highway 145 at	headwaters at	lat 37 56 56N long 107 50 56W	lat 37 58 58N long 107 50 39W	4		2/22/2006	5.25	05/15	07/14
Eightmile Creek	2	12	2-98CW157	1	2-98CW157	5/11/1998	10.9	FALSE	FALSE			confl East Fork Eightmile Creek at	headwaters in	lat 38 34 00N long 105 05 25W	SW SW S2 T16S R69W 6PM	5			0.649999976	10/15	03/31
Eightmile Creek	2	12	2-98CW157	1	2-98CW157	5/11/1998	10.9	FALSE	FALSE			confl East Fork Eightmile Creek at	headwaters in	lat 38 34 00N long 105 05 25W	SW SW S2 T16S R69W 6PM	5			1.100000024	04/1	05/14
Eightmile Creek	2	12	2-98CW157	1	2-98CW157	5/11/1998	10.9	FALSE	FALSE			confl East Fork Eightmile Creek at	headwaters in	lat 38 34 00N long 105 05 25W	SW SW S2 T16S R69W 6PM	5			1.100000024	07/15	10/14
Eightmile Creek	2	12	2-98CW157	1	2-98CW157	5/11/1998	10.9	FALSE	FALSE			confl East Fork Eightmile Creek at	headwaters in	lat 38 34 00N long 105 05 25W	SW SW S2 T16S R69W 6PM	5			2.5	05/15	07/14
Eightmile Creek	2	12	2-98CW158	2	2-98CW158	5/11/1998	7.3	FALSE	FALSE			BLM boundary at	confl East Fork Eightmile Creek at	lat 38 30 45N long 105 06 46W	lat 38 34 00N long 105 05 25W	5			1.399999976	11/1	05/14
Eightmile Creek	2	12	2-98CW158	2	2-98CW158	5/11/1998	7.3	FALSE	FALSE			BLM boundary at	confl East Fork Eightmile Creek at	lat 38 30 45N long 105 06 46W	lat 38 34 00N long 105 05 25W	5			2	07/15	10/31
Eightmile Creek	2	12	2-98CW158	2	2-98CW158	5/11/1998	7.3	FALSE	FALSE			BLM boundary at	confl East Fork Eightmile Creek at	lat 38 30 45N long 105 06 46W	lat 38 34 00N long 105 05 25W	5			3.400000095	05/15	07/14
Elk Creek	1	4	1-89CW207	1	1-89CW207	11/14/1989	3.6	FALSE	FALSE			confl Buckhorn Creek in	headwaters in	SE SW S16 T7N R72W 6PM	SW NE S30 T7N R72W 6PM	5			0.25	11/1	04/30
Elk Creek	1	4	1-89CW207	1	1-89CW207	11/14/1989	3.6	FALSE	FALSE			confl Buckhorn Creek in	headwaters in	SE SW S16 T7N R72W 6PM	SW NE S30 T7N R72W 6PM	5			0.5	09/1	10/31
Elk Creek	1	4	1-89CW207	1	1-89CW207	11/14/1989	3.6	FALSE	FALSE			confl Buckhorn Creek in	headwaters in	SE SW S16 T7N R72W 6PM	SW NE S30 T7N R72W 6PM	5			1	05/1	08/31
Escalante Creek	4	40	05/04/A-016	1	4-05CW250	1/25/2005	3.9	FALSE	FALSE			headgate Knob Hill Ditch at	confl EF & MF Escalante Crks at	lat 38 37 34N long 108 23 48W	lat 38 34 55N long 108 24 21W	4		6/1/2006	1.299999952	08/01	02/28
Escalante Creek	4	40	05/04/A-016	1	4-05CW250	1/25/2005	3.9	FALSE	FALSE			headgate Knob Hill Ditch at	confl EF & MF Escalante Crks at	lat 38 37 34N long 108 23 48W	lat 38 34 55N long 108 24 21W	4		6/1/2006	3.200000048	03/01	03/31
Escalante Creek	4	40	05/04/A-016	1	4-05CW250	1/25/2005	3.9	FALSE	FALSE			headgate Knob Hill Ditch at	confl EF & MF Escalante Crks at	lat 38 37 34N long 108 23 48W	lat 38 34 55N long 108 24 21W	4		6/1/2006	3.200000048	06/15	07/31
Escalante Creek	4	40	05/04/A-016	1	4-05CW250	1/25/2005	3.9	FALSE	FALSE			headgate Knob Hill Ditch at	confl EF & MF Escalante Crks at	lat 38 37 34N long 108 23 48W	lat 38 34 55N long 108 24 21W	4		6/1/2006	11.5	04/01	06/14
Escalante Creek	4	40	05/04/A-017	2	4-05CW251	1/25/2005	6.4	FALSE	FALSE			hdgt Captain H.A. Smith Ditch at	confl NF Escalante Creek at	lat 38 40 47N long 108 18 41W	lat 38 37 57N long 108 23 30W	4		6/1/2006	1.5	08/01	02/28
Escalante Creek	4	40	05/04/A-017	2	4-05CW251	1/25/2005	6.4	FALSE	FALSE			hdgt Captain H.A. Smith Ditch at	confl NF Escalante Creek at	lat 38 40 47N long 108 18 41W	lat 38 37 57N long 108 23 30W	4		6/1/2006	4	03/01	03/31
Escalante Creek	4	40	05/04/A-017	2	4-05CW251	1/25/2005	6.4	FALSE	FALSE			hdgt Captain H.A. Smith Ditch at	confl NF Escalante Creek at	lat 38 40 47N long 108 18 41W	lat 38 37 57N long 108 23 30W	4		6/1/2006	4	06/15	07/31
Escalante Creek	4	40	05/04/A-017	2	4-05CW251	1/25/2005	6.4	FALSE	FALSE			hdgt Captain H.A. Smith Ditch at	confl NF Escalante Creek at	lat 38 40 47N long 108 18 41W	lat 38 37 57N long 108 23 30W	4		6/1/2006	8.199999809	04/01	06/14
Ford Creek	3	26	03/3/A-011	3	3-03CW037	1/22/2003	2.1	FALSE	FALSE			BLM boundary at	confl unnamed tributary at	lat 38 10 58N long 106 17 00W	lat 38 12 29N long 106 16 08W	5		5/17/2006	0.300000012	08/01	10/31
Ford Creek	3	26	03/3/A-011	3	3-03CW037	1/22/2003	2.1	FALSE	FALSE			BLM boundary at	confl unnamed tributary at	lat 38 10 58N long 106 17 00W	lat 38 12 29N long 106 16 08W	5		5/17/2006	0.5	11/01	02/29
Ford Creek	3	26	03/3/A-011	3	3-03CW037	1/22/2003	2.1	FALSE	FALSE			BLM boundary at	confl unnamed tributary at	lat 38 10 58N long 106 17 00W	lat 38 12 29N long 106 16 08W	5		5/17/2006	0.699999988	03/01	07/31
Fourmile Creek	2	12	2/A/00-006	8	2-00CW106	1/26/2000	2.1	FALSE	FALSE			confl Wilson Creek	Canon Heights Diversion Structure	lat 38 30 11N long 105 12 30W	lat 38 31 44N long 105 12 59W	5			3.5	04/1	05/14
Fourmile Creek	2	12	2/A/00-006	8	2-00CW106	1/26/2000	2.1	FALSE	FALSE			confl Wilson Creek	Canon Heights Diversion Structure	lat 38 30 11N long 105 12 30W	lat 38 31 44N long 105 12 59W	5			3.5	06/15	10/31
Fourmile Creek	2	12	2/A/00-006	8	2-00CW106	1/26/2000	2.1	FALSE	FALSE			confl Wilson Creek	Canon Heights Diversion Structure	lat 38 30 11N long 105 12 30W	lat 38 31 44N long 105 12 59W	5			5	11/1	03/31
Fourmile Creek	2	12	2/A/00-006	8	2-00CW106	1/26/2000	2.1	FALSE	FALSE			confl Wilson Creek	Canon Heights Diversion Structure	lat 38 30 11N long 105 12 30W	lat 38 31 44N long 105 12 59W	5			9.5	05/15	06/14
Fryingpan River	5	38	5-73W1955	2	5-73W1955	7/12/1973	4.3	FALSE	FALSE			Ruedi Reservior in	confl NF Fryingpan River in	lat 39 21 42N long 106 44 14W	lat 39 20 39N long 106 40 19W	5			30	10/1	03/31
Fryingpan River	5	38	5-73W1955	2	5-73W1955	7/12/1973	4.3	FALSE	FALSE			Ruedi Reservior in	confl NF Fryingpan River in	lat 39 21 42N long 106 44 14W	lat 39 20 39N long 106 40 19W	5			65	09/1	09/30
Fryingpan River	5	38	5-73W1955	2	5-73W1955	7/12/1973	4.3	FALSE	FALSE			Ruedi Reservior in	confl NF Fryingpan River in	lat 39 21 42N long 106 44 14W	lat 39 20 39N long 106 40 19W	5			75	08/1	08/31
Fryingpan River	5	38	5-73W1955	2	5-73W1955	7/12/1973	4.3	FALSE	FALSE			Ruedi Reservior in	confl NF Fryingpan River in	lat 39 21 42N long 106 44 14W	lat 39 20 39N long 106 40 19W	5			100	04/1	04/30
Fryingpan River	5	38	5-73W1955	2	5-73W1955	7/12/1973	4.3	FALSE	FALSE			Ruedi Reservior in	confl NF Fryingpan River in	lat 39 21 42N long 106 44 14W	lat 39 20 39N long 106 40 19W	5			100	07/1	07/31
Fryingpan River	5	38	5-73W1955	2	5-73W1955	7/12/1973	4.3	FALSE	FALSE			Ruedi Reservior in	confl NF Fryingpan River in	lat 39 21 42N long 106 44 14W	lat 39 20 39N long 106 40 19W	5			150	05/1	05/31
Fryingpan River	5	38	5-73W1955	2	5-73W1955	7/12/1973	4.3	FALSE	FALSE			Ruedi Reservior in	confl NF Fryingpan River in	lat 39 21 42N long 106 44 14W	lat 39 20 39N long 106 40 19W	5			200	06/1	06/30
Garner Creek	3	25	03/3/A-017	3	03/3/A-017		1.7	FALSE	FALSE			BLM boundary	confl Major Creek	lat 38 09 03N long 105 51 15W	lat 38 09 33N long 105 49 28W	1			1.100000024	09/15	12/31
Garner Creek	3	25	03/3/A-017	3	03/3/A-017		1.7	FALSE	FALSE			BLM boundary	confl Major Creek	lat 38 09 03N long 105 51 15W	lat 38 09 33N long 105 49 28W	1			1.299999952	01/01	04/30
Garner Creek	3	25	03/3/A-017	3	03/3/A-017		1.7	FALSE	FALSE			BLM boundary	confl Major Creek	lat 38 09 03N long 105 51 15W	lat 38 09 33N long 105 49 28W	1			2.5	05/01	09/14
Graneros Creek	2	15	2-98CW150	1	2-98CW150	5/11/1998	5.4	FALSE	FALSE			Evergreen Ditch in	headwaters in the vincinity of	SE NW S1 T68W R25S 6PM	lat 37 52 59N long 105 01 22W	4			0.300000012	12/1	03/14
Graneros Creek	2	15	2-98CW150	1	2-98CW150	5/11/1998	5.4	FALSE	FALSE			Evergreen Ditch in	headwaters in the vincinity of	SE NW S1 T68W R25S 6PM	lat 37 52 59N long 105 01 22W	4			0.5	03/15	04/30
Graneros Creek	2	15	2-98CW150	1	2-98CW150	5/11/1998	5.4	FALSE	FALSE			Evergreen Ditch in	headwaters in the vincinity of	SE NW S1 T68W R25S 6PM	lat 37 52 59N long 105 01 22W	4			0.5	08/15	11/30
Graneros Creek	2	15	2-98CW150	1	2-98CW150	5/11/1998	5.4	FALSE	FALSE			Evergreen Ditch in	headwaters in the vincinity of	SE NW S1 T68W R25S 6PM	lat 37 52 59N long 105 01 22W	4			1.25	05/1	08/14
Greenhorn Creek	2	15	2-98CW154	1	2-98CW154	5/11/1998	6.8	FALSE	FALSE			Highline Ditch in	headwaters in vincinity of	SW NE S36 T24S R68W 6PM	lat 37 56 26N long 105 03 40W	5		1/12/2006	0.850000024	11/15	03/14

stream_name	water_division	water_district	segment_id	segment_order	cwcb_case_display	intent_to_appropriate_date	segment_length	donated	enlargement	donated_right	donation_type	lt_description	ut_description	lower_terminus_location	upper_terminus_location	phase_number	add_date	modify_date	amount	beg_period	end_period
Greenhorn Creek	2	15	2-98CW154	1	2-98CW154	5/11/1998	6.8	FALSE	FALSE			Highline Ditch in	headwaters in vincinity of	SW NE S36 T24S R68W 6PM	lat 37 56 26N long 105 03 40W	5		1/12/2006	1.5	03/15	04/30
Greenhorn Creek	2	15	2-98CW154	1	2-98CW154	5/11/1998	6.8	FALSE	FALSE			Highline Ditch in	headwaters in vincinity of	SW NE S36 T24S R68W 6PM	lat 37 56 26N long 105 03 40W	5		1/12/2006	1.5	07/15	11/14
Greenhorn Creek	2	15	2-98CW154	1	2-98CW154	5/11/1998	6.8	FALSE	FALSE			Highline Ditch in	headwaters in vincinity of	SW NE S36 T24S R68W 6PM	lat 37 56 26N long 105 03 40W	5		1/12/2006	4.75	05/1	07/14
Hamilton Creek	5	51	5-90CW311	2	5-90CW311	11/27/1990	3	FALSE	FALSE			confl Hurd Creek in	Denver Water Board diversion at	NE NE S5 T1S R75W 6PM	lat 39 59 50N long 105 44 40W	5			0.5	08/15	04/30
Hamilton Creek	5	51	5-90CW311	2	5-90CW311	11/27/1990	3	FALSE	FALSE			confl Hurd Creek in	Denver Water Board diversion at	NE NE S5 T1S R75W 6PM	lat 39 59 50N long 105 44 40W	5			1	05/1	05/31
Hamilton Creek	5	51	5-90CW311	2	5-90CW311	11/27/1990	3	FALSE	FALSE			confl Hurd Creek in	Denver Water Board diversion at	NE NE S5 T1S R75W 6PM	lat 39 59 50N long 105 44 40W	5			1.5	06/1	08/14
Horse Creek	5	53	00/5/A-003	1	5-00CW131	1/26/2000	2.3	FALSE	FALSE			confl E Fk Parachute Cr at	headwaters at	lat 39 33 20N long 107 58 45W	lat 39 32 39N long 107 56 19W	5		5/17/2006	0.100000001	09/1	03/14
Horse Creek	5	53	00/5/A-003	1	5-00CW131	1/26/2000	2.3	FALSE	FALSE			confl E Fk Parachute Cr at	headwaters at	lat 39 33 20N long 107 58 45W	lat 39 32 39N long 107 56 19W	5		5/17/2006	0.200000003	03/15	04/14
Horse Creek	5	53	00/5/A-003	1	5-00CW131	1/26/2000	2.3	FALSE	FALSE			confl E Fk Parachute Cr at	headwaters at	lat 39 33 20N long 107 58 45W	lat 39 32 39N long 107 56 19W	5		5/17/2006	0.300000012	07/1	08/31
Horse Creek	5	53	00/5/A-003	1	5-00CW131	1/26/2000	2.3	FALSE	FALSE			confl E Fk Parachute Cr at	headwaters at	lat 39 33 20N long 107 58 45W	lat 39 32 39N long 107 56 19W	5		5/17/2006	0.600000024	04/15	06/30
Hunkydory Creek	2	11	2-98CW152	2	2-98CW152	5/11/1998	1	FALSE	FALSE			confl NF S Arkansas River at	outlet Hunkydory Lake at	lat 38 36 04N long 106 17 17W	lat 38 35 42N long 106 18 10W	5			0.200000003	11/15	05/31
Hunkydory Creek	2	11	2-98CW152	2	2-98CW152	5/11/1998	1	FALSE	FALSE			confl NF S Arkansas River at	outlet Hunkydory Lake at	lat 38 36 04N long 106 17 17W	lat 38 35 42N long 106 18 10W	5			0.5	10/1	11/14
Hunkydory Creek	2	11	2-98CW152	2	2-98CW152	5/11/1998	1	FALSE	FALSE			confl NF S Arkansas River at	outlet Hunkydory Lake at	lat 38 36 04N long 106 17 17W	lat 38 35 42N long 106 18 10W	5			1	06/1	09/30
Hunters Creek	1	5	1-95CW262	1	1-95CW262	7/24/1995	4.6	FALSE	FALSE			confl North St Vrain Creek in	outlet Kiplinger Lake at	NE SE S21 T3N R73W 6PM	lat 40 14 28N long 105 37 58W	5			0.75	11/16	03/31
Hunters Creek	1	5	1-95CW262	1	1-95CW262	7/24/1995	4.6	FALSE	FALSE			confl North St Vrain Creek in	outlet Kiplinger Lake at	NE SE S21 T3N R73W 6PM	lat 40 14 28N long 105 37 58W	5			1.5	04/1	04/30
Hunters Creek	1	5	1-95CW262	1	1-95CW262	7/24/1995	4.6	FALSE	FALSE			confl North St Vrain Creek in	outlet Kiplinger Lake at	NE SE S21 T3N R73W 6PM	lat 40 14 28N long 105 37 58W	5			1.5	09/16	11/15
Hunters Creek	1	5	1-95CW262	1	1-95CW262	7/24/1995	4.6	FALSE	FALSE			confl North St Vrain Creek in	outlet Kiplinger Lake at	NE SE S21 T3N R73W 6PM	lat 40 14 28N long 105 37 58W	5			3.5	05/1	09/15
Indiana Gulch	2	11	04/2/A-002	1	04/2/A-002		1.9	FALSE	FALSE			East Fork Arkansas River	Headwaters	lat 39 18 36N long 106 13 43W	lat 39 17 10N long 106 13 15W	2			0.300000012	10/15	05/14
Indiana Gulch	2	11	04/2/A-002	1	04/2/A-002		1.9	FALSE	FALSE			East Fork Arkansas River	Headwaters	lat 39 18 36N long 106 13 43W	lat 39 17 10N long 106 13 15W	2			0.649999976	07/15	10/14
Indiana Gulch	2	11	04/2/A-002	1	04/2/A-002		1.9	FALSE	FALSE			East Fork Arkansas River	Headwaters	lat 39 18 36N long 106 13 43W	lat 39 17 10N long 106 13 15W	2			1.700000048	05/15	07/14
Iron Creek	5	51	5-90CW283	1	5-90CW283	11/27/1990	2.5	FALSE	FALSE			Denver Water Board diversion at	headwaters at natural lake at	lat 39 51 38N long 105 54 28W	lat 39 51 10N long 105 57 17W	5			0.5	11/1	04/1
Iron Creek	5	51	5-90CW283	1	5-90CW283	11/27/1990	2.5	FALSE	FALSE			Denver Water Board diversion at	headwaters at natural lake at	lat 39 51 38N long 105 54 28W	lat 39 51 10N long 105 57 17W	5			1	09/1	10/31
Iron Creek	5	51	5-90CW283	1	5-90CW283	11/27/1990	2.5	FALSE	FALSE			Denver Water Board diversion at	headwaters at natural lake at	lat 39 51 38N long 105 54 28W	lat 39 51 10N long 105 57 17W	5			2.5	04/15	08/31
Jack Creek	6	47	6-92CW052	1	6-92CW052	5/8/1992	8.4	FALSE	FALSE			headgate Teller Ditch at	headwaters at	lat 40 25 30N long 106 02 15W	lat 40 23 21N long 105 56 26W	5			2	11/1	04/30
Jack Creek	6	47	6-92CW052	1	6-92CW052	5/8/1992	8.4	FALSE	FALSE			headgate Teller Ditch at	headwaters at	lat 40 25 30N long 106 02 15W	lat 40 23 21N long 105 56 26W	5			4	08/16	10/31
Jack Creek	6	47	6-92CW052	1	6-92CW052	5/8/1992	8.4	FALSE	FALSE			headgate Teller Ditch at	headwaters at	lat 40 25 30N long 106 02 15W	lat 40 23 21N long 105 56 26W	5			8.5	05/1	08/15
Jim Creek	5	51	5-90CW286	1	5-90CW286	11/27/1990	4.2	FALSE	FALSE			diversion structure at	headwaters in vicinity of	lat 39 52 52N long 105 44 29W	lat 39 50 25N long 105 42 19W	5			1	12/1	04/14
Jim Creek	5	51	5-90CW286	1	5-90CW286	11/27/1990	4.2	FALSE	FALSE			diversion structure at	headwaters in vicinity of	lat 39 52 52N long 105 44 29W	lat 39 50 25N long 105 42 19W	5			1.5	10/1	11/30
Jim Creek	5	51	5-90CW286	1	5-90CW286	11/27/1990	4.2	FALSE	FALSE			diversion structure at	headwaters in vicinity of	lat 39 52 52N long 105 44 29W	lat 39 50 25N long 105 42 19W	5			4	04/15	09/30
JQS Gulch	5	39	00/5/A-002	1	5-00CW128	1/26/2000	1.1	FALSE	FALSE			confl Golden Castle Glch at	confl unnamed trib at	lat 39 35 08N long 107 54 55W	lat 39 35 44N long 107 54 00W	5		5/17/2006	0.100000001	09/1	03/14
JQS Gulch	5	39	00/5/A-002	1	5-00CW128	1/26/2000	1.1	FALSE	FALSE			confl Golden Castle Glch at	confl unnamed trib at	lat 39 35 08N long 107 54 55W	lat 39 35 44N long 107 54 00W	5		5/17/2006	0.200000003	03/15	04/14
JQS Gulch	5	39	00/5/A-002	1	5-00CW128	1/26/2000	1.1	FALSE	FALSE			confl Golden Castle Glch at	confl unnamed trib at	lat 39 35 08N long 107 54 55W	lat 39 35 44N long 107 54 00W	5		5/17/2006	0.200000003	07/1	08/31
JQS Gulch	5	39	00/5/A-002	1	5-00CW128	1/26/2000	1.1	FALSE	FALSE			confl Golden Castle Glch at	confl unnamed trib at	lat 39 35 08N long 107 54 55W	lat 39 35 44N long 107 54 00W	5		5/17/2006	0.699999988	04/15	06/30
La Plata Gulch	2	11	04/2/A-012	1	2-04CW085	1/28/2004	3.1	FALSE	FALSE			confl Lake Creek at	outlet unnamed lake at	lat 39 03 59N long 106 29 37W	lat 39 01 26N long 106 29 37W	5		1/10/2006	0.75	11/01	04/30
La Plata Gulch	2	11	04/2/A-012	1	2-04CW085	1/28/2004	3.1	FALSE	FALSE			confl Lake Creek at	outlet unnamed lake at	lat 39 03 59N long 106 29 37W	lat 39 01 26N long 106 29 37W	5		1/10/2006	1.799999952	09/15	10/31
La Plata Gulch	2	11	04/2/A-012	1	2-04CW085	1/28/2004	3.1	FALSE	FALSE			confl Lake Creek at	outlet unnamed lake at	lat 39 03 59N long 106 29 37W	lat 39 01 26N long 106 29 37W	5		1/10/2006	3.5	05/01	09/14
La Sal Creek	4	61	02/4/B-011	1	02/4/B-011		4	FALSE	FALSE			confluence Sharp Canyon	Colorado-Utah Stateline	lat 38 19 26N long 108 59 32W	lat 38 19 38N long 109 03 35W	2			1.200000048	06/15	12/14
La Sal Creek	4	61	02/4/B-011	1	02/4/B-011		4	FALSE	FALSE			confluence Sharp Canyon	Colorado-Utah Stateline	lat 38 19 26N long 108 59 32W	lat 38 19 38N long 109 03 35W	2			3	12/15	03/14
La Sal Creek	4	61	02/4/B-011	1	02/4/B-011		4	FALSE	FALSE			confluence Sharp Canyon	Colorado-Utah Stateline	lat 38 19 26N long 108 59 32W	lat 38 19 38N long 109 03 35W	2			5.099999905	03/15	06/14
La Sal Creek	4	61	02/4/B-012	2	4-02CW271	1/23/2002	6	FALSE	FALSE			confl Dolores River at	confl Sharp Canyon Cr at	lat 38 16 43N long 108 55 51W	lat 38 19 26N long 108 59 32W	4		2/22/2006	1.200000048	06/15	12/14
La Sal Creek	4	61	02/4/B-012	2	4-02CW271	1/23/2002	6	FALSE	FALSE			confl Dolores River at	confl Sharp Canyon Cr at	lat 38 16 43N long 108 55 51W	lat 38 19 26N long 108 59 32W	4		2/22/2006	3	12/15	03/14
La Sal Creek	4	61	02/4/B-012	2	4-02CW271	1/23/2002	6	FALSE	FALSE			confl Dolores River at	confl Sharp Canyon Cr at	lat 38 16 43N long 108 55 51W	lat 38 19 26N long 108 59 32W	4		2/22/2006	5.099999905	03/15	06/14
Leeman Gulch	5	37	5-97CW274	1	5-97CW274	9/22/1997	2.1	FALSE	FALSE			confl West Brush Creek at	outlet Leeman Lake at	lat 39 28 01N long 106 43 33W	lat 39 26 43N long 106 43 12W	5		5/17/2006	0.600000024	09/15	04/14
Leeman Gulch	5	37	5-97CW274	1	5-97CW274	9/22/1997	2.1	FALSE	FALSE			confl West Brush Creek at	outlet Leeman Lake at	lat 39 28 01N long 106 43 33W	lat 39 26 43N long 106 43 12W	5		5/17/2006	1.75	04/15	04/30
Leeman Gulch	5	37	5-97CW274	1	5-97CW274	9/22/1997	2.1	FALSE	FALSE			confl West Brush Creek at	outlet Leeman Lake at	lat 39 28 01N long 106 43 33W	lat 39 26 43N long 106 43 12W	5		5/17/2006	1.75	08/01	09/14
Leeman Gulch	5	37	5-97CW274	1	5-97CW274	9/22/1997	2.1	FALSE	FALSE			confl West Brush Creek at	outlet Leeman Lake at	lat 39 28 01N long 106 43 33W	lat 39 26 43N long 106 43 12W	5		5/17/2006	3.5	05/1	07/31
Lefthand Creek	1	5	1-86CW342	2	1-86CW342	9/5/1986	3.7	FALSE	FALSE			Lake Ditch diversion in	confl James Creek at	NE NE S23 T2N R71W 6PM	lat 40 06 08N long 105 20 29W	5			3	10/1	3/31
Lefthand Creek	1	5	1-86CW342	2	1-86CW342	9/5/1986	3.7	FALSE	FALSE			Lake Ditch diversion in	confl James Creek at	NE NE S23 T2N R71W 6PM	lat 40 06 08N long 105 20 29W	5			7	04/1	4/30
Lefthand Creek	1	5	1-86CW342	2	1-86CW342	9/5/1986	3.7	FALSE	FALSE			Lake Ditch diversion in	confl James Creek at	NE NE S23 T2N R71W 6PM	lat 40 06 08N long 105 20 29W	5			7	08/1	9/30
Lefthand Creek	1	5	1-86CW342	2	1-86CW342	9/5/1986	3.7	FALSE	FALSE			Lake Ditch diversion in	confl James Creek at	NE NE S23 T2N R71W 6PM	lat 40 06 08N long 105 20 29W	5			14	05/1	7/31
Little Cottonwood Creek	6	44	06/06/A-012		06/06/A-012		1.45	FALSE	FALSE			Inlet of Freeman Reservoir	Headwaters	lat 40 45 55N long 107 25 19W	lat 40 46 34N long 107 24 11W	2	1/6/2006	1/0/1900	0.200000003	12/15	04/30
Little Cottonwood Creek	6	44	06/06/A-012		06/06/A-012		1.45	FALSE	FALSE			Inlet of Freeman Reservoir	Headwaters	lat 40 45 55N long 107 25 19W	lat 40 46 34N long 107 24 11W	2	1/6/2006	1/0/1900	0.349999994	08/01	12/14
Little Cottonwood Creek	6	44	06/06/A-012		06/06/A-012		1.45	FALSE	FALSE			Inlet of Freeman Reservoir	Headwaters	lat 40 45 55N long 107 25 19W	lat 40 46 34N long 107 24 11W	2	1/6/2006	1/0/1900	0.699999988	05/01	07/31
Little Dolores River	4	73	04/4/A-005	2	4-04CW158	1/28/2004	2.5	FALSE	FALSE			hdgt Upper Saxbury Ditch at	confl Bieser Creek at	lat 39 00 28N long 108 56 12W	lat 38 59 13N long 108 54 48W	4		1/0/1900	1	11/01	03/31
Little Dolores River	4	73	04/4/A-005	2	4-04CW158	1/28/2004	2.5	FALSE	FALSE			hdgt Upper Saxbury Ditch at	confl Bieser Creek at	lat 39 00 28N long 108 56 12W	lat 38 59 13N long 108 54 48W	4		1/0/1900	1.600000024	08/01	10/31
Little Dolores River	4	73	04/4/A-005	2	4-04CW158	1/28/2004	2.5	FALSE	FALSE			hdgt Upper Saxbury Ditch at	confl Bieser Creek at	lat 39 00 28N long 108 56 12W	lat 38 59 13N long 108 54 48W	4		1/0/1900	2.400000095	04/01	07/31
Magdalene Gulch	4	59	4-98CW231	1	4-98CW231	5/11/1998	2	FALSE	FALSE			confl Texas Creek at	headwaters in the vicinity of	lat 38 53 04N long 106 20 54W	lat 38 54 01N long 106 21 53W	5			0.400000006	10/1	03/31
Magdalene Gulch	4	59	4-98CW231	1	4-98CW231	5/11/1998	2	FALSE	FALSE			confl Texas Creek at	headwaters in the vicinity of	lat 38 53 04N long 106 20 54W	lat 38 54 01N long 106 21 53W	5			0.75	04/1	04/30
Magdalene Gulch	4	59	4-98CW231	1	4-98CW231	5/11/1998	2	FALSE	FALSE			confl Texas Creek at	headwaters in the vicinity of	lat 38 53 04N long 106 20 54W	lat 38 54 01N long 106 21 53W	5			0.75	08/1	09/30
Magdalene Gulch	4	59	4-98CW231	1	4-98CW231	5/11/1998	2	FALSE	FALSE			confl Texas Creek at	headwaters in the vicinity of	lat 38 53 04N long 106 20 54W	lat 38 54 01N long 106 21 53W	5			1.75	05/1	07/31
Mesa Creek	4	63	02/4/B-013	1	02/4/B-013		0.3	FALSE	FALSE			Mesa Creek Ditch	confluence North & South Fork Mesa Creek	lat 38 27 03N long 108 49 17W	lat 38 27 10N long 108 49 00W	2			1.75	06/15	10/31
Mesa Creek	4	63	02/4/B-013	1	02/4/B-013		0.3	FALSE	FALSE			Mesa Creek Ditch	confluence North & South Fork Mesa Creek	lat 38 27 03N long 108 49 17W	lat 38 27 10N long 108 49 00W	2			3.200000048	11/01	03/31
Mesa Creek	4	63	02/4/B-013	1	02/4/B-013		0.3	FALSE	FALSE			Mesa Creek Ditch	confluence North & South Fork Mesa Creek	lat 38 27 03N long 108 49 17W	lat 38 27 10N long 108 49 00W	2			6.099999905	04/01	06/14
Middle Fork Escalante Creek	4	40	05/04/A-025		4-05CW153	1/25/2005	11.4	FALSE	FALSE			confl East Fork Escalante Creek at	headwaters in vicinity of	lat 38 34 55N long 108 24 21W	lat 38 30 12N long 108 34 04W	4		2/22/2006	1.25	11/01	03/31
Middle Fork Escalante Creek	4	40	05/04/A-025		4-05CW153	1/25/2005	11.4	FALSE	FALSE			confl East Fork Escalante Creek at	headwaters in vicinity of	lat 38 34 55N long 108 24 21W	lat 38 30 12N long 108 34 04W	4		2/22/2006	1.600000024	06/15	10/31
Middle Fork Escalante Creek	4	40	05/04/A-025		4-05CW153	1/25/2005	11.4	FALSE	FALSE			confl East Fork Escalante Creek at	headwaters in vicinity of	lat 38 34 55N long 108 24 21W	lat 38 30 12N long 108 34 04W	4		2/22/2006	3.099999905	04/01	06/14
Middle Fork Ranch Creek	5	51	5-90CW288	1	5-90CW288	11/27/1990	2.6	FALSE	FALSE			Denver Water Board diversion in	headwaters at Deadman Lake at	NW SW S25 T1S R75W 6PM	lat 39 55 13N long 105 41 32W	5			0.5	11/1	03/31
Middle Fork Ranch Creek	5	51	5-90CW288	1	5-90CW288	11/27/1990	2.6	FALSE	FALSE			Denver Water Board diversion in	headwaters at Deadman Lake at	NW SW S25 T1S R75W 6PM	lat 39 55 13N long 105 41 32W	5			1.5	08/15	10/31
Middle Fork Ranch Creek	5	51	5-90CW288	1	5-90CW288	11/27/1990	2.6	FALSE	FALSE			Denver Water Board diversion in	headwaters at Deadman Lake at	NW SW S25 T1S R75W 6PM	lat 39 55 13N long 105 41 32W	5			3.5	05/1	08/14
Middle Fork San Francisco Creek	3	20	3-94CW051	1	3-94CW051	3/9/1994	3.2	FALSE	FALSE			confl W Fk San Francisco Creek	headwaters at	lat 37 33 21N long 106 23 38W	lat 37 30 42N long 106 24 49W	5			1.75	12/1	4/14
Middle Fork San Francisco Creek	3	20	3-94CW051	1	3-94CW051	3/9/1994	3.2	FALSE	FALSE			confl W Fk San Francisco Creek	headwaters at	lat 37 33 21N long 106 23 38W	lat 37 30 42N long 106 24 49W	5			2.5	08/1	11/30
Middle Fork San Francisco Creek	3	20	3-94CW051	1	3-94CW051	3/9/1994	3.2	FALSE	FALSE			confl W Fk San Francisco Creek	headwaters at	lat 37 33 21N long 106 23 38W	lat 37 30 42N long 106 24 49W	5			4.5	04/15	7/31
Mill Creek	1	7	1-95CW255	1	1-95CW255	11/6/1995	6.9	FALSE	FALSE			confl Clear Creek at	outlet Bill Moore Lake at	lat 39 45 52N long 105 36 04W	lat 39 48 14N long 105 42 33W	5			1	09/16	04/14
Mill Creek	1	7	1-95CW255	1	1-95CW255	11/6/1995	6.9	FALSE	FALSE			confl Clear Creek at	outlet Bill Moore Lake at	lat 39 45 52N long 105 36 04W	lat 39 48 14N long 105 42 33W	5			3.25	08/16	09/15
Mill Creek	1	7	1-95CW255	1	1-95CW255	11/6/1995	6.9	FALSE	FALSE			confl Clear Creek at	outlet Bill Moore Lake at	lat 39 45 52N long 105 36 04W	lat 39 48 14N long 105 42 33W	5			4.75	04/15	08/15
Mill Creek	4	60	02/4/A-011	1	4-02CW273	1/23/2002	2	FALSE	FALSE			diversion at	headwaters in vicinity of	lat 37 57 44N long 107 49 27W	lat 37 58 36N long 107 48 02W	4		2/22/2006	1.899999976	12/01	04/30
Mill Creek	4	60	02/4/A-011	1	4-02CW273	1/23/2002	2	FALSE	FALSE			diversion at	headwaters in vicinity of	lat 37 57 44N long 107 49 27W	lat 37 58 36N long 107 48 02W	4		2/22/2006	2.400000095	07/15	11/30
Mill Creek	4	60	02/4/A-011	1	4-02CW273	1/23/2002	2	FALSE	FALSE			diversion at	headwaters in vicinity of	lat 37 57 44N long 107 49 27W	lat 37 58 36N long 107 48 02W	4		2/22/2006	6.699999809	05/01	07/14
Miller Fork	1	4	1-89CW203	1	1-89CW203	11/14/1989	4.2	FALSE	FALSE			confl NFK Big Thompson River at	confl unnamed tributary at	lat 40 27 34N long 105 24 56W	lat 40 30 07N long 105 28 12W	5			0.850000024	01/1	04/30
Miller Fork	1	4	1-89CW203	1	1-89CW203	11/14/1989	4.2	FALSE	FALSE			confl NFK Big Thompson River at	confl unnamed tributary at	lat 40 27 34N long 105 24 56W	lat 40 30 07N long 105 28 12W	5			1	10/1	12/31
Miller Fork	1	4	1-89CW203	1	1-89CW203	11/14/1989	4.2	FALSE	FALSE			confl NFK Big Thompson River at	confl unnamed tributary at	lat 40 27 34N long 105 24 56W	lat 40 30 07N long 105 28 12W	5			3	05/1	09/30
Muddy Creek	5	50	5-98CW305	3	5-98CW305	7/13/1998	9	FALSE	FALSE			hdgte Deberard Ditch in	outlet Wolford Mtn Reserv in	NE SE S7 T1N R80W 6PM	SW NE S25 T2N R81W 6PM	5		5/17/2006	20	07/15	04/30
Muddy Creek	5	50	5-98CW305	3	5-98CW305	7/13/1998	9	FALSE	FALSE			hdgte Deberard Ditch in	outlet Wolford Mtn Reserv in	NE SE S7 T1N R80W 6PM	SW NE S25 T2N R81W 6PM	5		5/17/2006	70	05/1	05/14
Muddy Creek	5	50	5-98CW305	3	5-98CW305	7/13/1998	9	FALSE	FALSE			hdgte Deberard Ditch in	outlet Wolford Mtn Reserv in	NE SE S7 T1N R80W 6PM	SW NE S25 T2N R81W 6PM	5		5/17/2006	70	07/1	07/14
Muddy Creek	5	50	5-98CW305	3	5-98CW305	7/13/1998	9	FALSE	FALSE			hdgte Deberard Ditch in	outlet Wolford Mtn Reserv in	NE SE S7 T1N R80W 6PM	SW NE S25 T2N R81W 6PM	5		5/17/2006	105	05/15	06/30
Norman Creek	5	52	5-95CW287	1	5-95CW287	11/6/1995	3.7	FALSE	FALSE			confl Catamount Creek in	confl unnamed tributary at	SW NW S28 T2S R84W 6PM	lat 39 48 40N long 106 50 05W	5			0.25	10/16	03/31
Norman Creek	5	52	5-95CW287	1	5-95CW287	11/6/1995	3.7	FALSE	FALSE			confl Catamount Creek in	confl unnamed tributary at	SW NW S28 T2S R84W 6PM	lat 39 48 40N long 106 50 05W	5			0.5	09/1	10/15
Norman Creek	5	52	5-95CW287	1	5-95CW287	11/6/1995	3.7	FALSE	FALSE			confl Catamount Creek in	confl unnamed tributary at	SW NW S28 T2S R84W 6PM	lat 39 48 40N long 106 50 05W	5			0.75	04/1	08/31
North Crestone Creek	3	25	3-94CW044	1	3-94CW044	3/9/1994	7.4	FALSE	FALSE			in the vicinity of	headwaters at	lat 37 59 25N long 105 42 24W	lat 38 04 25N long 105 38 32W	5			2	12/1	4/14
North Crestone Creek	3	25	3-94CW044	1	3-94CW044	3/9/1994	7.4	FALSE	FALSE			in the vicinity of	headwaters at	lat 37 59 25N long 105 42 24W	lat 38 04 25N long 105 38 32W	5			3.75	09/1	11/30
North Crestone Creek	3	25	3-94CW044	1	3-94CW044	3/9/1994	7.4	FALSE	FALSE			in the vicinity of	headwaters at	lat 37 59 25N long 105 42 24W	lat 38 04 25N long 105 38 32W	5			6.5	04/15	8/31
North East Creek	4	42	04/4/A-021	2	4-04CW159	1/28/2004	11.5	FALSE	FALSE			confl East Creek at	1st unnamed trib d/s of King Res at	lat 38 55 06N long 108 29 55W	lat 38 52 58N long 108 40 19W	4		2/22/2006	0.699999988	09/01	01/31
North East Creek	4	42	04/4/A-021	2	4-04CW159	1/28/2004	11.5	FALSE	FALSE			confl East Creek at	1st unnamed trib d/s of King Res at	lat 38 55 06N long 108 29 55W	lat 38 52 58N long 108 40 19W	4		2/22/2006	1	02/01	03/31
North East Creek	4	42	04/4/A-021	2	4-04CW159	1/28/2004	11.5	FALSE	FALSE			confl East Creek at	1st unnamed trib d/s of King Res at	lat 38 55 06N long 108 29 55W	lat 38 52 58N long 108 40 19W	4		2/22/2006	1	07/01	08/31
North East Creek	4	42	04/4/A-021	2	4-04CW159	1/28/2004	11.5	FALSE	FALSE			confl East Creek at	1st unnamed trib d/s of King Res at	lat 38 55 06N long 108 29 55W	lat 38 52 58N long 108 40 19W	4		2/22/2006	5	04/01	06/30
North Fork Halfmoon Creek	2	11	2-98CW155	2	2-98CW155	5/11/1998	2	FALSE	FALSE			confl Halfmoon Creek at	outlet lower Halfmoon Lake at	lat 39 09 26N long 106 28 19W	lat 39 10 39N long 106 29 34W	5		1/12/2006	0.899999976	01/1	03/31
North Fork Halfmoon Creek	2	11	2-98CW155	2	2-98CW155	5/11/1998	2	FALSE	FALSE			confl Halfmoon Creek at	outlet lower Halfmoon Lake at	lat 39 09 26N long 106 28 19W	lat 39 10 39N long 106 29 34W	5		1/12/2006	1	04/1	05/31

stream_name	water_division	water_district	segment_id	segment_order	cwcb_case_display	intent_to_appropriate_date	segment_length	donated	enlargement	donated_right	donation_type	lt_description	ut_description	lower_terminus_location	upper_terminus_location	phase_number	add_date	modify_date	amount	beg_period	end_period
North Fork Halfmoon Creek	2	11	2-98CW155	2	2-98CW155	5/11/1998	2	FALSE	FALSE			confl Halfmoon Creek at	outlet lower Halfmoon Lake at	lat 39 09 26N long 106 28 19W	lat 39 10 39N long 106 29 34W	5		1/12/2006	1	11/1	12/31
North Fork Halfmoon Creek	2	11	2-98CW155	2	2-98CW155	5/11/1998	2	FALSE	FALSE			confl Halfmoon Creek at	outlet lower Halfmoon Lake at	lat 39 09 26N long 106 28 19W	lat 39 10 39N long 106 29 34W	5		1/12/2006	3	06/1	10/31
North Fork Mesa Creek	4	63	02/4/B-015	2	4-02CW274	1/23/2002	5.9	FALSE	FALSE			headgate Cedar Tree Ditch at	confl Long Canyon at	lat 38 29 45N long 108 47 38W	lat 38 33 51N long 108 44 41W	4		2/22/2006	0.5	06/01	02/29
North Fork Mesa Creek	4	63	02/4/B-015	2	4-02CW274	1/23/2002	5.9	FALSE	FALSE			headgate Cedar Tree Ditch at	confl Long Canyon at	lat 38 29 45N long 108 47 38W	lat 38 33 51N long 108 44 41W	4		2/22/2006	1.899999976	03/01	03/31
North Fork Mesa Creek	4	63	02/4/B-015	2	4-02CW274	1/23/2002	5.9	FALSE	FALSE			headgate Cedar Tree Ditch at	confl Long Canyon at	lat 38 29 45N long 108 47 38W	lat 38 33 51N long 108 44 41W	4		2/22/2006	2.75	04/01	05/31
North Fork Smith Fork	4	40	05/04/A-006	1	4-05CW203	1/25/2005	9.4	FALSE	FALSE			confl SF Smith Fork at	headwaters at	lat 38 43 31N long 107 28 23W	lat 38 43 54N long 107 23 15W	4		5/31/2006	3	11/15	02/14
North Fork Smith Fork	4	40	05/04/A-006	1	4-05CW203	1/25/2005	9.4	FALSE	FALSE			confl SF Smith Fork at	headwaters at	lat 38 43 31N long 107 28 23W	lat 38 43 54N long 107 23 15W	4		5/31/2006	3.5	02/15	03/31
North Fork Smith Fork	4	40	05/04/A-006	1	4-05CW203	1/25/2005	9.4	FALSE	FALSE			confl SF Smith Fork at	headwaters at	lat 38 43 31N long 107 28 23W	lat 38 43 54N long 107 23 15W	4		5/31/2006	3.5	08/01	11/14
North Fork Smith Fork	4	40	05/04/A-006	1	4-05CW203	1/25/2005	9.4	FALSE	FALSE			confl SF Smith Fork at	headwaters at	lat 38 43 31N long 107 28 23W	lat 38 43 54N long 107 23 15W	4		5/31/2006	6.800000191	04/01	07/31
North Fork West Creek	4	63	04/4/A-004		4-04CW160	1/28/2004	6	FALSE	FALSE			confl West Creek at	confl two V Gulch at	lat 38 45 32N long 108 54 01W	lat 38 49 32N long 108 54 20W	4		1/0/1900	0.400000006	08/01	02/14
North Fork West Creek	4	63	04/4/A-004		4-04CW160	1/28/2004	6	FALSE	FALSE			confl West Creek at	confl two V Gulch at	lat 38 45 32N long 108 54 01W	lat 38 49 32N long 108 54 20W	4		1/0/1900	0.800000012	02/15	03/31
North Fork West Creek	4	63	04/4/A-004		4-04CW160	1/28/2004	6	FALSE	FALSE			confl West Creek at	confl two V Gulch at	lat 38 45 32N long 108 54 01W	lat 38 49 32N long 108 54 20W	4		1/0/1900	0.800000012	07/01	07/31
North Fork West Creek	4	63	04/4/A-004		4-04CW160	1/28/2004	6	FALSE	FALSE			confl West Creek at	confl two V Gulch at	lat 38 45 32N long 108 54 01W	lat 38 49 32N long 108 54 20W	4		1/0/1900	3.700000048	04/01	06/30
North St Vrain Creek	1	5	1-87CW282	2	1-87CW282	12/11/1987	10	FALSE	FALSE			confl South St Vrain Creek in	unnamed trib below Buttonrock Dam	SE SE S18 T3N R70W 6PM	SW NE S20 T3N R71W 6PM	5			3	1/1	3/31
North St Vrain Creek	1	5	1-87CW282	2	1-87CW282	12/11/1987	10	FALSE	FALSE			confl South St Vrain Creek in	unnamed trib below Buttonrock Dam	SE SE S18 T3N R70W 6PM	SW NE S20 T3N R71W 6PM	5			3	11/1	12/31
North St Vrain Creek	1	5	1-87CW282	2	1-87CW282	12/11/1987	10	FALSE	FALSE			confl South St Vrain Creek in	unnamed trib below Buttonrock Dam	SE SE S18 T3N R70W 6PM	SW NE S20 T3N R71W 6PM	5			4	10/25	10/31
North St Vrain Creek	1	5	1-87CW282	2	1-87CW282	12/11/1987	10	FALSE	FALSE			confl South St Vrain Creek in	unnamed trib below Buttonrock Dam	SE SE S18 T3N R70W 6PM	SW NE S20 T3N R71W 6PM	5			6	10/15	10/24
North St Vrain Creek	1	5	1-87CW282	2	1-87CW282	12/11/1987	10	FALSE	FALSE			confl South St Vrain Creek in	unnamed trib below Buttonrock Dam	SE SE S18 T3N R70W 6PM	SW NE S20 T3N R71W 6PM	5			8	04/1	4/30
North St Vrain Creek	1	5	1-87CW282	2	1-87CW282	12/11/1987	10	FALSE	FALSE			confl South St Vrain Creek in	unnamed trib below Buttonrock Dam	SE SE S18 T3N R70W 6PM	SW NE S20 T3N R71W 6PM	5			8	09/1	10/14
North St Vrain Creek	1	5	1-87CW282	2	1-87CW282	12/11/1987	10	FALSE	FALSE			confl South St Vrain Creek in	unnamed trib below Buttonrock Dam	SE SE S18 T3N R70W 6PM	SW NE S20 T3N R71W 6PM	5			14	08/1	8/31
North St Vrain Creek	1	5	1-87CW282	2	1-87CW282	12/11/1987	10	FALSE	FALSE			confl South St Vrain Creek in	unnamed trib below Buttonrock Dam	SE SE S18 T3N R70W 6PM	SW NE S20 T3N R71W 6PM	5			21	05/1	7/31
North Texas Creek	4	59	4-98CW229	2	4-98CW229	5/11/1998	2.8	FALSE	FALSE			confl Texas Creek at	outlet Pear Lake at	lat 38 52 42N long 106 23 54W	lat 38 54 39N long 106 23 01W	5		2/22/2006	0.5	12/15	04/30
North Texas Creek	4	59	4-98CW229	2	4-98CW229	5/11/1998	2.8	FALSE	FALSE			confl Texas Creek at	outlet Pear Lake at	lat 38 52 42N long 106 23 54W	lat 38 54 39N long 106 23 01W	5		2/22/2006	0.75	10/1	12/14
North Texas Creek	4	59	4-98CW229	2	4-98CW229	5/11/1998	2.8	FALSE	FALSE			confl Texas Creek at	outlet Pear Lake at	lat 38 52 42N long 106 23 54W	lat 38 54 39N long 106 23 01W	5		2/22/2006	1.5	08/1	09/30
North Texas Creek	4	59	4-98CW229	2	4-98CW229	5/11/1998	2.8	FALSE	FALSE			confl Texas Creek at	outlet Pear Lake at	lat 38 52 42N long 106 23 54W	lat 38 54 39N long 106 23 01W	5		2/22/2006	2.75	05/1	07/31
Nott Creek	1	7	1-98CW465	1	1-98CW465	1/29/1998	3.2	FALSE	FALSE			confl Ralston Creek	headwaters in	NW SE S28 T2S R71W 6PM	NW NW S24 T2S R72W 6PM	5			0.200000003	08/15	04/14
Nott Creek	1	7	1-98CW465	1	1-98CW465	1/29/1998	3.2	FALSE	FALSE			confl Ralston Creek	headwaters in	NW SE S28 T2S R71W 6PM	NW NW S24 T2S R72W 6PM	5			0.5	07/15	08/14
Nott Creek	1	7	1-98CW465	1	1-98CW465	1/29/1998	3.2	FALSE	FALSE			confl Ralston Creek	headwaters in	NW SE S28 T2S R71W 6PM	NW NW S24 T2S R72W 6PM	5			1	04/15	07/14
Oil Creek	2	12	2/A/00-7	1	2-00CW107	1/26/2000	5.5	FALSE	FALSE			confl Fourmile Creek at	headwaters in vicinity of	lat 38 50 22N long 105 10 29W	lat 38 50 17N long 105 05 59W	5		1/12/2006	0.300000012	10/15	04/14
Oil Creek	2	12	2/A/00-7	1	2-00CW107	1/26/2000	5.5	FALSE	FALSE			confl Fourmile Creek at	headwaters in vicinity of	lat 38 50 22N long 105 10 29W	lat 38 50 17N long 105 05 59W	5		1/12/2006	0.75	04/15	05/14
Oil Creek	2	12	2/A/00-7	1	2-00CW107	1/26/2000	5.5	FALSE	FALSE			confl Fourmile Creek at	headwaters in vicinity of	lat 38 50 22N long 105 10 29W	lat 38 50 17N long 105 05 59W	5		1/12/2006	0.75	07/1	10/14
Oil Creek	2	12	2/A/00-7	1	2-00CW107	1/26/2000	5.5	FALSE	FALSE			confl Fourmile Creek at	headwaters in vicinity of	lat 38 50 22N long 105 10 29W	lat 38 50 17N long 105 05 59W	5		1/12/2006	1.799999952	05/15	06/30
Pine Creek	6	44	6-92CW082	1	6-92CW082	9/16/1992	5.9	FALSE	FALSE			confl South Fork Williams Fork at	headwaters at	lat 40 13 14N long 107 26 52W	lat 40 10 44N long 107 30 22W	5			0.5	12/1	03/31
Pine Creek	6	44	6-92CW082	1	6-92CW082	9/16/1992	5.9	FALSE	FALSE			confl South Fork Williams Fork at	headwaters at	lat 40 13 14N long 107 26 52W	lat 40 10 44N long 107 30 22W	5			0.75	08/1	11/30
Pine Creek	6	44	6-92CW082	1	6-92CW082	9/16/1992	5.9	FALSE	FALSE			confl South Fork Williams Fork at	headwaters at	lat 40 13 14N long 107 26 52W	lat 40 10 44N long 107 30 22W	5			1.5	04/1	07/31
Pinos Creek	3	20	3-94CW057	1	3-94CW057	3/9/1994	3	FALSE	FALSE			Del Norte Pipeline in	confl Bennett Creek in	SW NW S15 T39N R5E NMPM	SW SE S29 T39N R5E NMPM	5		2/16/2006	4.5	12/1	2/29
Pinos Creek	3	20	3-94CW057	1	3-94CW057	3/9/1994	3	FALSE	FALSE			Del Norte Pipeline in	confl Bennett Creek in	SW NW S15 T39N R5E NMPM	SW SE S29 T39N R5E NMPM	5		2/16/2006	6	03/1	3/31
Pinos Creek	3	20	3-94CW057	1	3-94CW057	3/9/1994	3	FALSE	FALSE			Del Norte Pipeline in	confl Bennett Creek in	SW NW S15 T39N R5E NMPM	SW SE S29 T39N R5E NMPM	5		2/16/2006	6	08/16	11/30
Pinos Creek	3	20	3-94CW057	1	3-94CW057	3/9/1994	3	FALSE	FALSE			Del Norte Pipeline in	confl Bennett Creek in	SW NW S15 T39N R5E NMPM	SW SE S29 T39N R5E NMPM	5		2/16/2006	10	04/1	8/15
Pole Creek	5	51	5-90CW293	3	5-90CW293	11/27/1990	2.5	FALSE	FALSE			confl Skunk Creek at	confl unnamed tributary in	lat 39 59 01N long 105 52 03W	SW SE S5 T1S R76W 6PM	5		5/17/2006	1	08/1	03/31
Pole Creek	5	51	5-90CW293	3	5-90CW293	11/27/1990	2.5	FALSE	FALSE			confl Skunk Creek at	confl unnamed tributary in	lat 39 59 01N long 105 52 03W	SW SE S5 T1S R76W 6PM	5		5/17/2006	1.5	07/01	07/31
Pole Creek	5	51	5-90CW293	3	5-90CW293	11/27/1990	2.5	FALSE	FALSE			confl Skunk Creek at	confl unnamed tributary in	lat 39 59 01N long 105 52 03W	SW SE S5 T1S R76W 6PM	5		5/17/2006	3	04/1	06/30
Pole Creek	5	51	5-90CW293A	4	5-90CW293A	11/27/1990	1.6	FALSE	FALSE			confl Crooked Creek in	confl Skunk Creek at	SE NE S2 T1S R76W 6PM	lat 39 59 01N long 105 52 03W	5		5/17/2006	0.5	01/1	12/31
Pole Creek	5	51	5-90CW293A	4	5-90CW293A	11/27/1990	1.6	FALSE	FALSE			confl Crooked Creek in	confl Skunk Creek at	SE NE S2 T1S R76W 6PM	lat 39 59 01N long 105 52 03W	5		5/17/2006	1	09/1	03/31
Pole Creek	5	51	5-90CW293A	4	5-90CW293A	11/27/1990	1.6	FALSE	FALSE			confl Crooked Creek in	confl Skunk Creek at	SE NE S2 T1S R76W 6PM	lat 39 59 01N long 105 52 03W	5		5/17/2006	1.5	08/1	08/31
Pole Creek	5	51	5-90CW293A	4	5-90CW293A	11/27/1990	1.6	FALSE	FALSE			confl Crooked Creek in	confl Skunk Creek at	SE NE S2 T1S R76W 6PM	lat 39 59 01N long 105 52 03W	5		5/17/2006	2	07/1	07/31
Pole Creek	5	51	5-90CW293A	4	5-90CW293A	11/27/1990	1.6	FALSE	FALSE			confl Crooked Creek in	confl Skunk Creek at	SE NE S2 T1S R76W 6PM	lat 39 59 01N long 105 52 03W	5		5/17/2006	3	04/1	06/30
Potter Creek	4	40	04/4/A-014	2	4-04CW161	1/28/2004	9	FALSE	FALSE			confl Roubideau Creek at	BLM-USFS boundary at	lat 38 38 18N long 108 11 40W	lat 38 31 58N long 108 15 23W	5		2/22/2006	1.399999976	08/01	02/29
Potter Creek	4	40	04/4/A-014	2	4-04CW161	1/28/2004	9	FALSE	FALSE			confl Roubideau Creek at	BLM-USFS boundary at	lat 38 38 18N long 108 11 40W	lat 38 31 58N long 108 15 23W	5		2/22/2006	1.799999952	03/01	03/31
Potter Creek	4	40	04/4/A-014	2	4-04CW161	1/28/2004	9	FALSE	FALSE			confl Roubideau Creek at	BLM-USFS boundary at	lat 38 38 18N long 108 11 40W	lat 38 31 58N long 108 15 23W	5		2/22/2006	1.799999952	06/16	07/31
Potter Creek	4	40	04/4/A-014	2	4-04CW161	1/28/2004	9	FALSE	FALSE			confl Roubideau Creek at	BLM-USFS boundary at	lat 38 38 18N long 108 11 40W	lat 38 31 58N long 108 15 23W	5		2/22/2006	4	04/01	06/15
Prospector Gulch	4	59	4-98CW218	1	4-98CW218	1/29/1998	3	FALSE	FALSE			confl Texas Creek at	headwaters in vicinity of	lat 38 52 08N long 106 26 20W	lat 38 54 28N long 106 26 30W	5		2/22/2006	0.400000006	10/15	04/30
Prospector Gulch	4	59	4-98CW218	1	4-98CW218	1/29/1998	3	FALSE	FALSE			confl Texas Creek at	headwaters in vicinity of	lat 38 52 08N long 106 26 20W	lat 38 54 28N long 106 26 30W	5		2/22/2006	1	08/15	10/14
Prospector Gulch	4	59	4-98CW218	1	4-98CW218	1/29/1998	3	FALSE	FALSE			confl Texas Creek at	headwaters in vicinity of	lat 38 52 08N long 106 26 20W	lat 38 54 28N long 106 26 30W	5		2/22/2006	2	05/1	08/14
Ranch Creek	5	51	5-90CW290	1	5-90CW290	11/27/1990	2.8	FALSE	FALSE			Denver Water Board diversion in	headwaters at Pumphouse Lake at	SE SW S24 T1S R75W 6PM	lat 39 55 34N long 105 41 25W	5			0.5	10/1	04/14
Ranch Creek	5	51	5-90CW290	1	5-90CW290	11/27/1990	2.8	FALSE	FALSE			Denver Water Board diversion in	headwaters at Pumphouse Lake at	SE SW S24 T1S R75W 6PM	lat 39 55 34N long 105 41 25W	5			1.5	08/15	09/30
Ranch Creek	5	51	5-90CW290	1	5-90CW290	11/27/1990	2.8	FALSE	FALSE			Denver Water Board diversion in	headwaters at Pumphouse Lake at	SE SW S24 T1S R75W 6PM	lat 39 55 34N long 105 41 25W	5			4	04/15	08/14
Red Dirt Creek	5	53	5-95CW286	1	5-95CW286	11/6/1995	2.6	FALSE	FALSE			Wilson and Doll Ditch in	confl EF & WF Red Dirt Ck in	NW SE S12 T3S R86W 6PM	NE NE S3 T3S R86W 6PM	5			1	11/1	03/31
Red Dirt Creek	5	53	5-95CW286	1	5-95CW286	11/6/1995	2.6	FALSE	FALSE			Wilson and Doll Ditch in	confl EF & WF Red Dirt Ck in	NW SE S12 T3S R86W 6PM	NE NE S3 T3S R86W 6PM	5			1.75	08/1	10/31
Red Dirt Creek	5	53	5-95CW286	1	5-95CW286	11/6/1995	2.6	FALSE	FALSE			Wilson and Doll Ditch in	confl EF & WF Red Dirt Ck in	NW SE S12 T3S R86W 6PM	NE NE S3 T3S R86W 6PM	5			3	04/1	07/31
Red Sandstone Creek	5	37	5-77W3631	1	5-77W3631	7/27/1977	4.5	FALSE	FALSE			confl Indian Creek in	headwaters in vicinity of	S25 T4S R81W 6PM	lat 39 42 57N long 106 20 38W	5			1	10/1	04/30
Red Sandstone Creek	5	37	5-77W3631	1	5-77W3631	7/27/1977	4.5	FALSE	FALSE			confl Indian Creek in	headwaters in vicinity of	S25 T4S R81W 6PM	lat 39 42 57N long 106 20 38W	5			2	05/1	09/30
Redman Creek	2	11	2-98CW156	1	2-98CW156	5/11/1998	3.2	FALSE	FALSE			confl Green Creek at	headwaters in vicinity of	lat 38 30 43N long 106 10 44W	lat 38 28 54N long 106 12 43W	5		1/12/2006	0.300000012	10/15	05/14
Redman Creek	2	11	2-98CW156	1	2-98CW156	5/11/1998	3.2	FALSE	FALSE			confl Green Creek at	headwaters in vicinity of	lat 38 30 43N long 106 10 44W	lat 38 28 54N long 106 12 43W	5		1/12/2006	0.600000024	08/15	10/14
Redman Creek	2	11	2-98CW156	1	2-98CW156	5/11/1998	3.2	FALSE	FALSE			confl Green Creek at	headwaters in vicinity of	lat 38 30 43N long 106 10 44W	lat 38 28 54N long 106 12 43W	5		1/12/2006	1	05/15	08/14
Rock Creek	1	6	06/01/A-001		06/01/A-001		2.3	FALSE	FALSE			Rocky Flats Wildlife Refuge Boundary	Headwaters	lat 39 54 53N long 105 11 39W	lat 39 53 32N long 105 13 53W	3	1/6/2006	5/4/2006	0.100000001	06/01	10/31
Rock Creek	1	6	06/01/A-001		06/01/A-001		2.3	FALSE	FALSE			Rocky Flats Wildlife Refuge Boundary	Headwaters	lat 39 54 53N long 105 11 39W	lat 39 53 32N long 105 13 53W	3	1/6/2006	5/4/2006	0.25	11/01	02/28
Rock Creek	1	6	06/01/A-001		06/01/A-001		2.3	FALSE	FALSE			Rocky Flats Wildlife Refuge Boundary	Headwaters	lat 39 54 53N long 105 11 39W	lat 39 53 32N long 105 13 53W	3	1/6/2006	5/4/2006	0.699999988	03/01	05/31
Roubideau Creek	4	40	04/4/A-013		4-04CW162	1/28/2004	14.4	FALSE	FALSE			BLM boundary at	confl Moore Creek at	lat 38 40 18N long 108 09 09W	lat 38 31 22N long 108 12 12W	5		1/0/1900	1.899999976	08/01	02/29
Roubideau Creek	4	40	04/4/A-013		4-04CW162	1/28/2004	14.4	FALSE	FALSE			BLM boundary at	confl Moore Creek at	lat 38 40 18N long 108 09 09W	lat 38 31 22N long 108 12 12W	5		1/0/1900	5	03/01	03/31
Roubideau Creek	4	40	04/4/A-013		4-04CW162	1/28/2004	14.4	FALSE	FALSE			BLM boundary at	confl Moore Creek at	lat 38 40 18N long 108 09 09W	lat 38 31 22N long 108 12 12W	5		1/0/1900	5	06/16	07/31
Roubideau Creek	4	40	04/4/A-013		4-04CW162	1/28/2004	14.4	FALSE	FALSE			BLM boundary at	confl Moore Creek at	lat 38 40 18N long 108 09 09W	lat 38 31 22N long 108 12 12W	5		1/0/1900	21	04/01	06/15
San Francisco Creek	3	20	3-94CW050	1	3-94CW050	3/9/1994	2.3	FALSE	FALSE			USGS Gage in	confl WF & MF San Francisco Cr at	NE SE S36 T39N R5E NMPM	lat 37 33 21N long 106 23 38W	5			1	1/1	3/31
San Francisco Creek	3	20	3-94CW050	1	3-94CW050	3/9/1994	2.3	FALSE	FALSE			USGS Gage in	confl WF & MF San Francisco Cr at	NE SE S36 T39N R5E NMPM	lat 37 33 21N long 106 23 38W	5			1.5	04/1	4/30
San Francisco Creek	3	20	3-94CW050	1	3-94CW050	3/9/1994	2.3	FALSE	FALSE			USGS Gage in	confl WF & MF San Francisco Cr at	NE SE S36 T39N R5E NMPM	lat 37 33 21N long 106 23 38W	5			1.5	11/1	12/31
San Francisco Creek	3	20	3-94CW050	1	3-94CW050	3/9/1994	2.3	FALSE	FALSE			USGS Gage in	confl WF & MF San Francisco Cr at	NE SE S36 T39N R5E NMPM	lat 37 33 21N long 106 23 38W	5			2.5	05/1	10/31
Second Anvil Creek	5	39	00/5/A-005	1	5-00CW132	1/26/2000	2	FALSE	FALSE			confl E Fk Parachute Creek at	headwaters at	lat 39 34 05N long 107 56 52W	lat 39 34 05N long 107 56 52W	5		5/18/2006	0.100000001	09/1	03/14
Second Anvil Creek	5	39	00/5/A-005	1	5-00CW132	1/26/2000	2	FALSE	FALSE			confl E Fk Parachute Creek at	headwaters at	lat 39 34 05N long 107 56 52W	lat 39 34 05N long 107 56 52W	5		5/18/2006	0.200000003	03/15	04/14
Second Anvil Creek	5	39	00/5/A-005	1	5-00CW132	1/26/2000	2	FALSE	FALSE			confl E Fk Parachute Creek at	headwaters at	lat 39 34 05N long 107 56 52W	lat 39 34 05N long 107 56 52W	5		5/18/2006	0.200000003	07/01	08/31
Second Anvil Creek	5	39	00/5/A-005	1	5-00CW132	1/26/2000	2	FALSE	FALSE			confl E Fk Parachute Creek at	headwaters at	lat 39 34 05N long 107 56 52W	lat 39 34 05N long 107 56 52W	5		5/18/2006	0.699999988	04/15	06/30
Smith Fork Gunnison River	4	40	05/04/A-008		05/04/A-008		3.9	FALSE	FALSE			Little Coal Creek	North and South Smith Forks	lat 38 43 43N long 107 31 39W	lat 38 43 31N long 107 28 23W	2		1/0/1900	6.5	11/15	02/29
Smith Fork Gunnison River	4	40	05/04/A-008		05/04/A-008		3.9	FALSE	FALSE			Little Coal Creek	North and South Smith Forks	lat 38 43 43N long 107 31 39W	lat 38 43 31N long 107 28 23W	2		1/0/1900	7.699999809	03/1	03/31
Smith Fork Gunnison River	4	40	05/04/A-008		05/04/A-008		3.9	FALSE	FALSE			Little Coal Creek	North and South Smith Forks	lat 38 43 43N long 107 31 39W	lat 38 43 31N long 107 28 23W	2		1/0/1900	7.699999809	08/01	11/14
Smith Fork Gunnison River	4	40	05/04/A-008		05/04/A-008		3.9	FALSE	FALSE			Little Coal Creek	North and South Smith Forks	lat 38 43 43N long 107 31 39W	lat 38 43 31N long 107 28 23W	2		1/0/1900	12.89999962	04/01	07/31
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			7	11/1	12/31
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			8	01/1	03/31
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			8	10/22	10/31
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			8	12/29	12/31
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			8.5	12/22	12/28
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			9	01/1	03/31
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			9	10/16	10/21
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			9	11/15	12/21
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			9	12/15	12/31
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			10	01/1	03/31
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			10	11/1	11/14
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			10	11/1	12/14
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			10	12/1	03/31

stream_name	water_division	water_district	segment_id	segment_order	cwcb_case_display	intent_to_appropriate_date	segment_length	donated	enlargement	donated_right	donation_type	lt_description	ut_description	lower_terminus_location	upper_terminus_location	phase_number	add_date	modify_date	amount	beg_period	end_period
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			12	04/1	10/15
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			12	10/16	10/31
Snowmass Creek	5	38	5-76W2943A	2	5-76W2943A	1/14/1976	11.3	FALSE	FALSE			confl Capitol Creek in	confl W Snowmass Creek at	NW SE S34 T8S R86W 6PM	lat 39 11 24N long 107 00 57W	5			12	10/16	11/30
South Beaver Creek	4	62	4-98CW216	3	4-98CW216	5/11/1998	13.3	FALSE	FALSE			BLM boundary in	confl East Beaver Creek in	SE SW S32 T49N R1W NMPM	SE SW S12 T47N R1W NMPM	5		2/22/2006	0.699999988	11/1	04/14
South Beaver Creek	4	62	4-98CW216	3	4-98CW216	5/11/1998	13.3	FALSE	FALSE			BLM boundary in	confl East Beaver Creek in	SE SW S32 T49N R1W NMPM	SE SW S12 T47N R1W NMPM	5		2/22/2006	1.200000048	08/1	10/31
South Beaver Creek	4	62	4-98CW216	3	4-98CW216	5/11/1998	13.3	FALSE	FALSE			BLM boundary in	confl East Beaver Creek in	SE SW S32 T49N R1W NMPM	SE SW S12 T47N R1W NMPM	5		2/22/2006	2.5	04/15	07/31
South Fork Canadian River	6	47	6-92CW055	1	6-92CW055	5/8/1992	4	FALSE	FALSE			headgate Bradfield Ditch at	Jewel Lake at	lat 40 35 37N long 105 59 47W	lat 40 36 02N long 105 56 18W	5			0.5	11/1	04/15
South Fork Canadian River	6	47	6-92CW055	1	6-92CW055	5/8/1992	4	FALSE	FALSE			headgate Bradfield Ditch at	Jewel Lake at	lat 40 35 37N long 105 59 47W	lat 40 36 02N long 105 56 18W	5			1	09/1	10/31
South Fork Canadian River	6	47	6-92CW055	1	6-92CW055	5/8/1992	4	FALSE	FALSE			headgate Bradfield Ditch at	Jewel Lake at	lat 40 35 37N long 105 59 47W	lat 40 36 02N long 105 56 18W	5			2	04/16	08/31
South Fork Mesa Creek	4	63	02/4/B-020	2	4-02CW278	1/23/2002	10.4	FALSE	FALSE			confl East Mesa Creek	confl unnamed tributary at	lat 38 26 55N long 108 47 27W	lat 38 31 08N long 108 38 49W	4		2/22/2006	0.300000012	06/01	02/29
South Fork Mesa Creek	4	63	02/4/B-020	2	4-02CW278	1/23/2002	10.4	FALSE	FALSE			confl East Mesa Creek	confl unnamed tributary at	lat 38 26 55N long 108 47 27W	lat 38 31 08N long 108 38 49W	4		2/22/2006	1.25	03/01	03/31
South Fork Mesa Creek	4	63	02/4/B-020	2	4-02CW278	1/23/2002	10.4	FALSE	FALSE			confl East Mesa Creek	confl unnamed tributary at	lat 38 26 55N long 108 47 27W	lat 38 31 08N long 108 38 49W	4		2/22/2006	2	04/01	05/31
South Fork Michigan River	6	47	6-92CW056	1	6-92CW056	5/8/1992	2.1	FALSE	FALSE			headgate Mason Ditch at	confl Silver Creek at	lat 40 30 19N long 106 01 29W	lat 40 28 54N long 106 00 26W	5			4.5	11/1	04/30
South Fork Michigan River	6	47	6-92CW056	1	6-92CW056	5/8/1992	2.1	FALSE	FALSE			headgate Mason Ditch at	confl Silver Creek at	lat 40 30 19N long 106 01 29W	lat 40 28 54N long 106 00 26W	5			8.5	08/16	10/31
South Fork Michigan River	6	47	6-92CW056	1	6-92CW056	5/8/1992	2.1	FALSE	FALSE			headgate Mason Ditch at	confl Silver Creek at	lat 40 30 19N long 106 01 29W	lat 40 28 54N long 106 00 26W	5			18	05/1	8/15
South Fork Ranch Creek	5	51	5-90CW291	1	5-90CW291	11/27/1990	3.4	FALSE	FALSE			Denver Water Board diversion in	headwaters in vicinity of	SE NW S35 T1S R75W 6PM	lat 39 52 59N long 105 42 27W	5			0.5	11/1	03/31
South Fork Ranch Creek	5	51	5-90CW291	1	5-90CW291	11/27/1990	3.4	FALSE	FALSE			Denver Water Board diversion in	headwaters in vicinity of	SE NW S35 T1S R75W 6PM	lat 39 52 59N long 105 42 27W	5			1	08/15	10/31
South Fork Ranch Creek	5	51	5-90CW291	1	5-90CW291	11/27/1990	3.4	FALSE	FALSE			Denver Water Board diversion in	headwaters in vicinity of	SE NW S35 T1S R75W 6PM	lat 39 52 59N long 105 42 27W	5			3.5	05/1	08/14
South Fork Smith Fork	4	40	05/04/A-007		05/04/A-007		5.5	FALSE	FALSE			Saddle Mountain Ditch	headwaters	lat 38 43 24N long 107 28 04W	lat 38 40 20N long 107 24 30W	2		1/0/1900	2.400000095	11/15	03/14
South Fork Smith Fork	4	40	05/04/A-007		05/04/A-007		5.5	FALSE	FALSE			Saddle Mountain Ditch	headwaters	lat 38 43 24N long 107 28 04W	lat 38 40 20N long 107 24 30W	2		1/0/1900	3	08/01	11/14
South Fork Smith Fork	4	40	05/04/A-007		05/04/A-007		5.5	FALSE	FALSE			Saddle Mountain Ditch	headwaters	lat 38 43 24N long 107 28 04W	lat 38 40 20N long 107 24 30W	2		1/0/1900	4.099999905	03/15	04/14
South Fork Smith Fork	4	40	05/04/A-007		05/04/A-007		5.5	FALSE	FALSE			Saddle Mountain Ditch	headwaters	lat 38 43 24N long 107 28 04W	lat 38 40 20N long 107 24 30W	2		1/0/1900	6.400000095	04/15	07/31
South Fork Williams Fork River	6	44	6-92CW084	1	6-92CW084	9/16/1992	6.3	FALSE	FALSE			confl Beaver Creek at	confl Pagoda Creek at	lat 40 16 22N long 107 26 02W	lat 40 11 25N long 107 26 35W	5			3.5	08/1	09/30
South Fork Williams Fork River	6	44	6-92CW084	1	6-92CW084	9/16/1992	6.3	FALSE	FALSE			confl Beaver Creek at	confl Pagoda Creek at	lat 40 16 22N long 107 26 02W	lat 40 11 25N long 107 26 35W	5			5	10/1	03/15
South Fork Williams Fork River	6	44	6-92CW084	1	6-92CW084	9/16/1992	6.3	FALSE	FALSE			confl Beaver Creek at	confl Pagoda Creek at	lat 40 16 22N long 107 26 02W	lat 40 11 25N long 107 26 35W	5			8	03/16	07/31
South St Vrain Creek	1	5	1-87CW278	3	1-87CW278	12/11/1987	9.1	FALSE	FALSE			hdgate of Longmont Diversion in	confl Middle St Vrain Creek at	SE NW S19 T3N R70W 6PM	lat 40 10 03N long 105 23 46W	5			7	12/1	03/31
South St Vrain Creek	1	5	1-87CW278	3	1-87CW278	12/11/1987	9.1	FALSE	FALSE			hdgate of Longmont Diversion in	confl Middle St Vrain Creek at	SE NW S19 T3N R70W 6PM	lat 40 10 03N long 105 23 46W	5			12	10/1	11/30
South St Vrain Creek	1	5	1-87CW278	3	1-87CW278	12/11/1987	9.1	FALSE	FALSE			hdgate of Longmont Diversion in	confl Middle St Vrain Creek at	SE NW S19 T3N R70W 6PM	lat 40 10 03N long 105 23 46W	5			20	04/1	09/30
South St Vrain Creek	1	5	1-87CW283	4	1-87CW283	12/11/1987	0.7	FALSE	FALSE			confl North St Vrain Creek in	hdgate of Longmont Diversion in	SE SE S18 T3N R70W 6PM	SE NW S19 T3N R70W 6PM	5			4	12/1	03/31
South St Vrain Creek	1	5	1-87CW283	4	1-87CW283	12/11/1987	0.7	FALSE	FALSE			confl North St Vrain Creek in	hdgate of Longmont Diversion in	SE SE S18 T3N R70W 6PM	SE NW S19 T3N R70W 6PM	5			12	10/1	11/30
South St Vrain Creek	1	5	1-87CW283	4	1-87CW283	12/11/1987	0.7	FALSE	FALSE			confl North St Vrain Creek in	hdgate of Longmont Diversion in	SE SE S18 T3N R70W 6PM	SE NW S19 T3N R70W 6PM	5			20	04/1	09/30
South St Vrain Creek	1	5	1-95CW261	1	1-95CW261	7/24/1995	1.1	FALSE	FALSE			inlet of Long Lake at	outlet Lake Isabelle at	lat 40 04 12N long 105 35 45W	lat 40 04 10N long 105 36 52W	5			1	10/1	03/31
South St Vrain Creek	1	5	1-95CW261	1	1-95CW261	7/24/1995	1.1	FALSE	FALSE			inlet of Long Lake at	outlet Lake Isabelle at	lat 40 04 12N long 105 35 45W	lat 40 04 10N long 105 36 52W	5			2	04/1	04/30
South St Vrain Creek	1	5	1-95CW261	1	1-95CW261	7/24/1995	1.1	FALSE	FALSE			inlet of Long Lake at	outlet Lake Isabelle at	lat 40 04 12N long 105 35 45W	lat 40 04 10N long 105 36 52W	5			2	09/1	09/30
South St Vrain Creek	1	5	1-95CW261	1	1-95CW261	7/24/1995	1.1	FALSE	FALSE			inlet of Long Lake at	outlet Lake Isabelle at	lat 40 04 12N long 105 35 45W	lat 40 04 10N long 105 36 52W	5			5	05/1	08/31
South Texas Creek	4	59	4-98CW215	1	4-98CW215	1/29/1998	3.14	FALSE	FALSE			confl Texas Creek at	headwaters in vicinity of	lat 38 52 58N long 106 23 25W	lat 38 49 50N long 106 23 19W	5			0.600000024	12/1	4/30
South Texas Creek	4	59	4-98CW215	1	4-98CW215	1/29/1998	3.14	FALSE	FALSE			confl Texas Creek at	headwaters in vicinity of	lat 38 52 58N long 106 23 25W	lat 38 49 50N long 106 23 19W	5			1	09/15	11/30
South Texas Creek	4	59	4-98CW215	1	4-98CW215	1/29/1998	3.14	FALSE	FALSE			confl Texas Creek at	headwaters in vicinity of	lat 38 52 58N long 106 23 25W	lat 38 49 50N long 106 23 19W	5			2	05/1	9/14
Specie Creek	4	60	02/4/B-024	3	4-02CW279	1/23/2002	3.2	FALSE	FALSE			confl San Miguel River at	confl unnamed tributary at	lat 38 01 51N long 108 06 33W	lat 37 59 28N long 108 06 36W	4		2/22/2006	0.200000003	06/01	03/31
Specie Creek	4	60	02/4/B-024	3	4-02CW279	1/23/2002	3.2	FALSE	FALSE			confl San Miguel River at	confl unnamed tributary at	lat 38 01 51N long 108 06 33W	lat 37 59 28N long 108 06 36W	4		2/22/2006	1.600000024	04/01	04/30
Specie Creek	4	60	02/4/B-024	3	4-02CW279	1/23/2002	3.2	FALSE	FALSE			confl San Miguel River at	confl unnamed tributary at	lat 38 01 51N long 108 06 33W	lat 37 59 28N long 108 06 36W	4		2/22/2006	4.300000191	05/01	05/31
Spring Creek	4	40	02/4/A-041	2	4-05CW245A	1/23/2002	0.8	FALSE	FALSE			hdgt Downing Ditch at	spring outlet at	lat 39 01 55N long 107 19 40W	lat 39 01 55N long 107 18 57W	4		6/1/2006	0.5	10/15	04/14
Spring Creek	4	40	02/4/A-041	2	4-05CW245A	1/23/2002	0.8	FALSE	FALSE			hdgt Downing Ditch at	spring outlet at	lat 39 01 55N long 107 19 40W	lat 39 01 55N long 107 18 57W	4		6/1/2006	0.800000012	08/15	10/14
Spring Creek	4	40	02/4/A-041	2	4-05CW245A	1/23/2002	0.8	FALSE	FALSE			hdgt Downing Ditch at	spring outlet at	lat 39 01 55N long 107 19 40W	lat 39 01 55N long 107 18 57W	4		6/1/2006	2.700000048	04/15	08/14
Spring Creek	4	41	04/4/A-011		4-04CW163	1/28/2004	5.5	FALSE	FALSE			hdgt Kenton Ditch at	confl E & M Fks Spring Creek at	lat 38 23 23N long 107 56 47W	lat 38 19 49N long 107 59 53W	5		6/1/2006	0.899999976	08/01	03/31
Spring Creek	4	41	04/4/A-011		4-04CW163	1/28/2004	5.5	FALSE	FALSE			hdgt Kenton Ditch at	confl E & M Fks Spring Creek at	lat 38 23 23N long 107 56 47W	lat 38 19 49N long 107 59 53W	5		6/1/2006	2.599999905	06/16	07/31
Spring Creek	4	41	04/4/A-011		4-04CW163	1/28/2004	5.5	FALSE	FALSE			hdgt Kenton Ditch at	confl E & M Fks Spring Creek at	lat 38 23 23N long 107 56 47W	lat 38 19 49N long 107 59 53W	5		6/1/2006	5.300000191	04/01	06/15
St Louis Creek	5	51	5-90CW317	3	5-90CW317	11/27/1990	0.9	FALSE	FALSE			confl W St Louis Creek at	confl E St Louis Creek at	lat 39 54 33N long 105 52 42W	lat 39 53 50N long 105 52 55W	5		5/18/2006	3	09/16	05/14
St Louis Creek	5	51	5-90CW317	3	5-90CW317	11/27/1990	0.9	FALSE	FALSE			confl W St Louis Creek at	confl E St Louis Creek at	lat 39 54 33N long 105 52 42W	lat 39 53 50N long 105 52 55W	5		5/18/2006	10	05/15	05/31
St Louis Creek	5	51	5-90CW317	3	5-90CW317	11/27/1990	0.9	FALSE	FALSE			confl W St Louis Creek at	confl E St Louis Creek at	lat 39 54 33N long 105 52 42W	lat 39 53 50N long 105 52 55W	5		5/18/2006	10	08/1	09/15
St Louis Creek	5	51	5-90CW317	3	5-90CW317	11/27/1990	0.9	FALSE	FALSE			confl W St Louis Creek at	confl E St Louis Creek at	lat 39 54 33N long 105 52 42W	lat 39 53 50N long 105 52 55W	5		5/18/2006	11	06/1	07/31
St Louis Creek	5	51	5-90CW317A	4	5-90CW317A	11/27/1990	0.4	FALSE	FALSE			confl King Creek at	confl W St Louis Creek at	lat 39 54 52N long 105 52 27W	lat 39 54 33N long 105 52 42W	5		5/18/2006	4.5	09/16	05/14
St Louis Creek	5	51	5-90CW317A	4	5-90CW317A	11/27/1990	0.4	FALSE	FALSE			confl King Creek at	confl W St Louis Creek at	lat 39 54 52N long 105 52 27W	lat 39 54 33N long 105 52 42W	5		5/18/2006	10	05/15	05/31
St Louis Creek	5	51	5-90CW317A	4	5-90CW317A	11/27/1990	0.4	FALSE	FALSE			confl King Creek at	confl W St Louis Creek at	lat 39 54 52N long 105 52 27W	lat 39 54 33N long 105 52 42W	5		5/18/2006	10	08/1	09/15
St Louis Creek	5	51	5-90CW317A	4	5-90CW317A	11/27/1990	0.4	FALSE	FALSE			confl King Creek at	confl W St Louis Creek at	lat 39 54 52N long 105 52 27W	lat 39 54 33N long 105 52 42W	5		5/18/2006	11	06/1	07/31
Strawberry Creek	5	51	5-90CW319	1	5-90CW319	11/27/1990	4.2	FALSE	FALSE			confl unnamed tributary in	headwaters in	SW NE S5 T1N R75W 6PM	SW NW S12 T1N R75W 6PM	5			0.25	10/1	04/14
Strawberry Creek	5	51	5-90CW319	1	5-90CW319	11/27/1990	4.2	FALSE	FALSE			confl unnamed tributary in	headwaters in	SW NE S5 T1N R75W 6PM	SW NW S12 T1N R75W 6PM	5			0.75	08/15	09/30
Strawberry Creek	5	51	5-90CW319	1	5-90CW319	11/27/1990	4.2	FALSE	FALSE			confl unnamed tributary in	headwaters in	SW NE S5 T1N R75W 6PM	SW NW S12 T1N R75W 6PM	5			1.5	04/15	08/14
Swamp Canyon Creek	4	60	02/4/A-016	1	4-02CW280	1/23/2002	2.2	FALSE	FALSE			confl Howard's Fk San Miguel R at	outlet unnamed lake at	lat 37 51 18N long 107 48 11W	lat 37 49 42N long 107 48 25W	4		5/4/2006	0.899999976	10/15	04/30
Swamp Canyon Creek	4	60	02/4/A-016	1	4-02CW280	1/23/2002	2.2	FALSE	FALSE			confl Howard's Fk San Miguel R at	outlet unnamed lake at	lat 37 51 18N long 107 48 11W	lat 37 49 42N long 107 48 25W	4		5/4/2006	1.399999976	08/15	10/14
Swamp Canyon Creek	4	60	02/4/A-016	1	4-02CW280	1/23/2002	2.2	FALSE	FALSE			confl Howard's Fk San Miguel R at	outlet unnamed lake at	lat 37 51 18N long 107 48 11W	lat 37 49 42N long 107 48 25W	4		5/4/2006	3	05/01	08/14
Tennessee Creek	2	11	2-98CW145	3	2-98CW145	12/9/1998	1.2	FALSE	FALSE			confl St Kevin Gulch in	north Section Line	NE NE S8 T9S R80W 6PM	NE NE S5 T9S R80W 6PM	4		1/12/2006	4.5	10/15	05/14
Tennessee Creek	2	11	2-98CW145	3	2-98CW145	12/9/1998	1.2	FALSE	FALSE			confl St Kevin Gulch in	north Section Line	NE NE S8 T9S R80W 6PM	NE NE S5 T9S R80W 6PM	4		1/12/2006	7	08/1	10/14
Tennessee Creek	2	11	2-98CW145	3	2-98CW145	12/9/1998	1.2	FALSE	FALSE			confl St Kevin Gulch in	north Section Line	NE NE S8 T9S R80W 6PM	NE NE S5 T9S R80W 6PM	4		1/12/2006	19	05/15	07/31
Tennessee Creek	2	11	2-98CW146	4	2-98CW146	12/9/1998	2.2	FALSE	FALSE			confl E Fk Arkansas River in	confl St Kevin Gulch in	NW NW S21 T9S R80W 6PM	NE NE S8 T9S R80W 6PM	4		1/12/2006	6	10/15	05/14
Tennessee Creek	2	11	2-98CW146	4	2-98CW146	12/9/1998	2.2	FALSE	FALSE			confl E Fk Arkansas River in	confl St Kevin Gulch in	NW NW S21 T9S R80W 6PM	NE NE S8 T9S R80W 6PM	4		1/12/2006	9	08/01	10/14
Tennessee Creek	2	11	2-98CW146	4	2-98CW146	12/9/1998	2.2	FALSE	FALSE			confl E Fk Arkansas River in	confl St Kevin Gulch in	NW NW S21 T9S R80W 6PM	NE NE S8 T9S R80W 6PM	4		1/12/2006	19	05/15	07/31
Tennessee Creek	2	11	2-98CW151	2	2-98CW151	12/9/1998	1.2	FALSE	FALSE			north Section Line	confl Longs Gulch at	NE NE S5 T9S R80W 6PM	lat 39 19 01N long 106 20 23W	4		1/12/2006	3	10/15	05/14
Tennessee Creek	2	11	2-98CW151	2	2-98CW151	12/9/1998	1.2	FALSE	FALSE			north Section Line	confl Longs Gulch at	NE NE S5 T9S R80W 6PM	lat 39 19 01N long 106 20 23W	4		1/12/2006	5.5	08/01	10/14
Tennessee Creek	2	11	2-98CW151	2	2-98CW151	12/9/1998	1.2	FALSE	FALSE			north Section Line	confl Longs Gulch at	NE NE S5 T9S R80W 6PM	lat 39 19 01N long 106 20 23W	4		1/12/2006	17	05/15	07/31
Thirtyone Mile Creek	2	12	04/2/A-005	1	2-04CW087	1/28/2004	10.1	FALSE	FALSE			confl Currant Creek at	headwaters at	lat 38 44 07N long 105 32 16W	lat 38 46 00N long 105 40 58W	5		1/10/2006	0.349999994	11/01	04/14
Thirtyone Mile Creek	2	12	04/2/A-005	1	2-04CW087	1/28/2004	10.1	FALSE	FALSE			confl Currant Creek at	headwaters at	lat 38 44 07N long 105 32 16W	lat 38 46 00N long 105 40 58W	5		1/10/2006	0.5	05/15	10/31
Thirtyone Mile Creek	2	12	04/2/A-005	1	2-04CW087	1/28/2004	10.1	FALSE	FALSE			confl Currant Creek at	headwaters at	lat 38 44 07N long 105 32 16W	lat 38 46 00N long 105 40 58W	5		1/10/2006	1	04/15	05/14
Tunnel Gulch	2	11	04/2/A-010	1	2-04CW088	1/28/2004	2.4	FALSE	FALSE			confl Chalk Creek at	outlet Tunnel Lake at	lat 38 39 20N long 106 22 31W	lat 38 39 21N long 106 24 54W	5		1/10/2006	0.5	11/01	04/30
Tunnel Gulch	2	11	04/2/A-010	1	2-04CW088	1/28/2004	2.4	FALSE	FALSE			confl Chalk Creek at	outlet Tunnel Lake at	lat 38 39 20N long 106 22 31W	lat 38 39 21N long 106 24 54W	5		1/10/2006	1.100000024	09/15	10/31
Tunnel Gulch	2	11	04/2/A-010	1	2-04CW088	1/28/2004	2.4	FALSE	FALSE			confl Chalk Creek at	outlet Tunnel Lake at	lat 38 39 20N long 106 22 31W	lat 38 39 21N long 106 24 54W	5		1/10/2006	2.099999905	05/01	09/14
Twin Cabin Gulch	1	4	1-89CW209	1	1-89CW209	11/14/1989	3.4	FALSE	FALSE			confl Buckhorn Creek in	confl unnamed tributary in	NW NE S18 T7N R71W 6PM	NE SW S36 T8N R72W 6PM	5			0.25	11/1	04/30
Twin Cabin Gulch	1	4	1-89CW209	1	1-89CW209	11/14/1989	3.4	FALSE	FALSE			confl Buckhorn Creek in	confl unnamed tributary in	NW NE S18 T7N R71W 6PM	NE SW S36 T8N R72W 6PM	5			0.5	09/1	10/31
Twin Cabin Gulch	1	4	1-89CW209	1	1-89CW209	11/14/1989	3.4	FALSE	FALSE			confl Buckhorn Creek in	confl unnamed tributary in	NW NE S18 T7N R71W 6PM	NE SW S36 T8N R72W 6PM	5			1.5	05/1	08/31
Waterloo Gulch	4	59	4-98CW221	1	4-98CW221	5/11/1998	3.5	FALSE	FALSE			confl Texas Creek at	headwaters in vicinity of	lat 38 51 57N long 106 26 16W	lat 38 54 30N long 106 26 24W	5		2/22/2006	0.75	10/1	04/30
Waterloo Gulch	4	59	4-98CW221	1	4-98CW221	5/11/1998	3.5	FALSE	FALSE			confl Texas Creek at	headwaters in vicinity of	lat 38 51 57N long 106 26 16W	lat 38 54 30N long 106 26 24W	5		2/22/2006	2	08/15	09/30
Waterloo Gulch	4	59	4-98CW221	1	4-98CW221	5/11/1998	3.5	FALSE	FALSE			confl Texas Creek at	headwaters in vicinity of	lat 38 51 57N long 106 26 16W	lat 38 54 30N long 106 26 24W	5		2/22/2006	3.5	05/1	08/14
West Antelope Creek	4	59	04/4/A-008		4-04CW164	1/28/2004	7.8	FALSE	FALSE			Dooley Antelope Ditch at	headwaters in vicinity of	lat 38 34 48N long 106 58 51W	lat 38 39 45N long 107 03 23W	4		5/17/2006	1.100000024	01/15	03/31
West Antelope Creek	4	59	04/4/A-008		4-04CW164	1/28/2004	7.8	FALSE	FALSE			Dooley Antelope Ditch at	headwaters in vicinity of	lat 38 34 48N long 106 58 51W	lat 38 39 45N long 107 03 23W	4		5/17/2006	1.200000048	09/01	01/14
West Antelope Creek	4	59	04/4/A-008		4-04CW164	1/28/2004	7.8	FALSE	FALSE			Dooley Antelope Ditch at	headwaters in vicinity of	lat 38 34 48N long 106 58 51W	lat 38 39 45N long 107 03 23W	4		5/17/2006	1.649999976	04/01	08/31
West Fork Dry Creek	4	41	04/4/A-010		4-05CW155	1/25/2005	5.9	FALSE	FALSE			confl East Fork Dry Creek at	confl Grays Creek at	lat 38 26 13N long 108 05 01W	lat 38 22 37N long 108 08 47W	4		2/22/2006	0.300000012	08/01	02/29
West Fork Dry Creek	4	41	04/4/A-010		4-05CW155	1/25/2005	5.9	FALSE	FALSE			confl East Fork Dry Creek at	confl Grays Creek at	lat 38 26 13N long 108 05 01W	lat 38 22 37N long 108 08 47W	4		2/22/2006	0.850000024	03/1	03/31
West Fork Dry Creek	4	41	04/4/A-010		4-05CW155	1/25/2005	5.9	FALSE	FALSE			confl East Fork Dry Creek at	confl Grays Creek at	lat 38 26 13N long 108 05 01W	lat 38 22 37N long 108 08 47W	4		2/22/2006	0.850000024	06/15	07/31
West Fork Dry Creek	4	41	04/4/A-010		4-05CW155	1/25/2005	5.9	FALSE	FALSE			confl East Fork Dry Creek at	confl Grays Creek at	lat 38 26 13N long 108 05 01W	lat 38 22 37N long 108 08 47W	4		2/22/2006	3.400000095	04/01	06/14
West Fork Pass Creek	3	20	3-89CW019	1	3-89CW019	5/11/1989	3.6	FALSE	FALSE			confl Pass Creek at	headwaters at spring at	lat 37 29 23N long 106 45 46W	lat 37 29 11N long 106 48 11W	5			0.5	10/1	04/30
West Fork Pass Creek	3	20	3-89CW019	1	3-89CW019	5/11/1989	3.6	FALSE	FALSE			confl Pass Creek at	headwaters at spring at	lat 37 29 23N long 106 45 46W	lat 37 29 11N long 106 48 11W	5			1	05/1	09/30
West Fork Red Dirt Creek	5	53	5-89CW184	1	5-89CW184	7/11/1989	5.9	FALSE	FALSE			confl EF Red Dirt Creek in	headwaters at	NE NE S3 T3S R86W 6PM	lat 39 51 13N long 107 06 13W	5			0.5	11/1	03/31
West Fork Red Dirt Creek	5	53	5-89CW184	1	5-89CW184	7/11/1989	5.9	FALSE	FALSE			confl EF Red Dirt Creek in	headwaters at	NE NE S3 T3S R86W 6PM	lat 39 51 13N long 107 06 13W	5			1	08/1	10/31
West Fork Red Dirt Creek	5	53	5-89CW184	1	5-89CW184	7/11/1989	5.9	FALSE	FALSE			confl EF Red Dirt Creek in	headwaters at	NE NE S3 T3S R86W 6PM	lat 39 51 13N long 107 06 13W	5			2.5	04/1	07/31
Wildcat Gulch	2	11	04/2/A-011	1	2-04CW089	1/28/2004	2.9	FALSE	FALSE			confl Chalk Creek at	headwaters at	lat 38 40 12N long 106 22 26W	lat 38 40 04N long 106 25 31W	5		1/10/2006	0.550000012	11/01	05/14
Wildcat Gulch	2	11	04/2/A-011	1	2-04CW089	1/28/2004	2.9	FALSE	FALSE			confl Chalk Creek at	headwaters at	lat 38 40 12N long 106 22 26W	lat 38 40 04N long 106 25 31W	5		1/10/2006	1.350000024	09/01	10/31
Wildcat Gulch	2	11	04/2/A-011	1	2-04CW089	1/28/2004	2.9	FALSE	FALSE			confl Chalk Creek at	headwaters at	lat 38 40 12N long 106 22 26W	lat 38 40 04N long 106 25 31W	5		1/10/2006	2.900000095	08/01	08/31

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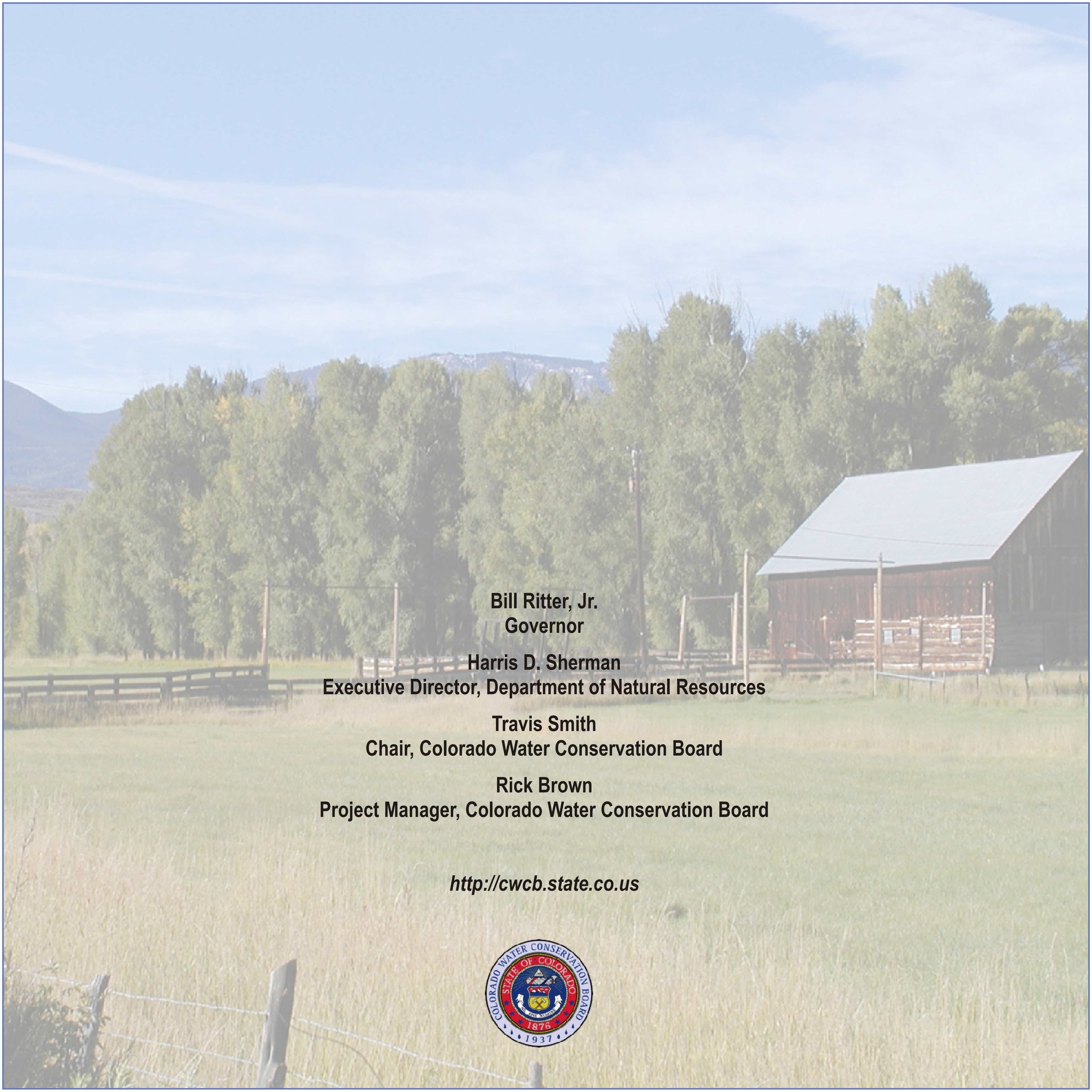
Wildcat Gulch	2	11	04/2/A-011	1	2-04CW089	1/28/2004	2.9	FALSE	FALSE			confl Chalk Creek at	headwaters at	lat 38 40 12N long 106 22 26W	lat 38 40 04N long 106 25 31W	5		1/10/2006	4.199999809	05/15	07/31
Willis Gulch	2	11	2-98CW147	2	2-98CW147	5/11/1998	4.1	FALSE	FALSE			confl Lake Creek at	confl unnamed tributary at	lat 39 04 03N long 106 23 23W	lat 39 01 37N long 106 25 54W	5		1/10/2006	1	01/1	03/31
Willis Gulch	2	11	2-98CW147	2	2-98CW147	5/11/1998	4.1	FALSE	FALSE			confl Lake Creek at	confl unnamed tributary at	lat 39 04 03N long 106 23 23W	lat 39 01 37N long 106 25 54W	5		1/10/2006	1.5	04/1	05/31
Willis Gulch	2	11	2-98CW147	2	2-98CW147	5/11/1998	4.1	FALSE	FALSE			confl Lake Creek at	confl unnamed tributary at	lat 39 04 03N long 106 23 23W	lat 39 01 37N long 106 25 54W	5		1/10/2006	1.5	11/1	12/31
Willis Gulch	2	11	2-98CW147	2	2-98CW147	5/11/1998	4.1	FALSE	FALSE			confl Lake Creek at	confl unnamed tributary at	lat 39 04 03N long 106 23 23W	lat 39 01 37N long 106 25 54W	5		1/10/2006	3	06/1	10/31
Woodfern Creek	3	20	3-94CW053	1	3-94CW053	3/9/1994	3.3	FALSE	FALSE			Woodfern Ditch in	headwaters at	NW NW S15 T40N R2W NMPM	lat 37 42 16N long 107 07 41W	5			0.400000006	09/1	4/15
Woodfern Creek	3	20	3-94CW053	1	3-94CW053	3/9/1994	3.3	FALSE	FALSE			Woodfern Ditch in	headwaters at	NW NW S15 T40N R2W NMPM	lat 37 42 16N long 107 07 41W	5			1.25	04/16	4/30
Woodfern Creek	3	20	3-94CW053	1	3-94CW053	3/9/1994	3.3	FALSE	FALSE			Woodfern Ditch in	headwaters at	NW NW S15 T40N R2W NMPM	lat 37 42 16N long 107 07 41W	5			1.25	07/1	8/31
Woodfern Creek	3	20	3-94CW053	1	3-94CW053	3/9/1994	3.3	FALSE	FALSE			Woodfern Ditch in	headwaters at	NW NW S15 T40N R2W NMPM	lat 37 42 16N long 107 07 41W	5			2.25	05/1	6/30



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