VOLUME 1 • JANUARY 2022

COLORADO

Basin Implementation Plan

Basin Implementation Plan at a Glance

The Colorado Basin Roundtable aims to provide much-needed water supply while supporting the local economy and protecting valuable resources.

KEY ACHIEVEMENTS

A variety of project successes support the Colorado Basin's needs while protecting valuable resources.

Those projects include:

- 2015 basinwide top projects
- Grant funds provided by the roundtable
- Stream management plans and integrated water management plans

CHALLENGES

The Colorado Basin needs to balance competing resources on a limited water supply.
Compact compliance, endangered species issues, sustaining the Basin's agricultural economy, and managing forests for improved resiliency and health throughout the watershed are all key challenges.

OUTREACH STRATEGIES

The Education Action Plan seeks to raise public awareness of roundtable activities and BIP, support watershed data and information gathering efforts, and foster collaboration with the roundtable. The outreach will focus on basin constituents, both water stakeholders and the general public, interested in funding and grant opportunities.

GOALS + OBJECTIVES

The basin has

6 KEY THEMES

each with supporting goals, centered around:

- ✓ **Protect and restore healthy streams, rivers, lakes, and riparian areas**
- ✓ **Secure safe drinking water**
- ✓ **Sustain agriculture**
- ✓ **Develop local water-conscious land use strategies**
- ✓ **Assure dependable basin administration**
- ✓ **Encourage a high level of basinwide conservation**

DEMAND, SUPPLY, POTENTIAL WATER NEEDS

Municipal and Industrial:
The Colorado Basin includes about 6 percent of the statewide population. Between the years 2015 and 2050, the population is projected to increase between 48 percent to 88 percent. Municipal demand is projected to increase for all scenarios except Hot Growth due to increased population. The diversion demand projections for all future scenarios are similar.

Agriculture:
Urbanization is expected to impact agricultural-based communities. Nearly 14,000 acres of irrigated land is expected to be urbanized, with one-third of that expected to occur within the Grand Valley Project and Grand Valley Irrigation Company service areas. Irrigated area is estimated to decrease basinwide irrigation water requirements, and diversion demand may increase in a warmer future climate.

Environment and Recreation:
Flows are projected to be variable depending on impacts of climate change. Decreased peak flows across the basin create risks for riparian/wetland plants and fish habitat. Instream flows and recreational in-channel diversions are likely to not be met if June-August flows decrease due to climate change.

Water Supply and Storage:
Available water supplies vary by location. Flows are projected to be available each year, though the amounts will vary annually and across scenarios (available flows under the scenarios impacted by climate change are less than in other scenarios). Storage in the Colorado Basin is critical to minimizing gaps.

FUTURE PROJECTS

More than
$4 billion
total estimated costs for project implementation*

321 Total Projects

104 Tier 1 Projects

205 Multi-purpose Projects

165 Projects meet agricultural needs

262 Projects meet environmental and recreational needs

** Total cost based on projects that provided cost information. Future basin projects include both consumptive and nonconsumptive projects that span all sectors of water use in the basin and are at various levels of development from conceptual to implementing.*

STRATEGIC VISION

Key strategies support broader goals with concise action.

These strategies are:

- **Fund the Basin Implementation Plan**
- **Support and promote legislation, policies, and agreements that align with the goals**
- **Use the integrated water management plan mechanism to reduce risks and enhance benefits across all sectors**
- **Implement projects that support the goals**
- **Plan for uncertainty in water supply**
- **Address the gap**
- **Integrate the Public Education, Participation & Outreach Plan with the Basin Implementation Plan Update**
- **Use the Colorado Basin Roundtable Next Steps Committee to implement these strategies**

List of Roundtable Members

The CWCB thanks the members of the Colorado Basin Roundtable for their efforts in updating their Basin Implementation Plan and contributions to the update of the Colorado Water Plan.

- **Paul Bruchez –** *Agriculture At-large Member*
- **Jim Pearce –** *At-large Representative*
- **Diane Johnson –** *At-large Representative*
- **Don Boyer –** *Basalt Water Conservancy District*
- **Carlyle Currier –** *Collbran Water Conservancy District*
- **Jason Turner –** *Colorado River Water Conservation District*
- **David Graf –** *Division of Wildlife (liason)*
- **Holly Loff –** *Eagle County Municipal Representative*
- **Nathan Bell –** *Garfield County*
- **Ed Moyer –** *Grand County*
- **Steve Acquafresca –** *Industrial Representative*
- **John Justman –** *Mesa County*
- **Stanley Cazier –** *Middle Park Water Conservancy District*
- **Raquel Flinker –** *Pitkin Municipality*
- **Scot Dedero –** *Silt Water Conservancy District*
- **Zach Margolis –** *Summit Municipality*
- **Rick McNeill –** *West Divide Water Conservancy District*
- **Ken Baker –** *Non-voting Member*
- **Maria Pastore –** *Colorado Springs Utilities - Non-voting Member*
- **Kim Albertson –** *At-large Representative*
- **Dave Reinersten –** *At-large Representative*
- **Merrit Linke –** *At-large Representative*
- **Victor Lee –** *Board of Regents (liason)*
- **Alan Martellaro –** *Colorado Division of Water Resources (liason)*
- **Gail Schwartz –** *Colorado Water Conservation Board Member*
- **Kathy Chandler-Henry –** *Eagle County*
- **Richard Van Gytenbeek –** *Environmental Representative*
- **Karl Hanlon –** *Garfield Municipality*
- **Bruce Hutchins –** *Grand Municipality*
- **April Long –** *Legislative Appointment*
- **Randi Kim –** *Mesa Municipality*
- **Kelly McNicholas Kury –** *Pitkin County*
- **Ken Ransford –** *Secretary; Recreation Representative*
- **Peggy Bailey –** *Summit County*
- **Greg Williams –** *Ute Water Conservancy District*
- **Jeff Bandy –** *Denver Water - Non-voting Member*
- **Kathy Kitzmann –** *Aurora Water - Non-voting Member*
- **Sam Stein –** *CWCB Liaison*

Photo source: Colorado River District

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DISCLAIMER

The Analysis and Technical Update to the Colorado Water Plan and the Basin Implementation Plan (BIP) provide technical data and information regarding Colorado's and the basin's water resources. The technical data and information generated are intended to help inform decision making and planning regarding water resources at a statewide or basinwide planning level. The information made available is not intended to replace projections or analyses prepared by local entities for specific project or planning purposes.

The Colorado Water Conservation Board (CWCB) and basin roundtables intend for the Technical Update and the BIP to help promote and facilitate a better understanding of water supply and demand considerations; however, the datasets provided are from a snapshot in time and cannot reflect actual or exact conditions in any given basin or the State at any given time. While the Technical Update and BIP strive to reflect the CWCB's best estimates of future water supply and demands under various scenarios, the reliability of these estimates is affected by the availability and reliability of data and the current capabilities of data evaluation. Moreover, the Technical Update and BIP cannot incorporate the varied and complex legal and policy considerations that may be relevant and applicable to any particular basin or project; therefore, nothing in the Technical Update, BIP, the associated Flow Tool, or Costing Tool is intended for use in any administrative, judicial, or other proceeding to evince or otherwise reflect the State of Colorado's or the CWCB's legal interpretations of state or federal law.

Furthermore, nothing in the Technical Update, BIP, Flow Tool, Costing Tool, or any subsequent reports generated from these datasets is intended to, nor should be construed so as to interpret, diminish, or modify the rights, authorities, or obligations of the State of Colorado or the CWCB under state law, federal law, administrative rule, regulation, guideline, or other administrative provision.

What is the Basin Implementation Plan?

The Basin Implementation Plan (BIP), developed in a collaborative process by basin stakeholders, focuses on the current and future water needs in the Colorado Basin, the vision for how individuals and organizations can meet future needs, and the goals and projects that provide a pathway to success. The initial BIP was completed in 2015, and this is the first update of that plan.

THE COLORADO BASIN IMPLEMENTATION PLAN CONSISTS OF TWO VOLUMES:	
VOLUME 1:	A summary of the Colorado Basin's current and future water resources, focusing on goals, projects, and a strategic vision to meet future water needs.
VOLUME 2:	A more comprehensive description of Colorado Basin achievements, challenges, goals, and strategic vision for meeting future water needs as well as detailed regional supplies and demands. Note that Volume 2 is organized in a slightly different order than Volume 1.

Section 1. Basin Overview

The Colorado Basin extends from Rocky Mountain National Park to the Utah State Line. Mountainous upper reaches gradually give way to a series of canyons and gentler terrain as the river flows along the Interstate 70 corridor toward Grand Junction and the Utah border. Snowpack in the elevations above 9,000 feet is an important water source for human use on both sides of the Continental Divide in Colorado. This water is also important for compliance with legal obligations, since as much as 70 percent of the river flows out of state. Figure 1 shows an overview of the Colorado Basin.

The Colorado Basin is a region of diverse natural systems, outstanding beauty, and extensive recreational opportunities. Many communities within the area rely heavily on the tourism and recreational industry as a primary economic driver. Tourism is the predominant industry in the headwaters counties (Grand, Eagle, Summit, and Pitkin) with world-class visitor attractions, including ski resorts, boating and Gold Medal fishing, national parks, and Wild and Scenic-eligible rivers. Municipal and industrial activities help support the diverse and vibrant communities of the region.

Agriculture and the open spaces it maintains contribute to the economy and quality of life in the Colorado Basin. Ranching and livestock production are typical agricultural activities in the upper reaches, while the Grand Valley has a long history of fruit and vegetable production. Agriculture is part of the historic culture; it is complementary to tourism and a vital source of return flows that sustain late-season streamflows for fisheries.

AGRICULTURE

- The irrigated agriculture industry across the Colorado Basin is highly diverse. Large ranching operations dominate agriculture in the Colorado Basin's higher elevations, particularly around the towns of Kremmling, Collbran, and Rifle.
- Farming regions focused on the cultivation of fruits, vegetables, and alfalfa are more prevalent in the lower basin due to a longer growing season and warmer summer temperatures.
- The largest of these farming operations, the Grand Valley Project, irrigates about a quarter of the 206,700 acres irrigated in the entire basin.

WATERSHED

- A substantial portion of the Colorado Basin is federally owned land.
- Of the almost 6 million acres in the Colorado Basin, almost half is owned by the United States Forest Service.
- Bureau of Land Management-controlled rangeland is the second-most predominant land use, accounting for approximately 40 percent of the total area.

MUNICIPAL AND INDUSTRIAL

- Located in Glenwood Canyon along the Colorado River, the Shoshone Hydroelectric Plant is an essential water right for the Colorado Basin. The plant holds very senior water rights and has the ability to call for water year-round whenever the Colorado River is flowing below 1,250 cubic feet per second.
- Many water providers in the resort headwater communities face highly variable demands; during peak seasons, populations can swell to more than 600 percent of the permanent population.

COMPACTS, ADMINISTRATION, AND REGULATORY

- In 1922, the seven states that touch the mainstem of the Colorado River or its tributaries signed the Colorado River Compact (Compact). This Compact established apportionments, i.e., a fixed amount of water per year, for the upper and lower basins.
- The Compact has not restricted Colorado in its water use, but as the annual average water yield of the Colorado River decreases and water demand from the seven states increases, chances of Colorado being affected by a Compact call in the near future are more likely.

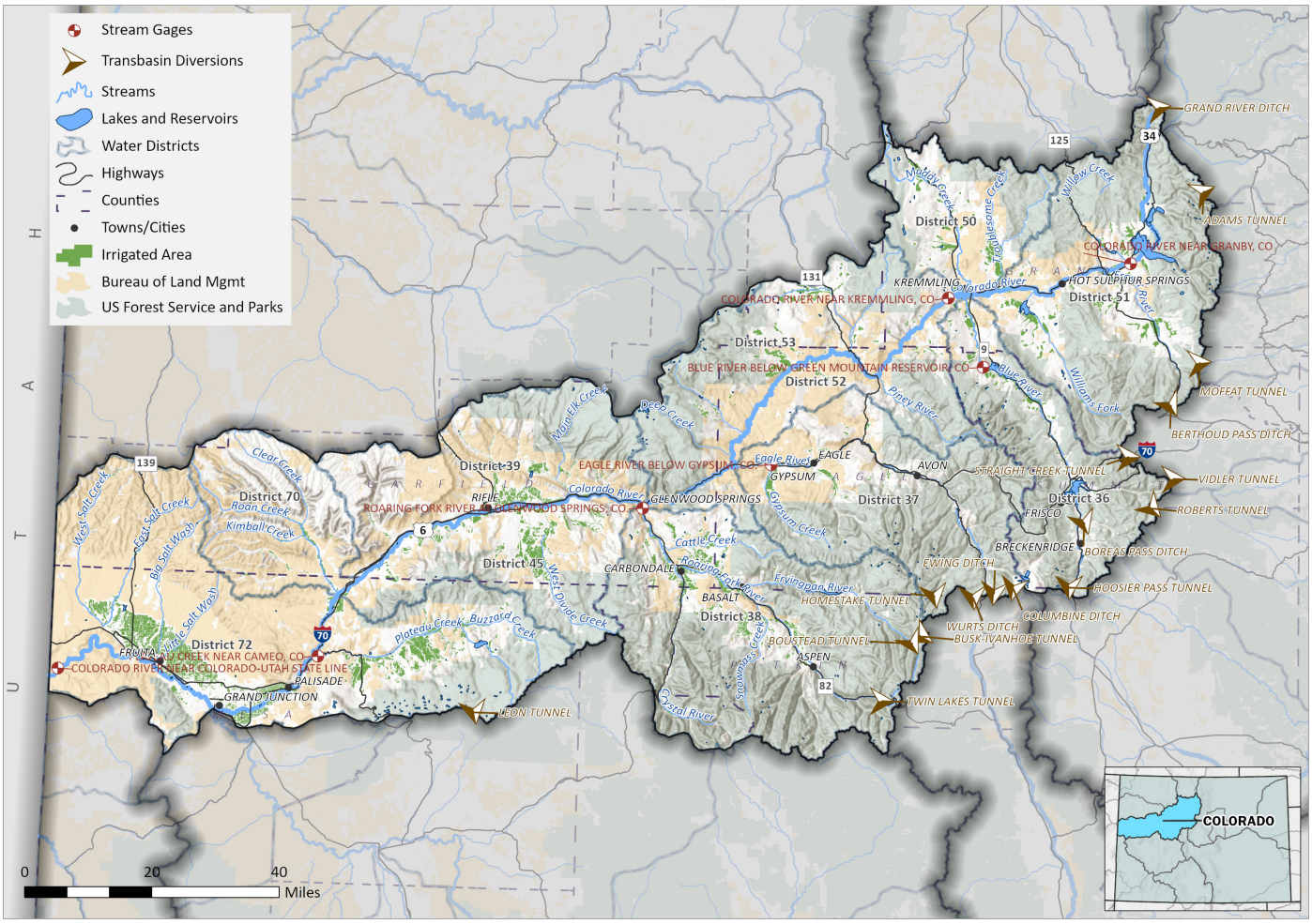


Figure 1. Colorado Basin Map

Section 2. Basin Challenges

The Colorado Basin faces several key issues and challenges pertaining to competing resources for agriculture, tourism and recreation, protection of endangered species, and threat of a Colorado River Compact call.

KEY CHALLENGE

The Colorado Basin will need to balance competing resources on a limited water supply. Compact compliance, endangered species issues, sustaining the basin's agricultural economy, and managing forests for improved resiliency and health throughout the watershed are all major challenges.

Table 1. Key Future Water Management Issues and Challenges in the Colorado Basin




AGRICULTURE	WATERSHED	MUNICIPAL AND INDUSTRIAL	COMPACTS, ADMINISTRATION, AND REGULATORY
• Despite the importance of agriculture, continued urbanization of agricultural lands could reduce irrigated acres in the Colorado Basin. • The value of agriculture in the basin is often understated; it is a critical component of the basin's economy.	• In an uncertain future, maintaining flows supportive of recreation and the environment is vital. These are major drivers in the Colorado Basin and are important for economic health and quality of life.	• Development of conditional transbasin water rights and potential full use of existing transbasin diversions is a concern, and the effect on in-basin supplies in the Colorado Basin must be considered.	• There is concern over a potential compact shortage during severe and sustained drought and the potential effects to in-basin supplies. Demand management to conserve water per the recently signed Drought Contingency Plan is a pressing issue.

CROSS-SECTOR CHALLENGES

- Selenium and salinity are water quality concerns in parts of the basin.
- Since 2000, the Colorado Basin has been experiencing historic extended drought. The effects of drought and climate change affect water supply availability, ecosystems, industry, and agriculture. There are concerns with dry soil moisture conditions, earlier runoff, and aridification.
- The Colorado Basin faces the challenge of balancing water exports from the basin and the need to provide for in-basin demands with limited supplies.
- Across the Colorado Basin there are challenges with forest and watershed health, especially given the impacts of recent wildfire activity. Insect infestations, avalanches, and sustaining riparian health are also challenges.

IMPLEMENTING A SUCCESSFUL UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM IS VITAL TO ENSURING PROTECTION OF EXISTING AND FUTURE WATER USES.

Section 3. Achievements

The Colorado Basin Roundtable (BRT) has been engaged in a wide variety of projects and activities since the Colorado BIP was issued in 2015. The ongoing and completed projects have achieved results that further the goals of the Colorado BRT and have provided benefits to agricultural, environmental, recreational, and municipal water users. Several of these achievements are summarized in this section. The achievements are organized by **2015 Basinwide Top Projects**, as identified in the 2015 BIP, and **achievements since 2015**.

See Exhibit E in Volume 2 for a complete list of projects and their status.

2015 BASINWIDE TOP PROJECTS

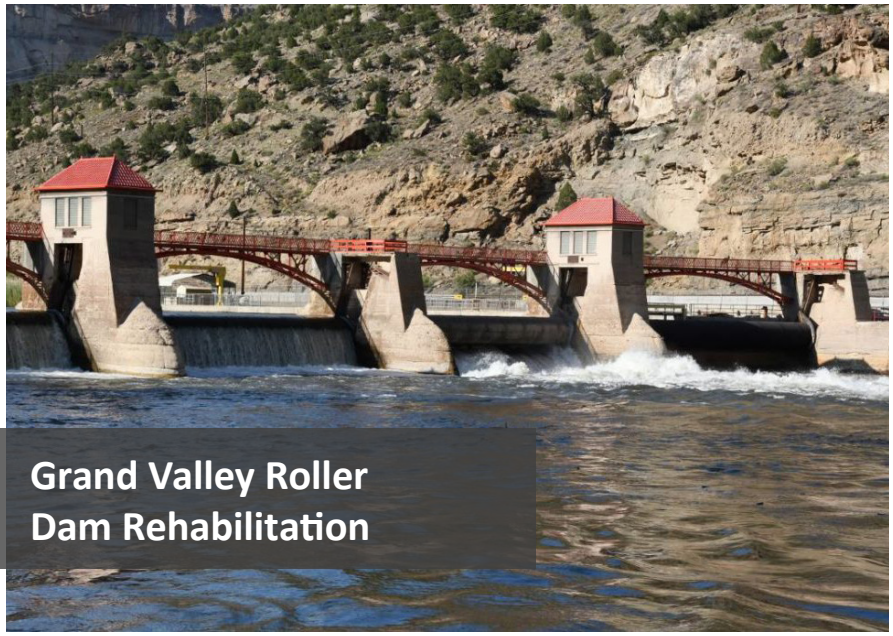
Colorado River Cooperative Agreement

Photo source: Colorado BRT

The Colorado River Cooperative Agreement (CRCA) is an agreement between Denver Water and various west slope entities, including Grand County, which if implemented will provide water supply, water quality, and stream health benefits to Grand County streams. Actions initiated by the CRCA continue to progress, including the Learning by Doing program and multiple rehabilitation projects on the Fraser River. Several projects identified in this agreement are completed or underway.

PROJECT PROPONENTS:
Grand County

TIMELINE: Ongoing



Grand Valley Roller Dam Rehabilitation

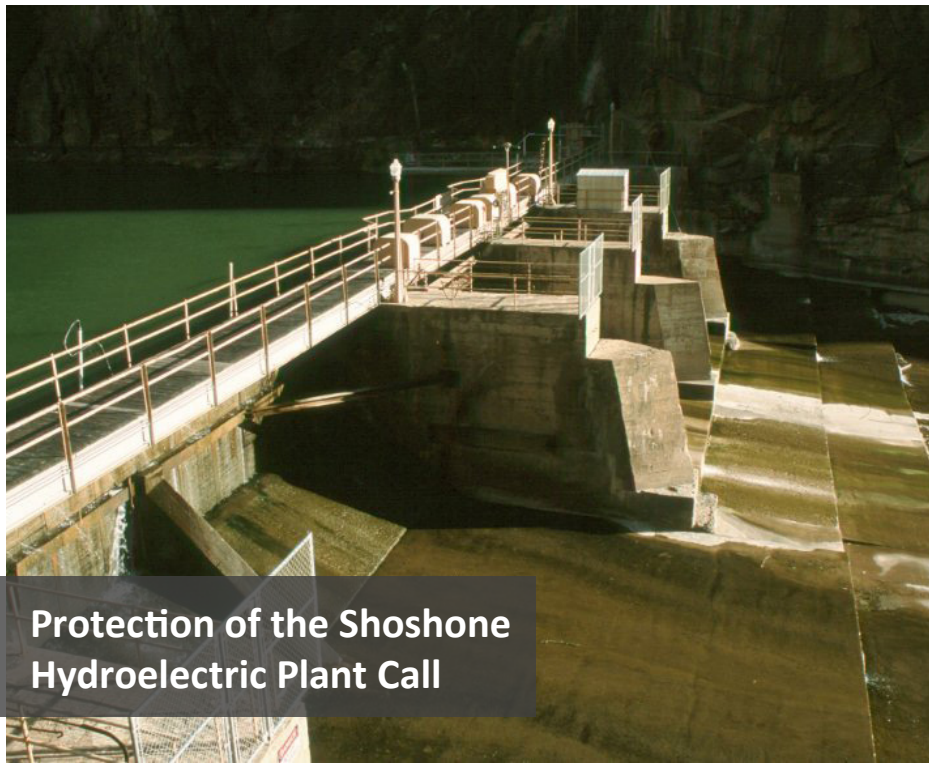
Photo source: Colorado BRT

Significant progress on this project has been made since 2015, including completion of the Grand Valley Roller Dam and Canyon Master Plan Phase 1 and Phase 2, as well as the Upper Canyon Improvement Project and portions of the Electrical Upgrades Project. Water Supply Reserve Fund grants, Water Plan grants, and Water Project loans supported the financing of these projects.

PROJECT PROPONENTS: Grand Valley Water Users Association

TIMELINE: Ongoing

COSTS: $2.7 million (completed); $4.9 million (implementing); $2.5 million (planned)



Protection of the Shoshone Hydroelectric Plant Call

Photo source: Colorado BRT

Protection of the Shoshone Hydroelectric Plant call remains a top priority of the Colorado BRT. These efforts are ongoing and continue to be the focus of significant conversation.

PROJECT PROPONENTS:
Colorado BRT

TIMELINE: Ongoing

Protection of Existing and Future West Slope Uses

Photo source: Colorado River District

The Colorado BRT now considers this to be a policy statement rather than a project that can be tracked. This continues to be a priority for the Colorado Basin.

PROJECT PROPONENTS:
Colorado BRT

TIMELINE: Ongoing

ACHIEVEMENTS SINCE 2015

Grant Funds Provided by the Roundtable

The Colorado BRT has provided $3.7 million in grant funding to further the projects identified in the 2015 BIP. These roundtable funds assisted in leveraging $6.5 million in State funding. The Executive Summary of Volume 2 includes maps that show the locations of funded projects; a full list of funded projects and supporting information is included in Volume 2 Exhibit E. Four example projects are highlighted below.

Abrams Creek Cutthroat Trout Project

Photo source: Colorado BRT

The project addressed irrigation efficiency to increase streamflows in Abrams Creek to preserve an indigenous population of cutthroat trout. The benefits are expected to improve habitat connectivity and quality, enhance sediment transport, increase aquatic insect productivity, and maintain cooler water temperatures.

APPLICANT: Trout Unlimited and Buckhorn Valley

TOTAL GRANT REQUEST: $364,711

DATE: March 2017

Crystal River Watershed Assessment and Design Restoration Projects

Photo source: Colorado BRT

A local, self-selected, public group has been working to identify and implement priority restoration projects in the Crystal Valley. Roaring Fork Conservancy and Pitkin County Open Space and Trails are both actively involved.

APPLICANT: Roaring Fork Water Conservancy and the Town of Carbondale

TOTAL GRANT REQUEST: $325,164

DATE: September 2012 and March 2018

Irrigators of Land in the Vicinity of Kremmling

Photo source: Colorado BRT

The Irrigators of Land in the Vicinity of Kremmling (ILVK) project seeks a long-term, regional effort to restore 12 miles of the Colorado River, 1.5 miles of the Blue River, and agricultural operations impacted by transmountain diversions. ILVK has received support to implement measures that address both irrigation and aquatic habitat issues.

APPLICANT: Trout Unlimited

TOTAL GRANT REQUEST: $465,400

DATE: March 2016

Stream Management Plans and Integrated Water Management Plans

Photo source: Middle Colorado IWMP

Integrated water management planning is a locally driven problem-solving process that addresses the increasing likelihood of droughts in Colorado and seeks water security for all uses. Through funding and facilitation, the Colorado BRT commissioned the assembly of tools, frameworks, and datasets designed to 1) promote understanding of local needs or opportunities, 2) structure planning efforts to ensure all needs are evaluated for all uses, and 3) generate straightforward reporting of locally generated planning outcomes for comparison among watersheds. As a result of this funding, integrated water management plans (IWMP) in the Colorado Basin provide a holistic approach to water management by integrating local communities to address necessary water needs. Key concerns include population growth, aridification, interstate agreements, aging infrastructure, impaired waterways, demand for recreational uses, and protection of public lands.

The Colorado BRT believes that one of the basin's top successes since 2015 is the progress made on the development of stream management plans (SMP) and IWMPs throughout the basin. Those efforts include:

- Crystal River Management Plan (2016)
- Upper Roaring Fork River Management Plan (2017)
- Roaring Fork River Watershed Plan (2019 update)
- Middle Colorado IWMP (2021)
- Blue River IWMP (in progress)
- Eagle River Community Water Plan (in progress)
- Grand Valley Watershed Plan (update in progress)
- Grand County SMP (2010, established the Learning by Doing concept and ongoing sampling for macroinvertebrates and water quality)

Section 4. Updated Goals and Objectives

Each of the BRTs across Colorado developed goals and strategies or actions to achieve their goals during the development of their 2015 BIPs. The structure and naming convention of goals, objectives, strategies, and actions slightly vary across roundtables, but they all include a discrete set of high-level targets (described as goals and/or themes) with supporting objectives, actions, strategies, or processes that help stakeholders and respective roundtables achieve their basin targets.

The Colorado BRT developed six themes in the 2015 Colorado BIP that carried forward, and these themes are supported by goals. In other words, the goals are organized by theme.

Through the BIP update stakeholder engagement process, the Colorado BRT provided feedback on the original 2015 goals. The consensus was that the goals were generally applicable but needed some additions, minor revisions, and/or wordsmithing. New goals that were added since 2015 include a goal to address forest health and wildfire impacts, and a goal to protect and preserve agricultural lands. The themes and supporting goals are described below.

The intent of the themes and goals is to represent Colorado BRT's desired outcome or vision while recognizing the limited authority of the BRT to implement them. The Colorado BRT is able to support and fund actions or activities related to the themes and goals.

THEMES

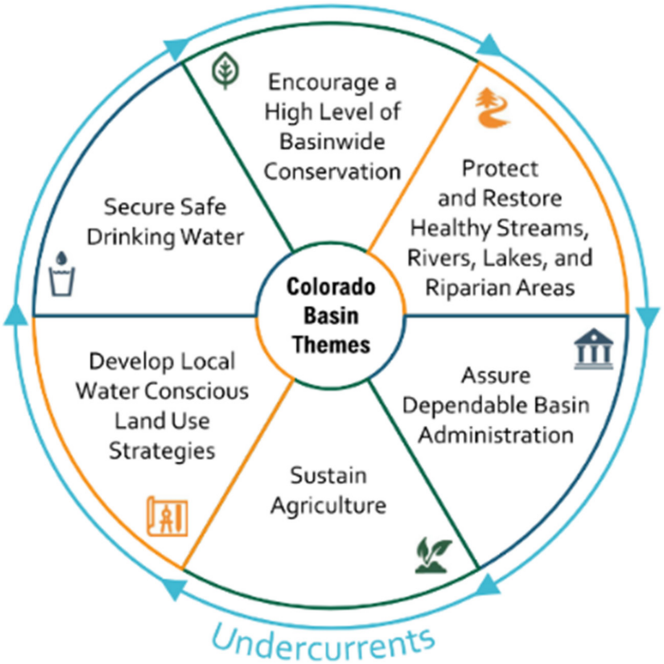
- **Protect and restore healthy streams, rivers, lakes, and riparian areas**
- **Secure safe drinking water**
- **Sustain agriculture**
- **Develop local water conscious land use strategies**
- **Assure dependable basin administration**
- **Encourage a high level of basinwide conservation**

THEMES, GOALS, AND UNDERCURRENTS

The Colorado Basin has six themes, which are supported by goals. The six themes are connected and interrelated and contain undercurrents of funding, education, climate change, and collaboration.

In the process of reviewing the themes, stakeholders wanted to recognize the importance of funding, education, climate change, and basinwide collaboration and partnership on a theme level and in a way that recognized that they are woven throughout all of the six themes. Hence the concept of undercurrents was created. The undercurrents include:

- Encourage collaboration and partnerships across stakeholders throughout the basin
- Adapt to climate change
- Increase education about Colorado Basin issues
- Ensure adequate funding



Volume 1 describes the goals and themes jointly, whereas Volume 2 describes them independently.

1 Protect and restore healthy streams, rivers, lakes, and riparian areas

Rivers are the lifeblood of all basins, and the Colorado Basin in particular. Tourism, recreation, and agriculture are economic drivers, and healthy rivers are foundational for these industries to thrive. Colorado's outdoor recreation economy generates $37 billion in consumer spending annually, contributes 511,000 direct jobs, and represents 10 percent of the states' gross domestic product. Those who work in the industry have collectively earned more than $21 billion in wages and salaries, while those who support it have generated $9 billion in state and local tax revenue.[1]

The core water values of vibrant and sustainable cities, productive agriculture, safe drinking water, wildlife and habitat, and robust recreation and tourism industries depend on a strong environment that includes healthy watersheds, streams, rivers, lakes, and riparian areas.

The environmental and recreational sectors—often collectively referred to as environmental and recreational (E&R)—do not consume water as part of their existence. Instead, they simply thrive from the presence of water. This type of water use is referred to as nonconsumptive use.

The Colorado BRT also recognizes that watershed health is a function of the condition of the forests and impact the quality of streams, rivers, lakes, and riparian areas. The Colorado Basin faces many forest and watershed health challenges, such as wildfire and debris flows. As such, enhancing climate resiliency of watersheds is a critical part of protecting and restoring healthy streams, rivers, lakes, and riparian areas.

THE FOLLOWING GOALS WERE SET FOR THEME 1:

- Protect and maintain healthy and self-sustaining aquatic and riparian ecosystems and rehabilitate damaged ecosystems.
- Define and understand water quality needs and at-risk water bodies and resolve impairments.
- Support and provide for high-quality river and stream recreational opportunities with appropriate flows.
- Increase funding opportunities to meet basin E&R needs.
- Protect and maintain healthy forests, mitigate wildfire impacts, and rehabilitate damaged forests. ***New in 2021***

Photo source: Colorado River District

[1] Colorado Office of Economic Development & International Trade, 2021. Outdoor Recreation. https://choosecolorado.com/key-industries/outdoor-recreation/

2 Secure safe drinking water

Clean, safe drinking water is essential. Because of the excellent uninterrupted service provided by Colorado's water providers, it has become easy to take safe drinking water for granted.

The Colorado Basin includes about 6 percent of the statewide population, estimated to be 5.76 million in 2019.[2]

Between the years 2015 and 2050, the 2019 Technical Update projected the basin's population to grow from approximately 310,000 to between 460,000 and 580,000 people in the low- and high-growth projections, respectively. And all planning scenarios project an increase in municipal demands relative to the Baseline planning scenario.

The Colorado Basin has approximately 66 water providers (including municipalities, special water districts, and conservation or conservancy districts). Most of these water providers are small (< 5,000 taps). For many residents in rural areas, drinking water is supplied from private wells. The two largest water providers in the basin include the Ute Water Conservancy District in the Grand Valley region and the Eagle River Water and Sanitation District in the Eagle River region. Many water providers in the resort headwater communities face the unique challenge of highly variable demands; during peak seasons, city populations can swell to more than 600 percent of the permanent population.

Most water providers throughout the Colorado Basin have surface water intakes and/or wells as their primary source of supply, and very few rely on physical water from larger upstream reservoirs. The majority of water providers rely on augmentation from Green Mountain Reservoir or Ruedi Reservoir to meet mainstem senior calls.

Water providers in the basin are vulnerable to extended droughts, a Lower Basin Compact call, future forest fires, uncertainties of climate change, planned future transmountain diversions (TMD), and unpredictable future land use. Several water providers (especially higher up in the headwaters) are seeking upstream reservoirs as an additional source of physical and legal water supply despite the challenges associated with the cost, complexity, and timeframe associated with the permitting and regulatory climate. The development of additional water supplies may create adverse environmental, recreational, and economic impacts to the Colorado Basin that should be identified during permitting and approval processes with required mitigation. Water quality may be negatively impacted as diversion increase or diminish high quality dilution flows. Several examples in different regions of the Colorado Basin are provided in Volume 2, Section 4.

Another growing concern, not unique to the Colorado Basin, is the aging infrastructure requiring costly and timely replacement.

Water treatment plants do not remove all contaminants. Emerging contaminants are chemicals that are detected at trace levels in drinking water supplies, such as pharmaceuticals, personal care products, antibiotics, pesticides, herbicides, and endocrine disrupting compounds. Many of these emerging contaminants are difficult to remove in the treatment process, and the impacts of these compounds are still not fully understood. Emerging contaminants are a growing concern, especially for water providers that use the Colorado River as the primary source of supply.

THE FOLLOWING GOALS WERE SET FOR THEME 2:

- Secure water supplies to meeting growing demand by developing and preserving in-basin supplies and expanding raw water storage supply.
- Raise awareness of current obstacles and efforts facing water providers, such as limited supply, degraded water quality, aging infrastructure, and funding.
- Protect drinking water supplies from natural impacts such as extended droughts, forest fires, and climate change.
- Ensure the ability to provide safe drinking water.

[2] Colorado State Demography Office. https://demography.dola.colorado.gov/

3 Sustain agriculture

Agriculture is extremely important to the Colorado Basin and is important to the economy. Agriculture supports open space, provides wildlife habitat, contributes to late-season flows in rivers and streams, maintains groundwater levels, and is part of the culture and heritage. The younger generations overwhelmingly say that local food sources are key to a sustainable future. Farmers are often called stewards of the land because of the connection between land and water resources and sustainable production.

Colorado production agriculture (all farming and ranching) generated approximately $14 billion in 2019 and supported nearly 86,000 jobs, which equated to 2.2 percent of all jobs in Colorado. Of Colorado's production agriculture industries, the cattle ranching and farming industry is the most productive and accounts for a total economic output of more than $3.5 billion and employing more than 18,800 people in 2012.[3]

Agritourism is a growing segment of the headwaters counties economies as ranchers and farmers look for additional ways to support their business activity. The Colorado Department of Agriculture defines agritourism as activities, events, and services related to agriculture that connect consumers with the heritage, natural resource, or culinary experience they value.

With the many challenges facing the Colorado Basin, the agricultural community will continue to be a leader in the basin's efforts toward building water, climate, and economic resilience. Agricultural producers have always been resilient in adapting to reduced water supplies and challenging market forces.

Sustaining agriculture protects our working landscapes. The Colorado BRT supports protecting and preserving agricultural lands, water rights, and the ability of producers to maintain profitable and productive operations. Infrastructure repairs and upgrades can help keep agricultural lands in operation and aid producers in more efficiently diverting water for beneficial uses. Many producers rely on tributary supplies that have senior water rights, but reduced supply often leads to curtailment. Storage in tributaries can help reduce these water supply gaps.

Throughout the State, loss of agricultural land is a risk. As development increases, there has been significant pressure to convert agricultural land to other land uses. Agriculture uses the largest amount of water in the Basin and generally holds the most senior water rights. These senior agricultural water rights are a potentially attractive water supply for municipalities and industrial water users. The transfer of agricultural water rights to other uses and the resulting permanent loss of irrigated lands is referred to as "buy and dry." Buy and dry of irrigated lands has lasting impacts on the rural economies supported by agriculture, as well as on the landscape and environment.

Alternatives to buy-and-dry, referred to as alternative transfer methods (ATM), aim to provide a temporary water supply to municipal or industrial users while preventing the permanent loss of irrigated lands. Examples of agricultural water supply methods for ATMs include temporary fallowing, deficit irrigation, and switching to lower-water-use crops. Examples of agricultural water transfer methods include water banking, interruptible water supply agreements, and purchase and lease-back (in which a municipality purchases water rights and leases them back to farmers).

[3] Lipetzky, Tom, Colorado Department of Agriculture, February 14, 2020.

The agricultural community in the Colorado Basin has concerns with alternatives to buy-and-dry that should be addressed in any ATM program:

- Producers do not want to lose their water rights or have the value of their water rights reduced.
- Landowners should be provided with help to address issues such as lost income and lost market share.
- Payments must adequately cover all of the producers' expenses.
- The land might not tolerate short-term fallowing (grapes, orchards, and forages for example).
- ATM practices such as fallowing may have longer-term impacts on the productivity of the land even after fallowing ceases, which would have to be included in the compensation agreement to prevent loss of farming income.
- Producers may not have the equipment or experience to produce new types of crops.

Reducing the buy-and-dry trend would require that producers be given help to transition to different practices and be protected from financial losses, and that the support be provided long-term.

Because the problems with alternatives to buy-and-dry are not just limited to the Colorado Basin, addressing the obstacles on a broad scale may make it possible to continue profitable agricultural production with less water use and to address future water demands without building new diversion projects from the Colorado Basin.

The difficulties associated with successfully implementing alternatives to buy-and-dry reflect the overall trend in Colorado's agricultural sector. The fact is that the number of agricultural producers statewide continues to decline, which leads to a sell-off of land and water previously used to grow food. The primary reason that land and water are being taken out of production and sold for other uses is the fact that producers are leaving the industry. Because farm economics cannot compete with the prices offered by buyers for the land and water, incoming generations of producers elect to leave the industry. If this trend is to be reversed, the root causes of the decline in the number of producers needs to be thoroughly examined. Farm economics, limited options for young producers, centralized markets, transportation costs, access to consumers, and consumer willingness to pay are factors that have impacted the agricultural sector.

THE FOLLOWING GOALS WERE SET FOR THEME 3:

- Reduce and prevent agricultural water shortages.
- Minimize potential for permanent transfer of agricultural water rights to municipal uses.
- Support profitable and productive agriculture and the integrated benefits and services associated with agriculture.
- Engage, educate, learn from, and collaborate with the agricultural community on Colorado Basin water issues, and increase awareness among the broader community about the importance of agriculture.
- Protect and preserve agricultural lands. ***New in 2021***

Photo source: Colorado River District

4 Develop local water conscious land use strategies

Colorado water issues cannot be solved without addressing the fundamental link between water and land use. Colorado Basin residents recognize that the limited water supply in the state and the ever-increasing water demands both in the Colorado Basin and throughout the state require the development of new policies that link land use and water.

An increased emphasis is being placed on the importance of integrating land use and water use planning in Colorado and the Western United States. The 2015 Colorado Water Plan identified a goal of integrating land use and water planning (Chapter 6.3). Colorado Senate Bill SB15-008, introduced in 2015, directed the Colorado Water Conservation Board (CWCB), with assistance from the Department of Local Affairs (DOLA) to incorporate land use planning into water efficiency planning. The bill directed CWCB and DOLA to implement training to support integration of these concepts and make recommendations regarding management practices that a municipality could include in its water efficiency plan that can be implemented through land use planning efforts.

The Colorado Basin from the headwaters to the state line is very diverse. Land use policies, water conservation practices, and local economies are all very different and are best managed by local authorities who represent and understand the local needs and are directly accountable to the local population. Implementation of these policies will likely vary based on geographic region within the basin. Local governments have the authority and tools to ensure that new growth and development do not out-strip water supply.

In general, local water-conscious land use policies should ultimately:

- Build a culture of water conservation within the development community.
- Encourage local authorities to implement conservation and growth strategies that protect and preserve efficient water resources not only for meeting consumptive needs but to address nonconsumptive needs as well.
- Promote regional cooperation for water resource use within the basin.
- Plan for water demands that will continue to grow beyond the current 2060 planning horizon.
- Achieve balanced economies that protect and encourage agriculture.
- Adopt local and regional comprehensive plans that respect and recognize locally available limited water supplies.
- Direct denser growth within urban growth boundaries where water supply infrastructure and plans are in place.
- Recognize the shortage and limits of water supply and establish achievable and meaningful water conservation goals.
- Recognize and articulate preserving water for streams and rivers and maintaining agriculture as a trade-off for efficient outdoor landscapes and indoor use.

The Colorado BRT recommends that these policies be supported in Colorado's Water Plan, recognizing that current and future land use practices will have a significant impact on water use statewide.

THE FOLLOWING GOALS WERE SET FOR THEME 4:

- Develop land use policies that require and promote conservation and mitigate impacts to water quality.
- Support, preserve, and promote local authorities' management of stream health, development, and conservation efforts.
- Expand regional cooperation efforts to improve efficiencies, provide water supply flexibility, and enhance E&R amenities.
- Extend water planning beyond 2060.

5 Assure dependable basin administration

Colorado's water law and the administration of those laws provide reliability and flexibility in the development and protection of water resources. Protecting the Shoshone Hydroelectric Plant, Grand Valley irrigators' water rights (Cameo Call), and the 15-Mile Reach are vital to both consumptive and nonconsumptive needs. It is imperative that basin and West Slope entities work together to ensure the Shoshone Hydroelectric Plant water rights are maintained in perpetuity to ensure downstream water deliveries are made.

Other challenges in assuring dependable basin administration are related to the 1922 Colorado River Compact. One challenge is avoiding a compact deficit which might lead to administration or curtailment. This is related to maintaining Lake Powell elevations above the minimum power pool elevation to continue power production at Lake Powell. The Risk Study effort completed by the Colorado River District and the Southwestern Water Conservation District explored drivers of risk including hydrology, consumptive use, and low reservoir storage conditions. Phase III of the Risk Study also explored some potential approaches to involuntary curtailment.[4]

THE FOLLOWING GOALS WERE SET FOR THEME 5:

- Protect and defend maximum mainstem calls at Shoshone Hydroelectric Plant, senior Grand Valley irrigation diversions, and Green Mountain Reservoir beneficiaries.
- Ensure sufficient Lake Powell water level for uninterrupted hydroelectric power production.
- Maintain Interstate Compact deliveries to Lake Powell.
- Improve water court process.

6 Encourage a high level of basinwide conservation

The Colorado BRT supports adoption of significant water conservation and efficiency measures for all water users, including water providers, agriculture, and industry. Conservation and efficiency measures vary significantly throughout the Colorado Basin, which is expected based on the unique geographic, cultural, economic, and climatic setting of each region. In general, there is a broad recognition that water is a finite resource.

The former "soil" conservation districts, established by state law in the 1950s, now called simply conservation districts, encouraged landowners to install soil and water conservation practices. The Colorado River mainstem drainage area has seven conservation districts that promote conservation work with private landowners. This work is considered private information of the landowners and is generally not available publicly; however, it is estimated that these landowners have spent more than $100 million of private dollars to install conservation practices over the last 60 years within the Colorado Basin. In some instances, these improvements have had a 50 percent match with federal and/or state programs, such as the Environmental Quality Incentive Program and the many other matching-dollars programs. These practices include, but are not limited to, pipelines, water control structures, gated pipes, and sprinkler systems.

[4] Colorado River Risk Study Phase III Final Report, November 20, 2019. Prepared for the Colorado River District and the Southwestern Water Conservation District.

Currently, most water providers in the Colorado Basin have aggressive conservation programs. Typical efficiency and conservation measures include:

- Education and outreach
- Voluntary and/or mandatory outdoor watering restrictions (often with increasing restrictions triggered by drought or water supply conditions)
- Leak detection and correction programs
- Water loss tracking
- Integrating conservation into land use planning and regulations
- Increasing block rate structures (tiered rates), which encourage conservation
- Radio read meters, which can detect leakage or red flag water usage
- Limiting potable water use for outside irrigation
- Adopting best management land use practices for outside irrigation
- Adopting plans that require more xeriscaping, i.e., using plants that don't require irrigation, and reducing irrigation of remaining turf
- Codes or ordinances requiring low-flow appliances

The Colorado Basin has been making continual progress toward this theme. Some water providers have even seen a decrease in overall demand despite population growth. Despite this progress, there is still work to be done.

Other examples of more cutting-edge conservation practices within the Colorado Basin include:

- Incentives for xeriscaping
- Restrictions on outdoor irrigation for new development
- Land use comprehensive plans that have a maximum allowable population growth or number of taps limited by finite water supplies and/or based on leaving adequate water in receiving streams for instream flows
- Requirements for new developments to incorporate raw water irrigation, or offering incentives for raw water irrigation
- Coordination of conservation goals and SMPs or IWMPs. For example, the Brush Creek Management Plan includes agreed-upon diversion reductions triggered by low flows

THE FOLLOWING GOALS WERE SET FOR THEME 6:

- Improve Colorado water law to encourage efficiency, conservation, and reuse.
- Pursue continued municipal and industrial (M&I) conservation.
- Promote agricultural conservation that maintains agricultural production and viability.

Section 5. Demand, Supply, and Potential Water Needs

Water in the Basin

The Colorado Basin encompasses approximately 9,830 square miles. The headwaters of the Colorado Basin originate at the Continental Divide, and the Colorado river flows 250 miles from Rocky Mountain National Park to the Colorado-Utah state line. Elevations in the Colorado Basin range from more than 14,000 feet in the headwaters areas to about 4,300 feet where the Colorado River exits the state. The Colorado Basin's mountains receive an average annual precipitation of approximately 60 inches per year, and snowpack in the high country is an important water source. Many tributaries are fed by spring snowmelt, which results in peak runoff occurring in May and June. Streamflow decreases rapidly throughout the summer and is considerably lower by September and through the winter months.

Planning Scenarios

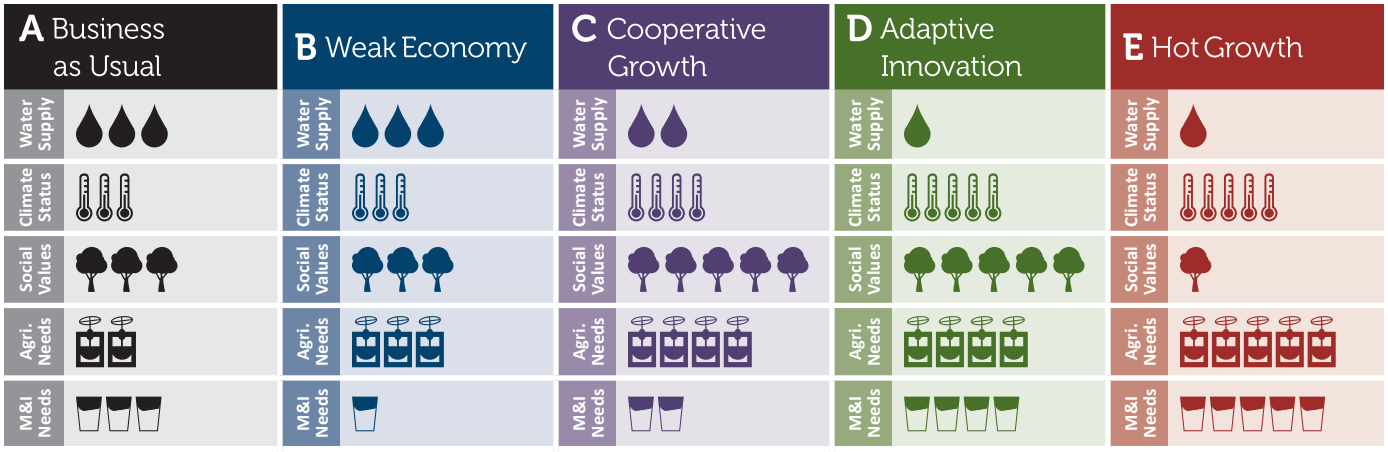
The Analysis and Technical Update to the Colorado Water Plan (Technical Update) published in 2019 quantified the current and potential future water demands, supplies, and additional water needs associated with the basin under five alternative future scenarios. A key enhancement to Colorado's water planning processes has been the incorporation of scenario planning. The Colorado Water Plan identified five different but plausible future conditions for the year 2050. The scenarios each consider several water resources drivers and how the drivers may change. The drivers include population, urban land use, climate change, industrial water needs, agricultural conditions, and adoption of municipal and agricultural water conservation measures.

Water demands, supplies, and potential future water needs were quantified in the Technical Update. The analyses in the Technical Update were enhanced with new data during the BIP update. This section summarizes demands, supplies, and potential water needs based on the new input data.

Photo source: Colorado River District

Potential future water needs, aka gaps, were estimated for each planning scenario. Gaps are a characterization of the potential risk that water supplies will not be adequate to meet future demand.

The graphic below provides a brief overview of the drivers and the scenarios. Refer to the Technical Update, Sections 2.1.3 and 2.1.4, for more details on the scenarios and drivers (**https://cwcb.colorado.gov/colorado-water-plan/technical-update-to-the-plan**).



A Business as Usual

- Population growth increases at trends predicted by the State Demography Office (SDO).
- Future hydrology, per capita water demands, and adoption of conservation measures are similar to what has recently occurred.

B Weak Economy

- The world's economy slows, and the state's population growth is less than predicted.
- Hydrology is similar to recent patterns.
- This scenario puts the least amount of stress on future water supplies and is a bookend for scenarios.

C Cooperative Growth

- Statewide population is similar to SDO predictions but is distributed differently across the state.
- Climate is moderately warmer, and irrigation demands increase.
- People seek to mitigate increased demands by more aggressively adopting water conservation.

D Adaptive Innovation

- Both scenarios assume that population growth is higher than projected, and both assume a much warmer and drier future climate.
- The scenarios' primary differences revolve around conservation. In the Adaptive Innovation scenario, the state aggressively adopts conservation measures in both municipal and agricultural sectors. In the Hot Growth scenario, conservation is not a focus.

E Hot Growth

THE FUTURE WATER CONDITIONS DESCRIBED FOR THE COLORADO BASIN WILL BE IN THE CONTEXT OF THE FIVE PLANNING SCENARIOS.

Refinements to Technical Update Modeling

Several modeling revisions were implemented in the Colorado Basin since the Technical Update, including revisions to agricultural demands, industrial demands, and model operations. A portion of these revisions were identified by stakeholders after review of the approach and initial results. Other revisions, however, were identified through on-going modeling efforts that also rely on the Colorado water allocation models. These identified revisions were implemented at the same time as the stakeholder-driven revisions in order to improve the representation of the modeled demands and operations.

Major revisions to the model based on stakeholder comments include:

- A snowmaking demand increase of 90 acre-feet per year (AFY) for Powderhorn Mountain Resort
- Red Top Valley Ditch changes to reflect Northern Water's storage of its purchased ditch shares in Lake Granby
- Redlands Canal (Gunnison Basin) diversion updates, with returns impacting the Colorado Basin
- Green Mountain Reservoir operation revisions
- Reduced Grand Valley area acreage from 68,900 acres to 54,000 acres
- ISF water rights modeling corrections for 13 ISF water rights in the basin
- Eagle River transbasin diversion capacity and water rights modeling revisions

Several minor revisions to the Colorado water allocation model were also made, primarily to correct model input file formatting, which have little impact to the overall results. Collectively, the revisions had a limited impact to the overall water supply and gap results in the Colorado Basin; however, it is important that the model representation has been improved through these revisions.

The BIP update modeled historical diversions associated with TMDs. Future full development will be considered in modeling under the future Technical Update and BIP processes.

The effects of these modeling refinements are described in Appendix A.

Photo source: Colorado River District

Municipal and Industrial Demands

POPULATION PROJECTIONS

The Colorado Basin includes about 6 percent of the statewide population. Between the years 2015 and 2050, it is projected to grow from approximately 310,000 to between 460,000 and 580,000 people in the low- and high-growth projections, respectively, as shown in Table 2. Using the specific numbers, this is an increase in population of 48 percent to 88 percent.

Current and future diversion demands for municipal water users are driven by population and water usage rates. Population estimates were based on SDO projections, with upward or downward adjustments based on the scenario description.

DEMANDS

The Colorado Basin Baseline water demands were largely based on water-provider-reported data, with approximately 43 percent of the Baseline population demands represented by water efficiency plans, 25 percent from 1051 data, and 9 percent from BIPs. The remaining Baseline water demand had to be estimated.

The Colorado Basin currently includes about 4 percent of the statewide industrial demand. Industrial demands are associated with the large industry, snowmaking, and energy development sub-sectors, with no demands projected for the thermoelectric sub-sector. The following are observations on M&I diversion demands:

- Overall municipal demand is projected to increase for all scenarios due to increased population, as shown on Figure 2; however, except for Hot Growth, the diversion demand projections for all future scenarios are similar.
- The increase in industrial demand in Business as Usual and Hot Growth represent anticipated energy development.

GAPS

Current and projected M&I water demands were evaluated against available water supplies in the various planning scenarios using Colorado Decision Support System (CDSS) modeling tools. Gaps were calculated when physically and legally available water supplies were unable to meet demands. The following are observations on M&I gaps:

- Average annual M&I gap in the Colorado Basin ranges from 770 acre-feet (AF) to more than 3,900 AF.
- The maximum M&I gap for the five planning scenarios ranges from 3,500 AF to nearly 11,000 AF, as shown on Figure 3.
- Figure 4 shows M&I gaps are present under all scenarios and increase during dry periods, especially in the climate-adjusted scenarios.

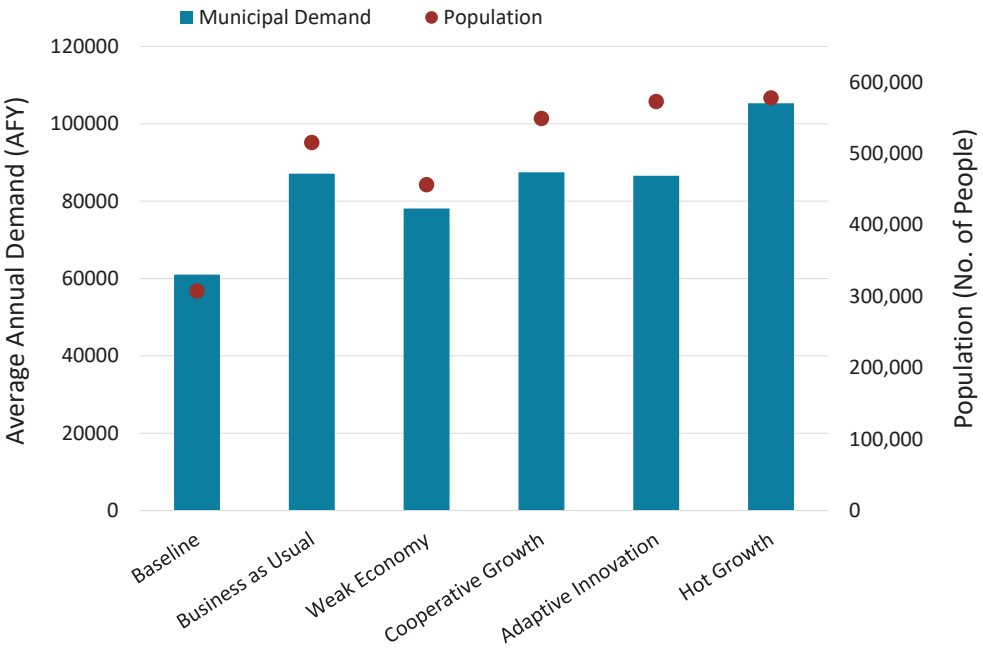


Figure 2. Baseline and 2050 Projected Population and Municipal Demand

Table 2. Summary of Baseline and 2050 Projected Municipal and Industrial Water Demands and Gaps

	Baseline[1]	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Population	308,000	515,000	456,000	549,000	573,000	578,000
Systemwide Per Capita Demands (gallons per capita per day)	179	153	156	145	136	165
Municipal Diversion Demand (AFY)	61,000	87,100	78,100	87,500	86,600	105,300
Industrial Diversion Demand (AFY)	7,200	10,900	7,300	7,500	7,500	15,700
Total M&I Diversion Demand (AFY)[2]	68,200	98,000	85,400	95,000	94,100	121,000
Average Annual Gap (AFY)[3]	0	1,100	770	1,900	2,100	3,900
Maximum Annual Gap (AF) [3]	0	4,500	3,500	5,200	5,600	10,800

[1] *Baseline year is 2015*

[2] *M&I demands may vary slightly from the M&I Demand section of the Technical Update (Section 4.4.5) due to differences in geographic distribution of demand for counties that lie in multiple basins.*

[3] *CDSS water allocation model in this basin calculates small baseline M&I gaps, but they are either due to calibration issues or they are reflective of infrequent, dry-year shortages that are typically managed with temporary demand reductions, such as watering restrictions.*

Calculation methodologies and assumptions for M&I water demands are available in the Technical Update documentation.

https://cwcb.colorado.gov/colorado-water-plan/technical-update-to-the-plan

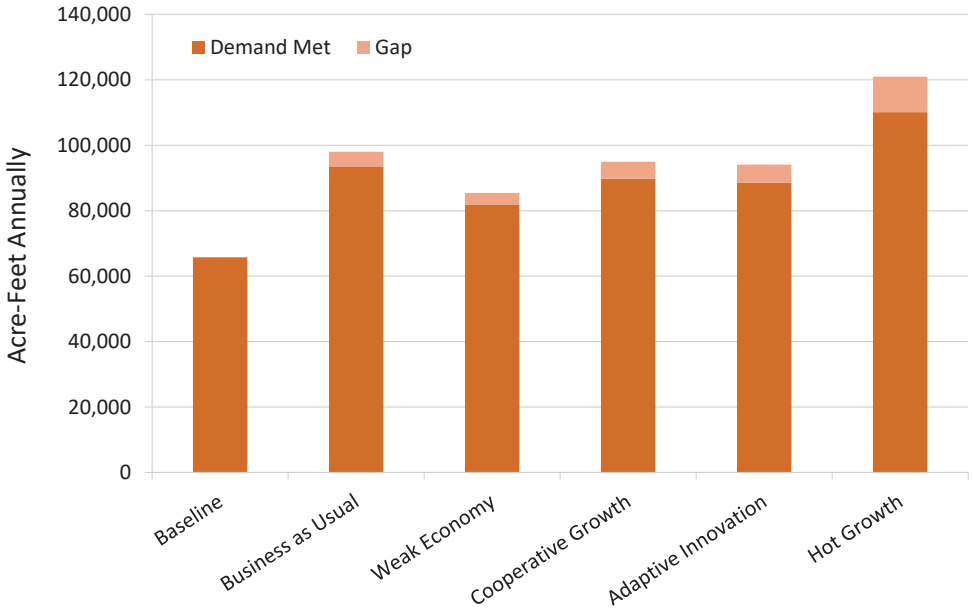


Figure 3. Baseline and 2050 Projected Maximum Annual M&I Demand Met and Gaps

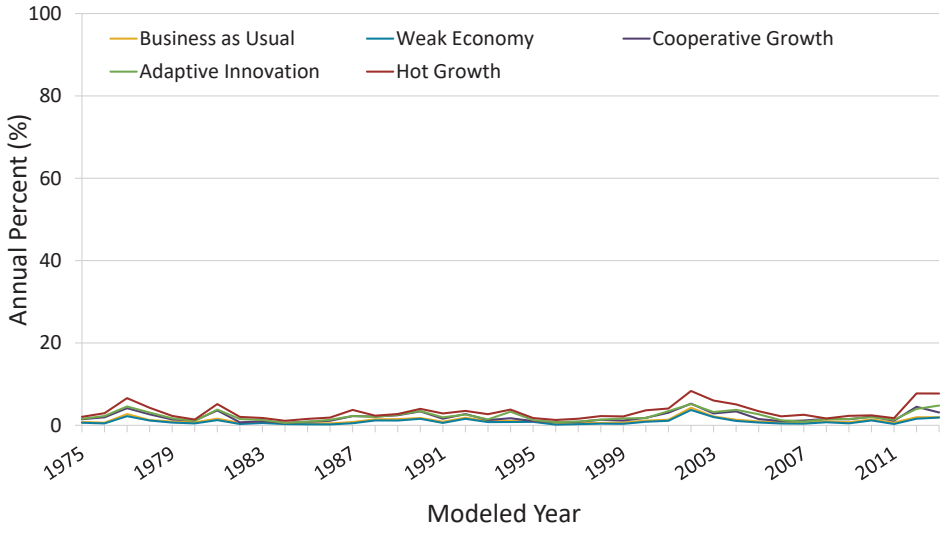


Figure 4. Modeled Annual M&I Gaps (expressed as a percent of demand unmet) by planning scenario

"Modeled Years" are not a reference to historical conditions. Models used to simulate the planning scenarios consider 1975 to recent-year water supplies in some scenarios, adjusted for climate change impacts, current administrative practices and infrastructure, and projected 2050 demands.

Agricultural Demands

DEMAND

Current and potential future agricultural diversion demands for the year 2050 were estimated using CDSS modeling tools and assumptions that were informed by the planning scenarios and information from the prior Colorado BIP. Table 3 summarizes the acreage, irrigation water requirement (IWR), and the agricultural diversion demand for surface water supplies in the Colorado Basin for Baseline conditions and the five planning scenarios. Several key adjustments to drivers for agricultural diversion demand were incorporated into the estimates of potential future demands:

- 2050 population projections reflect significant increases for counties across the Colorado Basin. The impact of urbanization is expected to be much larger in agricultural-based communities, such as Fruita, Grand Junction, Palisade, Eagle, and Rifle. In total, nearly 14,000 acres of irrigated land are expected to be urbanized, with one-third of that expected to occur in municipalities located within the Grand Valley Project and Grand Valley Irrigation Company service areas.
- IWR could increase in the Colorado Basin due to climate change by 20 percent to 31 percent on average in the climate projections.
- In Adaptive Innovation, in addition to assuming reduced IWR, the average irrigation efficiency was assumed to increase by 10 percent.

Agriculture diversion demand represents the amount of water that would need to be diverted or pumped to meet the full crop irrigation water requirement. The diversion demand does not reflect historically applied irrigation amounts because irrigators often operate under water-short conditions and do not have enough supply to fully irrigate their crops.

Observations on agricultural demands include:

- Although irrigated area is estimated to decrease by 13,600 acres as cities expand onto irrigated land, basinwide IWR and diversion demand may increase in a warmer future climate.
- Emerging technologies, including the adoption of more efficient irrigation practices, modernizing irrigation infrastructure (e.g., automation), and producing crops with lower irrigation requirements may mitigate climate impacts and reduce demand below Baseline.
- Adaptive Innovation has the lowest agricultural diversion demand.

GAPS

Current and projected agricultural diversion demands were evaluated against available water supplies in the various planning scenarios using CDSS modeling tools. Gaps were calculated when physically and legally available water supplies were unable to meet demands. Observations on agricultural demands and gaps include:

- The future incremental gap ranges from 0 percent to nearly 4 percent of Baseline demand, as shown on Figure 5.
- Scenarios that assume current climate conditions (Business as Usual and Weak Economy) have agricultural gaps around 3 percent of demand. Gaps (as a percentage of demand) increase in scenarios that assume a warmer and drier future climate.
- Current and future agricultural gaps persist throughout the simulation results and increased in dry periods, as shown on Figure 6.

Table 3. Summary of Baseline and 2050 Projected Agricultural Diversion Demands and Gaps

	Baseline[1]	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Irrigated Acreage (acres)	200,700	187,100	187,100	187,100	187,100	187,100
Average IWR (AFY)	443,500	412,800	412,800	468,200	454,400	505,000
Average Annual Demand (AFY)	1,593,300	1,471,200	1,471,200	1,656,700	1,289,600	1,743,700
Average Annual Gap (AFY)	45,200	44,000	44,000	76,700	61,900	104,400
Incremental Avg. Ann. Gap (AFY)	-	0	0	31,500	16,700	59,200
Maximum Annual Gap (AFY)	146,800	142,700	142,500	173,200	135,600	214,700

[1] *Baseline agricultural demands were estimated using a model that used "current" irrigated acreage and cropping patterns and incorporated historical weather patterns.*

Calculation methodologies and assumptions for agriculture water demands are available in the Technical Update documentation.

https://cwcb.colorado.gov/colorado-water-plan/technical-update-to-the-plan

The Incremental Average Annual Gap quantifies the degree to which the basinwide gap could increase beyond what agriculture has historically experienced under water-short conditions.

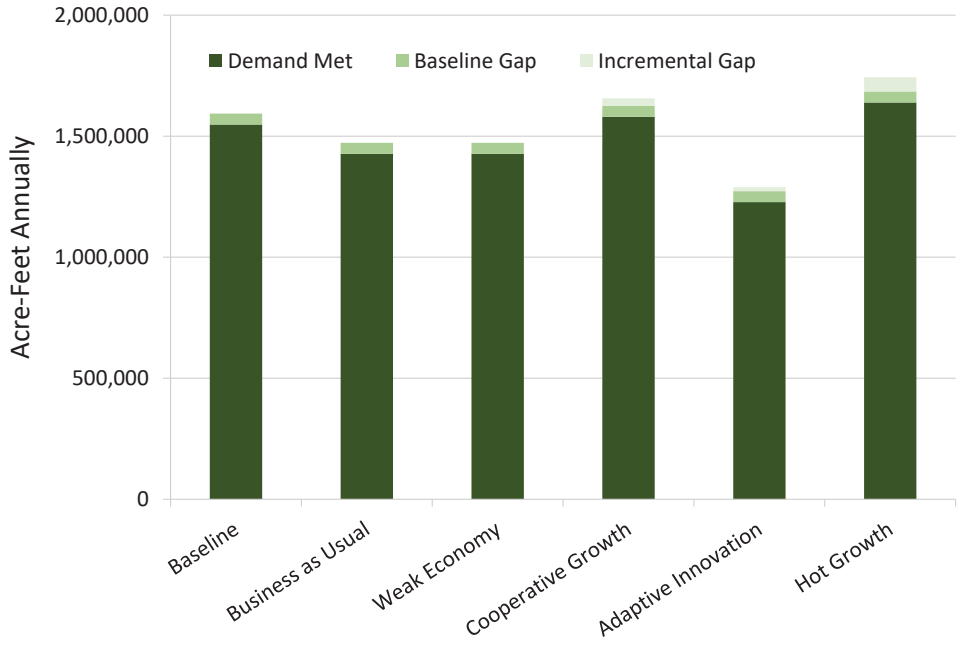


Figure 5. Baseline and 2050 Projected Average Annual Agricultural Diversion Demand, Demand Met, and Gaps

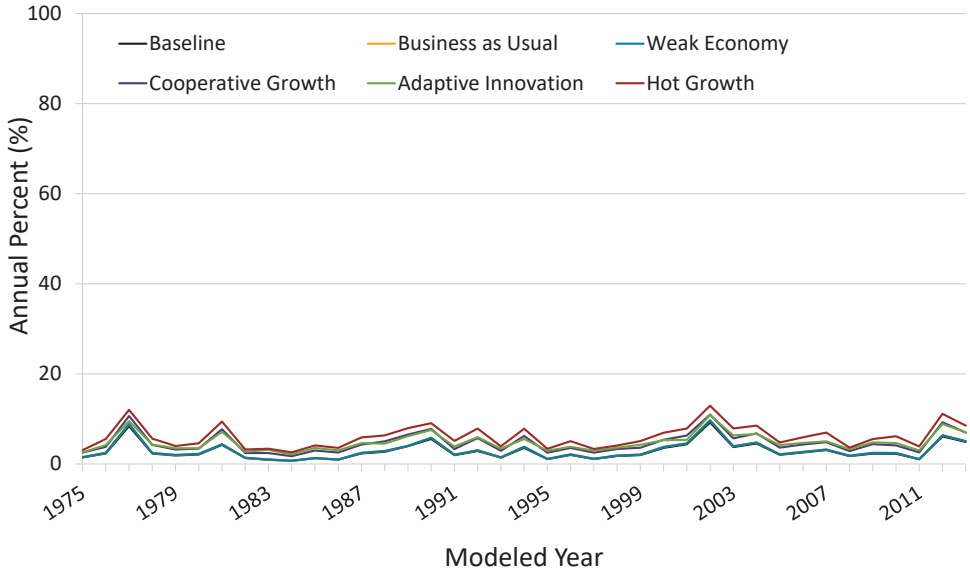


Figure 6. Modeled Annual Agricultural Gaps (expressed as a percentage of demand unmet) by Planning Scenario

Irrigated acreage is expected to decrease in the Colorado Basin; however, a projected warmer and drier climate drive IWR and resulting demand to increase. The Colorado Basin will need to lean on emerging technologies that can mitigate the increase in demand in the future.

Regional Summary of M&I and Agricultural Demands and Gaps

The Colorado Basin wanted to further understand model results and opted to summarize a regional breakdown of the Technical Update results. The regions, first presented in the 2015 BIP, are shown on Figure 7. The Grand County, State Bridge, Middle Colorado, and Grand Valley regions contain the mainstem of the Colorado River. The Summit, Eagle, and Roaring Fork regions contain tributaries to the Colorado River.

Agricultural demands and gaps are characterized in terms of averages, while municipal demands and gaps are characterized in terms of maximums. The reason for this is that water providers must plan for the maximum demand to meet service standards. Refer to Table 4 for a summary of the results and observations on each region. Further detail can be found in Volume 2, Section 4.

Volume 2, Section 4 provides detailed regional perspectives that include a description of the region, watershed groups and conservation districts; focus area maps; projects; and discussion on supply, demands, and gaps.

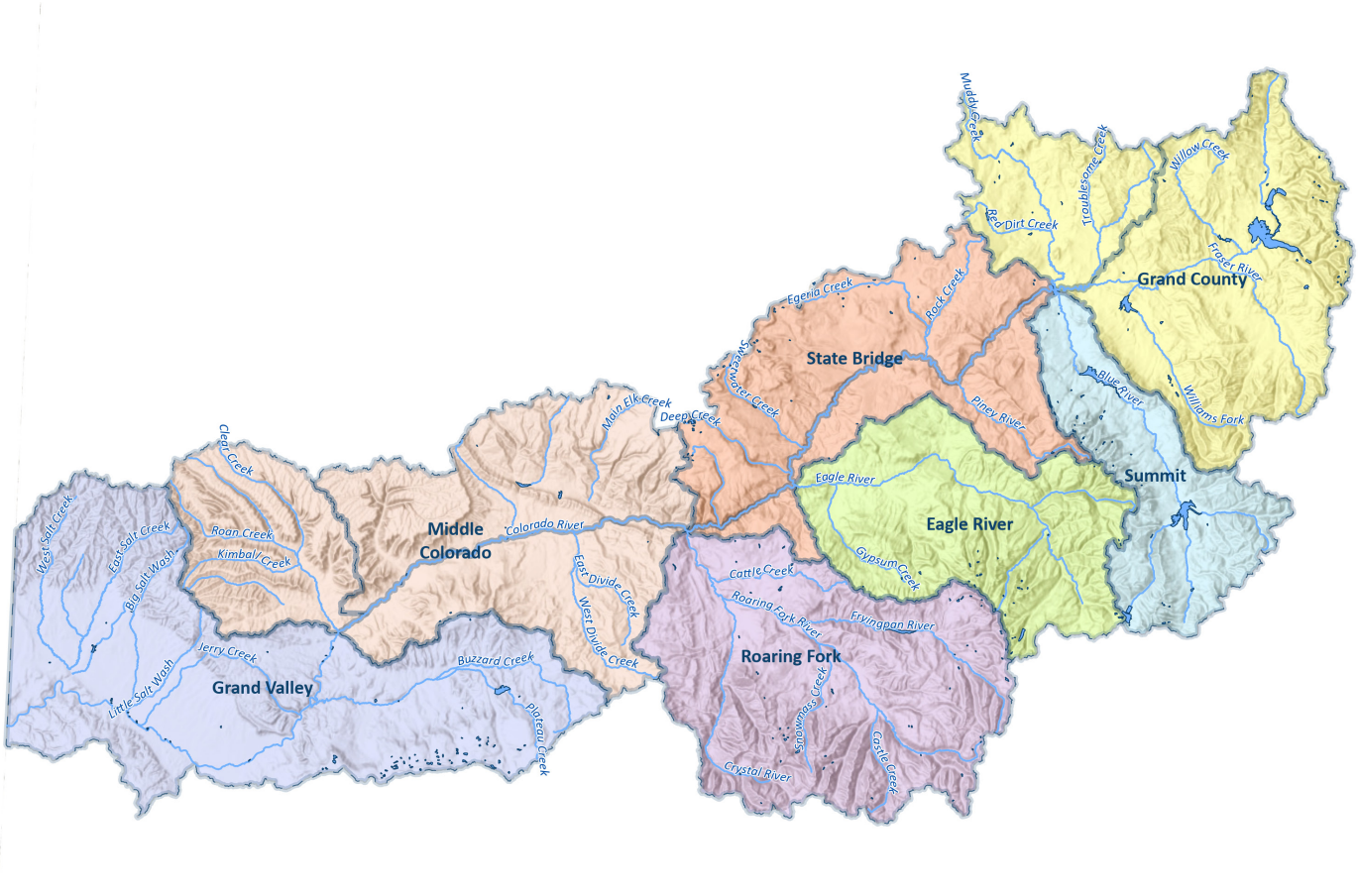


Figure 7. Colorado Basin Regional Map

Table 4. Summary of M&I and Agricultural Water Demands and Gaps by Region

			Baseline[1]	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Grand County	Municipal & Industrial	Demand in Maximum Gap Year (AF)	6,400	8,600	7,800	8,700	8,200	9,800
		Maximum Annual Gap (AF) [1]	0	1,500	1,200	1,900	1,700	2,800
		• The region has a projected M&I gap across all planning scenarios. • The highest demand and gap are in the Hot Growth scenario. • Grand County subbasin water supplies are impacted by transmountain diversions.						
	Agricultural	Average Annual Demand (AFY)	214,400	204,200	204,200	253,300	180,200	273,800
		Average Annual Gap (AFY)	6,500	5,900	5,900	13,900	12,000	20,700
		Average Demand Met (AFY)	207,900	198,300	198,300	239,400	168,200	253,100
		Incremental Gap (AFY)	-	0	0	7,400	5,500	14,200
		• The region experiences a high agricultural shortage related to its location in the headwaters with little access to upstream storage. • The region has the second highest agricultural gap of any region under most of the planning scenarios. • Although there is an agricultural gap across all planning scenarios, there is only an incremental gap in Cooperative Growth, Adaptive Innovation, and Hot Growth (scenarios that include climate change).						
Summit	Municipal & Industrial	Demand in Maximum Gap Year (AF)	9,000	12,000	11,300	11,800	11,000	12,900
		Maximum Annual Gap (AF) [1]	0	900	890	1,000	1,200	1,200
		• The region has a projected M&I gap across all planning scenarios, and the M&I gap is relatively small compared to other regions. • The highest demand and gap are in Adaptive Innovation and Hot Growth. • The region exports approximately 75,000 AF per year of subbasin water supplies.						
	Agricultural	Average Annual Demand (AFY)	70,200	67,300	67,300	82,700	50,900	89,700
		Average Annual Gap (AFY)	60	40	40	280	190	20,700
		Average Demand Met (AFY)	70,100	67,300	67,300	82,400	50,700	69,000
		Incremental Gap (AFY)	-	0	0	200	100	20,600
		• The region is nearly able to meet its full agricultural demands under baseline conditions. • Although there is an agricultural gap across all planning scenarios, there is only an incremental gap in the Cooperative Growth, Adaptive Innovation, and Hot Growth (scenarios that include climate change). • Even though the Summit Region has small agricultural gaps, it has placed a focus on sustaining agriculture and improving the environment.						
Eagle River	Municipal & Industrial	Demand in Maximum Gap Year (AF)	7,000	10,100	9,200	10,200	9,600	12,100
		Maximum Annual Gap (AF) [1]	0	0	0	0	0	0
		• There is no M&I gap across all scenarios. The Eagle region contains several major municipalities, including Eagle, Gypsum, Vail, Edwards, and Avon. This gap may be underestimated, likely due to how modeling attributes demand on smaller tributaries that are not the mainstem of the Colorado River.						
	Agricultural	Average Annual Demand (AFY)	56,600	32,700	32,700	40,500	26,200	43,100
		Average Annual Gap (AFY)	0	0	0	0	0	10
		Average Demand Met (AFY)	56,600	32,700	32,700	40,500	26,200	43,090
		Incremental Gap (AFY)	-	0	0	0	0	10
		• The agricultural gap is zero across all scenarios except Hot Growth. This gap may be underestimated, likely due to how modeling attributes demand on smaller tributaries that are not the mainstem of the Colorado River. • There is only an incremental gap in Hot Growth. • Agricultural projects in the Eagle region tend to focus on rehabilitation and efficiency.						

Table 4. Summary of M&I and Agricultural Water Demands and Gaps by Region *(continued)*

			Baseline[1]	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
State Bridge	Municipal & Industrial	Demand in Maximum Gap Year (AF)	2,500	3,800	3,400	3,800	3,500	4,500
		Maximum Annual Gap (AF) [1]	0	0	0	0	0	0
		• The region has the smallest M&I demands and consists of mostly state and federal land with very few population centers. • The region has no M&I gap across all planning scenarios.						
	Agricultural	Average Annual Demand (AFY)	80,900	80,900	80,900	98,900	68,700	104,600
		Average Annual Gap (AFY)	3,400	3,400	3,400	8,100	6,900	10,800
		Average Demand Met (AFY)	77,500	77,500	77,500	90,800	61,800	93,800
		Incremental Gap (AFY)	-	0	0	4,700	3,500	7,400
		• The agricultural demand exceeds supplies across all planning scenarios. • Although there is an agricultural gap across all planning scenarios, there is only an incremental gap in the Cooperative Growth, Adaptive Innovation, and Hot Growth (scenarios that include climate change). • Agricultural use is not projected to decrease in the region due to the dominance of public lands and lack of large municipalities.						
Roaring Fork	Municipal & Industrial	Demand in Maximum Gap Year (AF)	12,700	14,800	13,600	15,600	14,600	18,000
		Maximum Annual Gap (AF) [1]	0	1,200	1,000	1,400	1,300	2,200
		• The region has the highest maximum municipal gap across all planning scenarios except for Hot Growth. The region is experiencing rapid urbanization and municipal growth. • Annual exports diverted out of the Colorado Basin to the Front Range yield approximately 100,000 AF.						
	Agricultural	Average Annual Demand (AFY)	179,000	161,200	161,200	200,200	127,000	216,800
		Average Annual Gap (AFY)	3,200	3,200	3,200	6,600	5,600	9,600
		Average Demand Met (AFY)	175,800	158,000	158,000	193,600	121,400	207,200
		Incremental Gap (AFY)	-	0	0	3,400	2,400	6,400
		• The agricultural demand exceeds supplies across all planning scenarios, reflecting a headwaters basin with insufficient upstream storage where low flows during dry years can cause serious supply issues. • Although there is an agricultural gap across all planning scenarios, there is only an incremental gap in the Cooperative Growth, Adaptive Innovation, and Hot Growth (scenarios that include climate change).						
Middle Colorado	Municipal & Industrial	Demand in Maximum Gap Year (AF)	13,400	20,600	16,400	19,500	17,500	27,400
		Maximum Annual Gap (AF) [1]	0	920	790	1,000	920	2,200
		• There is an M&I gap across all planning scenarios, with the maximum gap in Hot Growth. • Industrial demands in this region are related to energy development, and demands increase significantly under Hot Growth. • The Shoshone Hydropower Plant in Glenwood Canyon has a nonconsumptive use that returns to the Colorado River and is available downstream.						
	Agricultural	Average Annual Demand (AFY)	233,100	216,200	216,200	253,500	181,700	266,400
		Average Annual Gap (AFY)	26,100	26,100	26,100	37,100	31,400	45,500
		Average Demand Met (AFY)	207,000	190,100	190,100	216,400	150,300	220,900
		Incremental Gap (AFY)	-	0	0	11,000	5,300	19,400
		• Across all scenarios, the region has the highest agricultural demand gap. • Although there is an agricultural gap across all planning scenarios, there is only an incremental gap in Cooperative Growth, Adaptive Innovation, and Hot Growth (scenarios that include climate change). • Dam rehabilitation and enlargement are critical components to the overall solution to the agricultural gap in the region.						

Table 4. Summary of M&I and Agricultural Water Demands and Gaps by Region *(continued)*

			Baseline[1]	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Grand Valley	Municipal & Industrial	Demand in Maximum Gap Year (AF)	0	28,100	23,100	26,100	29,100	35,700
		Maximum Annual Gap (AF) [1]	0	450	380	450	640	3,100
		• There is an M&I gap across all planning scenarios, with the maximum gap in Hot Growth. • Industrial demands in this region are related to energy development, and demands increase significantly under Hot Growth.						
	Agricultural	Average Annual Demand (AFY)	759,100	708,600	708,600	727,600	654,900	749,400
		Average Annual Gap (AFY)	6,000	5,400	5,400	10,800	5,900	17,200
		Average Demand Met (AFY)	753,100	703,200	703,200	716,800	649,000	732,200
		Incremental Gap (AFY)	-	0	0	4,800	0	11,200
		• The region is known for its robust agricultural production and, therefore, has the highest agricultural demand in the Colorado Basin. • Although there is an agricultural gap across all planning scenarios, there is only an incremental gap in Cooperative Growth and Hot Growth (scenarios that include climate change). • Considering the high acreage in Grand Valley, the region's gaps are not as drastic as other regions, due in part to the seniority of the region's agricultural water rights.						

[1] *CDSS water allocation model in this basin calculates small baseline M&I gaps, but they are either due to calibration issues or they are reflective of infrequent, dry-year shortages that are typically managed with temporary demand reductions, such as watering restrictions.*

Photo source: Colorado BRT

Environment and Recreation

During the Technical Update, current and potential future risks to E&R attributes in the basin were evaluated using the Colorado Environment and Recreation Flow Tool (Flow Tool). The Flow Tool was developed to help BRTs evaluate their portfolios of E&R projects by fostering an improved understanding of potential streamflow-related risks (both existing and projected) to E&R attributes throughout their respective basin.

The Flow Tool uses streamflow data from CDSS, modeled streamflow data for various planning scenarios, and established flow-ecology relationships to assess risks to flows and E&R attribute categories at preselected gages across the state. The Flow Tool is a high-level tool that is intended to provide guidance during SMP and BIP development.

A total of 11 water allocation model nodes were selected for the Flow Tool within the Colorado Basin, shown on Figure 8. Nodes include:

- Colorado River below Baker Gulch near Grand Lake, Colorado (09010500)
- Muddy Creek near Kremmling, Colorado (09041000)
- Blue River below Green Mountain Reservoir, Colorado (09057500)
- Eagle River at Red Cliff, Colorado (09063000)
- Colorado River near Dotsero, Colorado (09070500)
- Roaring Fork River near Aspen, Colorado (09073400)
- Fryingpan River near Ruedi, Colorado (09080400)
- Crystal River above Avalanche Creek, near Redstone, Colorado (09081600)
- Roaring Fork River at Glenwood Springs, Colorado (09085000)
- Colorado River near Cameo, Colorado (09095500)
- Colorado River near Colorado-Utah State Line (09163500)

Results and observations from the Flow Tool analysis are described in Table 5. Note that the results described in Table 5 do not consider the potential future effects of planned TMDs or other planned water supply projects.

The identification of future risks to E&R attributes helps facilitate discussions about projects or strategies that can be implemented to reduce the risks. This type of discussion is similar to and integrates with roundtable strategies that focus on reducing the risk of experiencing municipal or agricultural gaps.

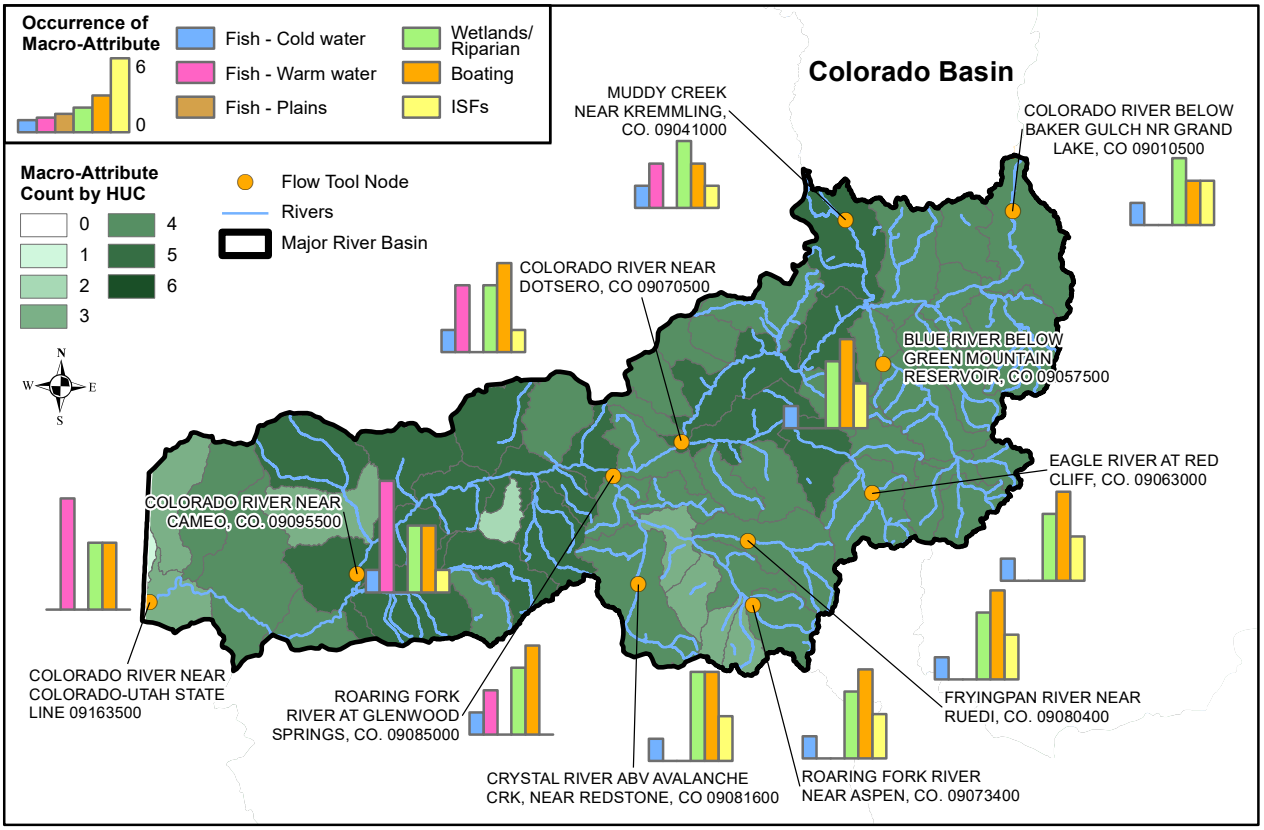


Figure 8. Flow Tool Nodes Selected in the Basin

Table 5. Summary of Flow Tool Results in the Basin

Category	Observation
Projected Flows	• Annual flow in the headwaters (Colorado River below Baker's Gulch) under climate-impacted scenarios (Cooperative Growth, Adaptive Innovation, Hot Growth) are projected to be variable compared to Baseline, Business as Usual, and Weak Economy. Some years, climate-impacted scenarios will have greater annual flow and some years less compared to Baseline. Farther down the Colorado River mainstem (Dotsero, Cameo, and the state line), annual flows are forecasted to be less for all climate-impacted scenarios compared to Baseline. Business as Usual and Weak Economy will have similar annual flows compared to Baseline. The Fryingpan River below Ruedi Reservoir is an exception to the large projected decreases in mid- and late-summer flows because releases are made steadily from the reservoir. • Under climate-impacted scenarios, annual depletions are estimated to increase from headwaters to the state line. • Along the Colorado River and its tributaries, spring runoff peak flows are estimated to occur sooner in April and May for the climate-impacted scenarios compared to the peak occurring in June for Baseline, Business as Usual, and Weak Economy. Subsequently, mean monthly flows are less for climate-impacted scenarios for all other months (July through March). The magnitude of difference in flows is predicted to be greater in the headwaters and less farther downstream on the Colorado River. • Under climate-impacted scenarios, snowmelt and timing of peak flows are expected to shift to earlier in the year.
Ecological Risk	• Decreased peak flows that are prevalent across the Colorado Basin under Baseline conditions create risk for riparian/wetland plants and fish habitat. • This risk increases under climate-impacted scenarios. Anticipated decreases in mid- and late-summer flows create risk for fish from loss of habitat and, in trout regions, increased water temperatures. Downstream from major reservoirs (e.g., Fryingpan, Green Mountain), projected diminished peak flows create increased risk for riparian/wetland vegetation and fish habitat if sediment is not flushed, while projected consistent mid- and late-summer flows keep risk to fish low to moderate. • Due to the shift in mean monthly peak flows for the climate-impacted scenarios to an earlier spring peak runoff and lower mid- to late-summer flows, both spawning windows for various species and summer low-flow conditions could adversely affect fish species. Lower flow conditions combined with warmer air temperatures due to climate change could result in warmer water temperatures that would negatively affect cold-water fish species.
ISFs and RICDs	• Several ISFs throughout the Colorado Basin and recreational in-channel diversions (RICD) are unlikely to be met if June to August flows decrease as projected under climate-impacted scenarios. • In critical habitat for endangered species, projected reduced flows in mid and late summer will make it more difficult to meet flow recommendations. For example, August flows under climate-impacted scenarios on the Colorado River at Cameo suggest that flow recommendations for endangered fish will not be met during August in approximately one-third of years.
E&R Attributes	• Under Baseline, Business as Usual, and Weak Economy, current flow issues related to E&R attributes arise from timing/water delivery issues. • Under climate change scenarios, the shift in the timing of peak flow, reductions in total runoff, and increasing demands for consumptive uses contribute to reductions in mid- and late-summer flows. Several water management programs implemented in the context of the Upper Colorado River Endangered Fish Recovery Program (e.g., Coordinated Reservoir Operations Program) have demonstrated that flow timing and magnitude, along with stream temperature, can be improved through water management that explicitly considers the needs of E&R attributes.

Focus Area Mapping

Since the 2005 passage of the Colorado Water for the 21st Century Act, the nine basin roundtables of Colorado and the CWCB have worked to characterize Colorado's E&R water needs. The effort has included extensive inventory, analysis, and synthesized mapping of each basin's E&R attributes. Through this process, each basin created Focus Area maps that identify streams or watersheds where E&R attributes are located and/or where these attributes may be at risk. The maps were included in the 2010 version of the Statewide Water Supply Initiative and were updated by some basins during the development of the 2015 BIPs.

As a part of the 2015 BIP effort, the Colorado BRT built upon the Focus Area mapping, referred to as nonconsumptive needs assessment (NCNA) in the 2015 BIP, by providing regional breakdowns of the consumptive and E&R conditions.

During the current BIP update effort, the Colorado BRT continued to enhance the regional Focus Area mapping by identifying and adding new datasets to the existing consumptive and E&R conditions maps for each region. The Colorado BRT supplemented this with a third map that shows project locations. Further details can be found in Volume 2, Section 4.

Figure 9 shows the current Focus Area Map for the Colorado Basin.

Regional maps that characterize the varied uses, conditions, and projects throughout the region are included in Volume 2, Section 4. The maps include consumptive uses, E&R, and project locations.

The Focus Area maps were created to:

1. **Help guide water supply planning**
2. **Help identify where projects could reduce risks to E&R attributes**
3. **Identify potential collaborative projects**

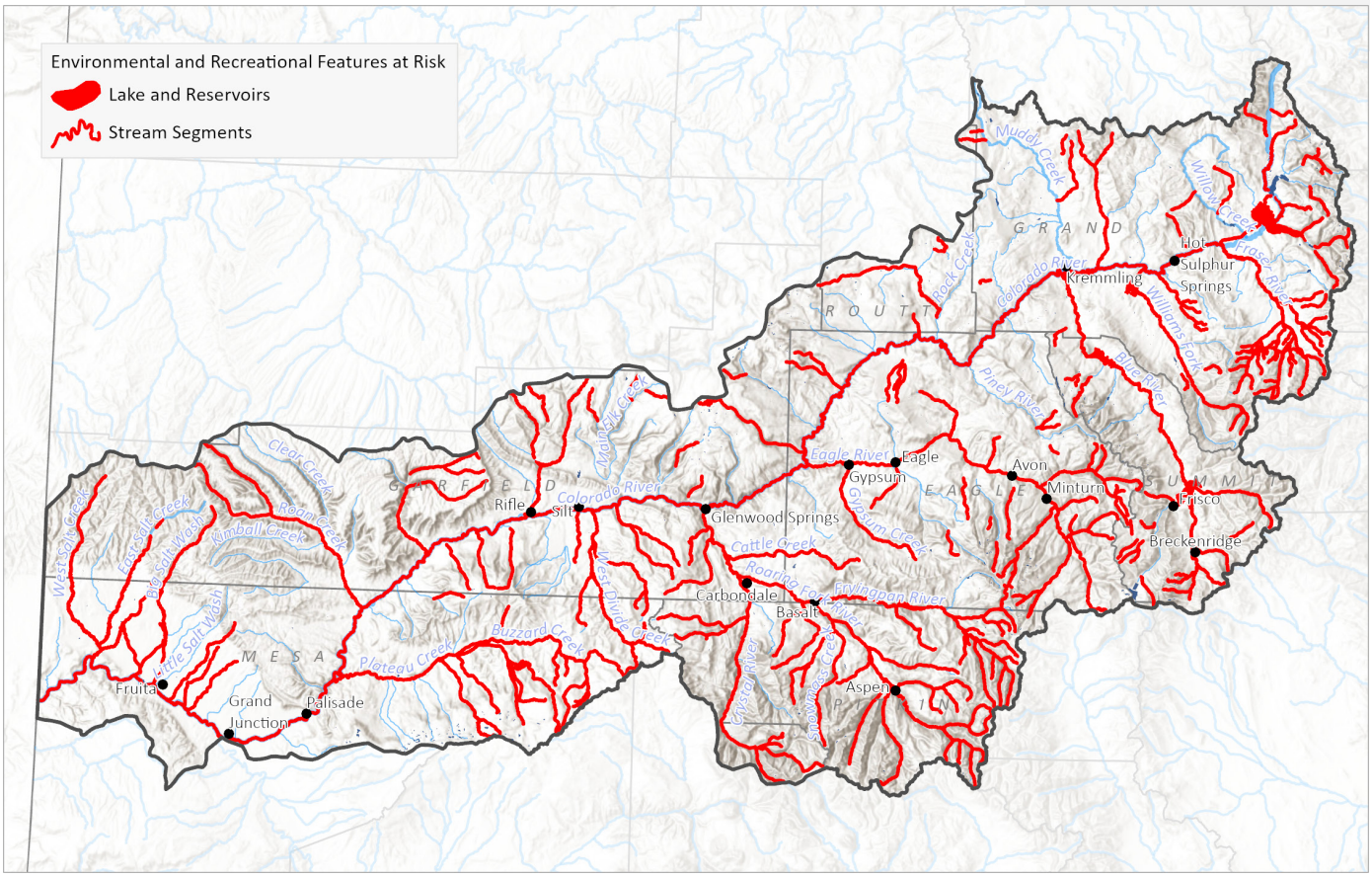


Figure 9. Focus Area Map of the Basin

Water Supplies

Available water supplies in the Colorado Basin vary by location and are impacted by contributing drainage area, diversions, storage facilities, and the prior appropriation system. The CDSS model used to evaluate current and projected future available supplies in the Colorado Basin includes supply evaluations at numerous locations throughout the basin.

Figures 10 and 11 show simulated monthly available flow for the Colorado Basin at locations representative of the Shoshone Hydroelectric Plant diversion (near Dotsero) and the Cameo Call, which are generally the controlling rights on the mainstem of the Colorado River. Streamflow and available flow nearly double between the upstream and downstream locations due to inflows from the Roaring Fork, Parachute Creek, and Rifle Creek. The figures show that flows are projected to be available each year, though the amounts will vary annually and across scenarios (available flows under the scenarios impacted by climate change are less than in other scenarios). Peak flows are projected to occur earlier in the year under scenarios impacted by climate change. Figures 12 and 13 show average monthly simulated hydrographs of available flow at those locations. Note that the figures do not include the potential effects from future TMDs or other future water supply projects.

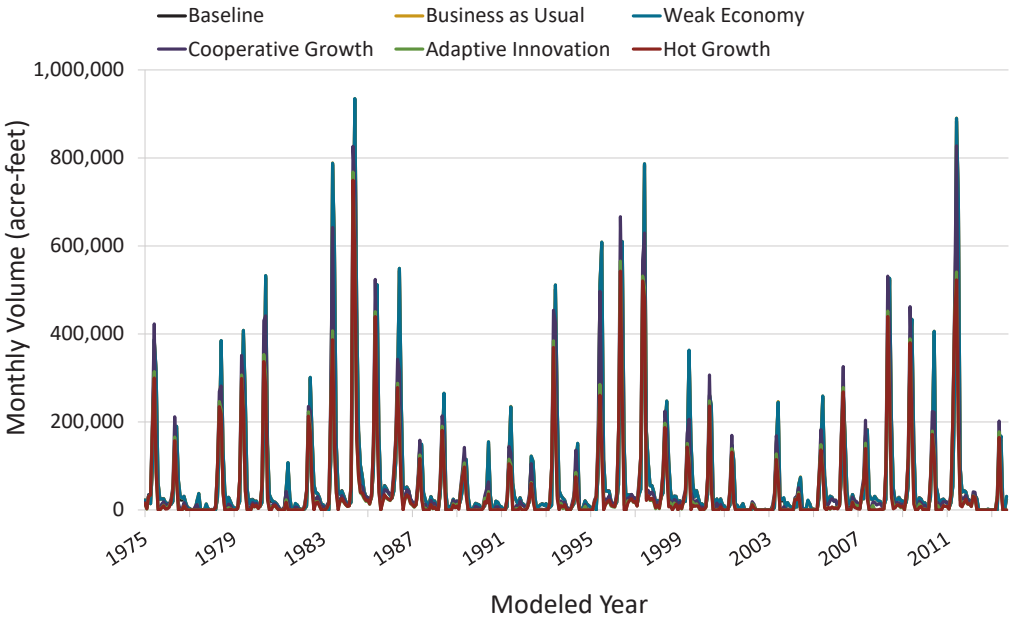


Figure 10. Simulated Hydrograph of Available Flow at Colorado River near Dotsero

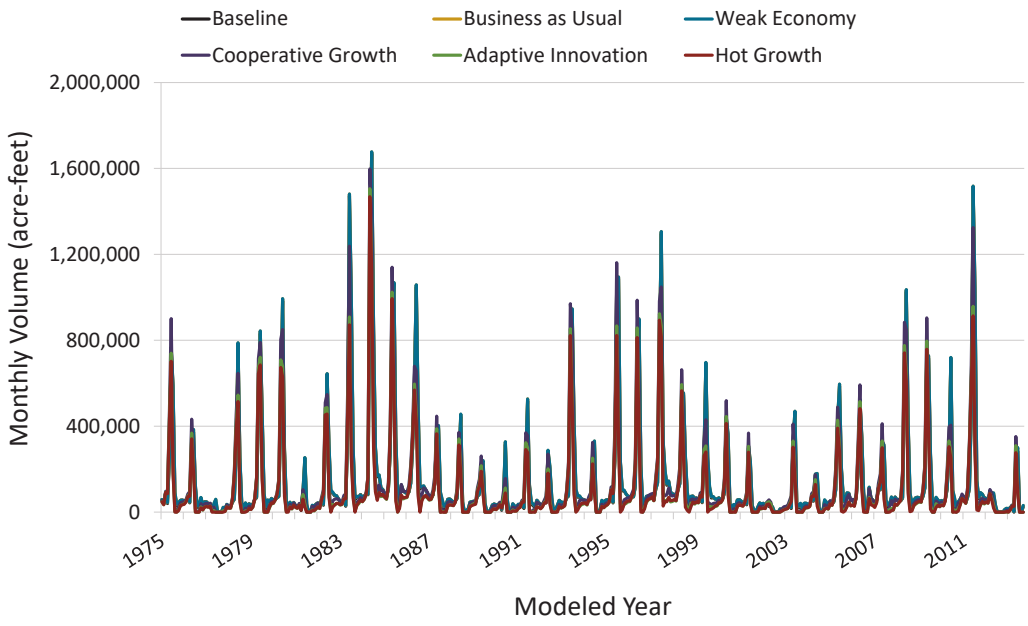


Figure 11. Simulated Hydrograph of Available Flow at Colorado River near Cameo

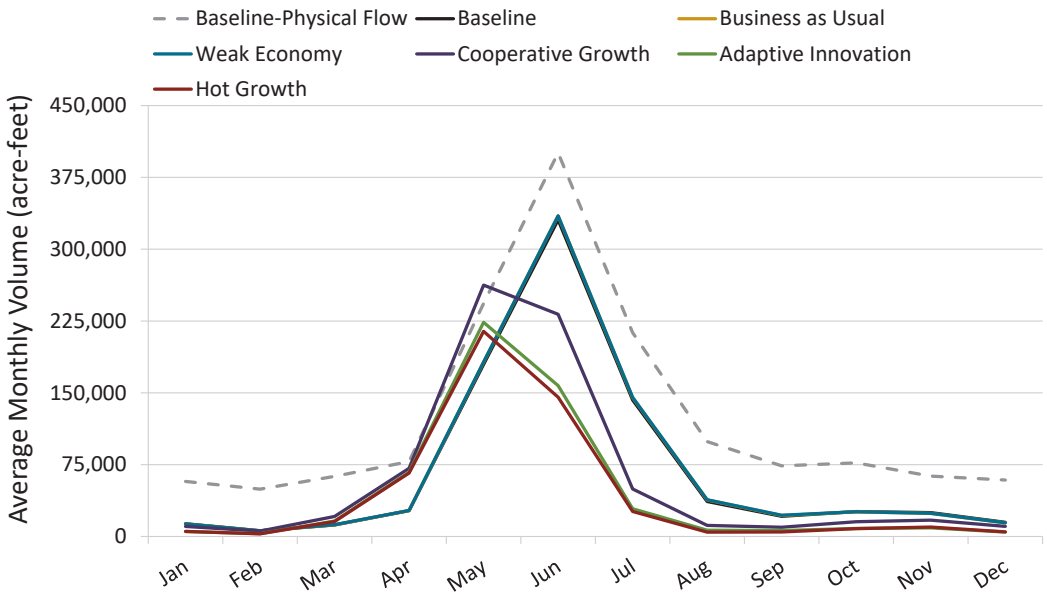


Figure 12. Average Monthly Simulated Hydrographs of Available Flow at Colorado River near Dotsero

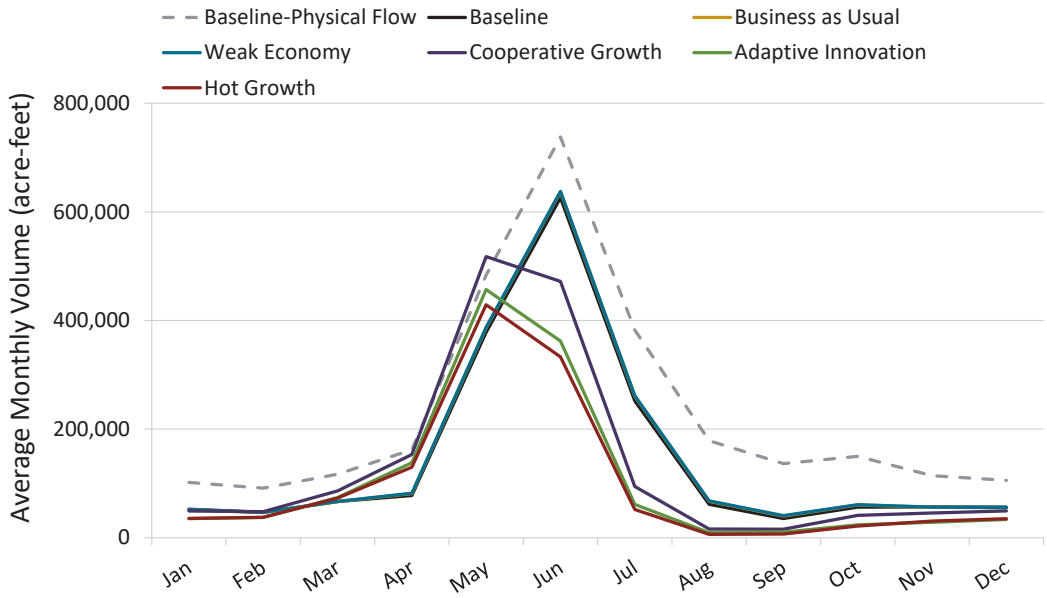


Figure 13. Average Monthly Simulated Hydrographs of Available Flow at Colorado River near Cameo

Storage

Total simulated reservoir storage from the Colorado water allocation model is shown on Figure 14. Baseline conditions show the highest levels of water in storage (in general) and Hot Growth showing the lowest. Cooperative Growth, Adaptive Innovation, and Hot Growth show lower amounts of water in storage during dry periods than the two scenarios that do not include the impacts of a drier climate; however, storage levels generally recover from dry periods back to Baseline levels. Storage in the Colorado Basin is critical to minimizing gaps as demonstrated by the large degree of fluctuation in basinwide storage amount.

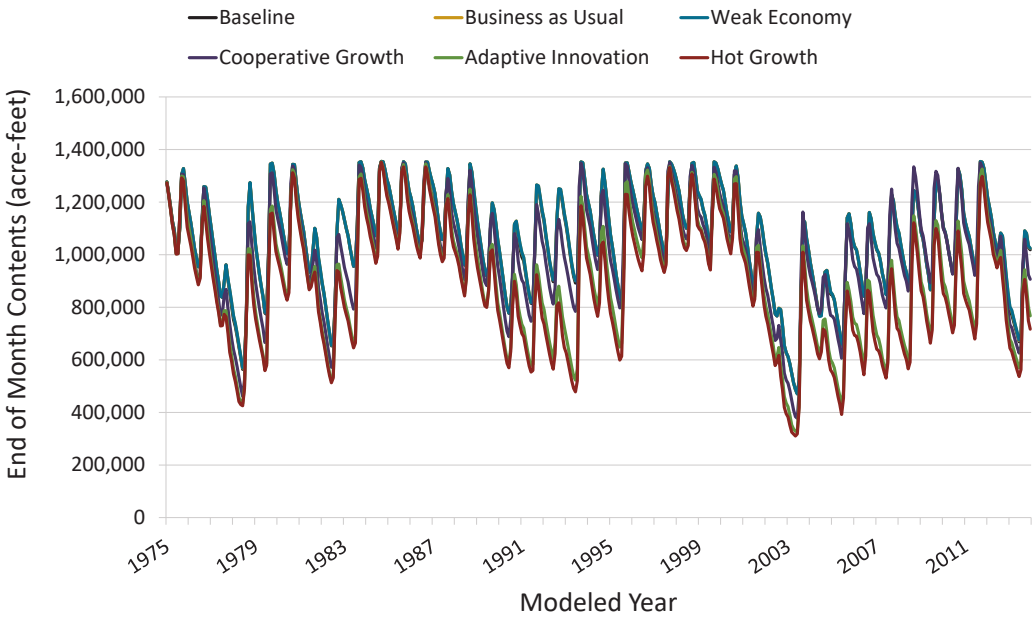


Figure 14. Basin Total Simulated Storage

Future Transmountain Diversion Projects

Four future TMD projects are in the planning process to divert additional water from the West Slope and deliver it to the East Slope to serve growing demands. The projects are listed and described in Table 6 and are shown on Figure 15. The projects may potentially affect unappropriated water supplies and streamflows in parts of the Colorado Basin.

Table 6. Planned Future TMDs in the Colorado Basin

Project	Proponent	Completion	Description and Status
Gross Reservoir Expansion	Denver Water	2027	Existing collection system will divert additional supplies to enlarged Gross Reservoir on the East Slope. Water quality and environmental enhancements are captured in the CRCA.
Windy Gap Firming & Chimney Hollow Reservoir Project	Northern Colorado Water Conservancy District	2025	Existing collection system will divert additional supplies to new Chimney Hollow Reservoir on the East Slope. Actions will be implemented to enhance aquatic habitat on the West Slope.
Continental-Hoosier System Project	Colorado Springs Utilities	2030	Optimize existing collection system by enlarging Montgomery Reservoir located in the South Platte Basin.
Eagle River Joint Use Project	Colorado Springs Utilities, Aurora Water, and West Slope Entities	2040	Existing water rights and new/existing infrastructure will provide supplies to users on the East Slope (20,000 AFY avg yield) and West Slope (10,000 AFY firm yield)

In general, no future water supply projects, including future TMDs, were modeled in the Technical Update, reserving consideration of these future projects for the BIP update process.

The potential effects of future TMD projects on available water supplies and streamflows are important for the Colorado BRT to understand and incorporate into basinwide strategies for meeting future water needs. A qualitative description of the potential effects of the future TMD projects is provided on the next page. The description was derived from various public documents including Environmental Impact Statements.

Future TMDs cannot be modeled at this time for the following reasons:

- Several of the TMD projects are either undergoing permitting or in litigation.
- The CWCB did not include modeling specific to TMDs. The CWCB understands the importance of this modeling for both West and East Slope stakeholders and intends to engage those stakeholders in identifying an appropriate approach for future updates to the Colorado Water Plan.

The map below shows the general locations of the four future TMD projects and the approximate areas where the effects of streamflow depletions from TMDs may or may not be realized. The observations below the map are intended to provide a high-level understanding of potential TMD effects for Colorado BRT planning purposes. Refer to public and permitting documents for more specifics on the development of the projects.

The language for this header is still under discussion between the Colorado BRT and Attorney General's Office, regarding future TMDs and flows along the Colorado River mainstem.

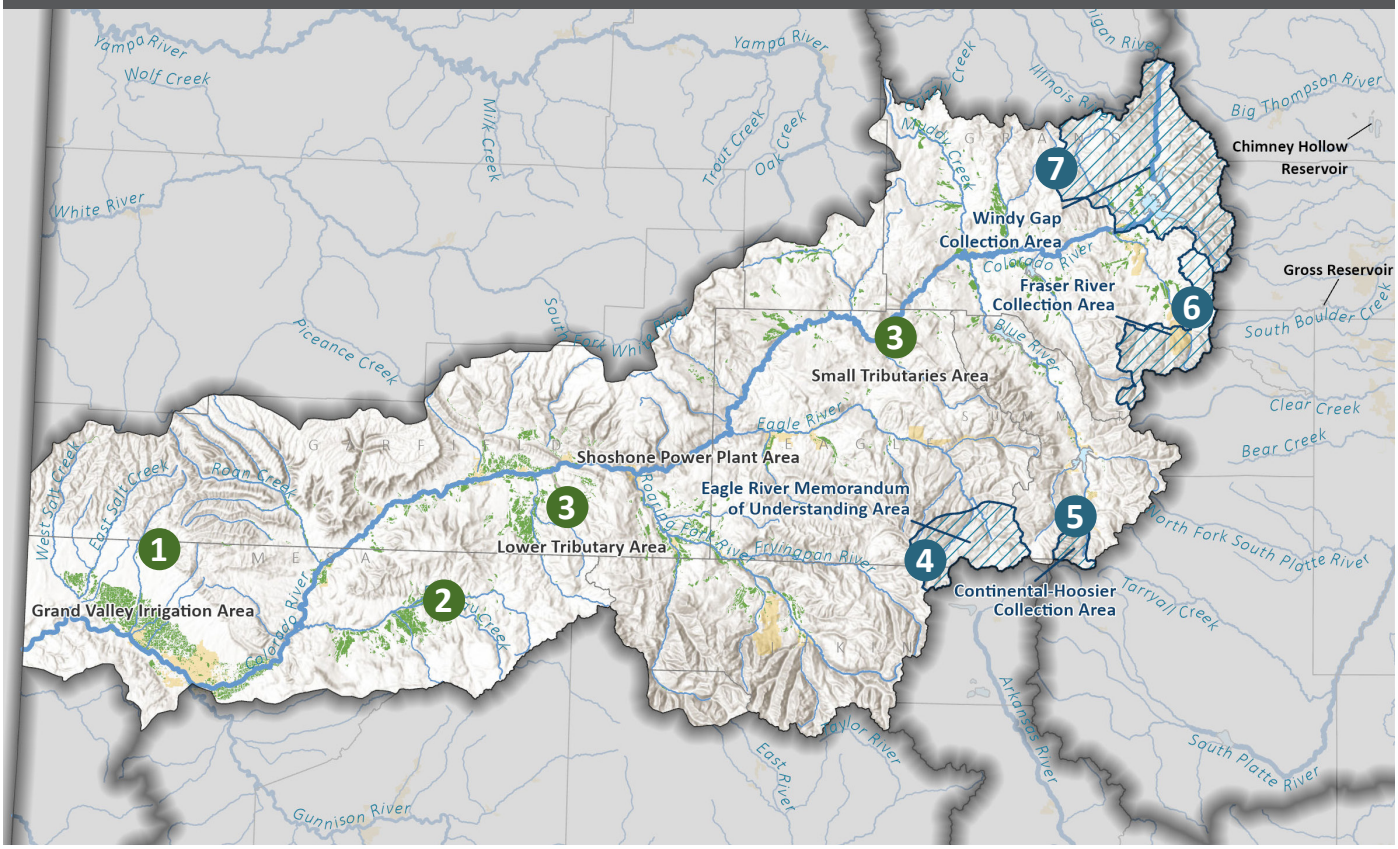


Figure 16. Planned Future TMDs in the Colorado Basin

Potentially Unaffected Areas

1 Water rights senior to TMDs should not be affected (example: Shoshone Hydroelectric Plant and Grand Valley agricultural water rights).

2 Some tributaries of the Colorado River, such as the Roaring Fork or Divide Creek, should not be affected by the TMDs.

3 Diversion to TMDs will typically occur when streamflow conditions are high and would not impact gaps on smaller tributaries that experience physical shortages.

Project Collection Areas

4 The Eagle River Joint Use Project will deliver 20,000 AF/yr on average for East Slope water users from the upper Eagle River Basin with diversions occurring during average and wet years. The project will provide 10,000 AF/yr of firm yield from the upper Eagle River Basin for West Slope water users in the Eagle River Basin.

5 The Continental-Hoosier System Project will yield an additional 4,000 AF/yr on average. These additional diversions from the headwaters of the Blue River will occur during wet and average years.

6 The Gross Reservoir Expansion will divert 10,300 AF and 11,800 AF in average and wet years (respectively) during spring runoff from several tributaries to the Fraser River.

7 Adams Tunnel deliveries would increase about 19,100 AF with the Windy Gap Firming Project compared to an increase of about 10,700 AF under the No Action Alternative.

Additional Resources:

- Eagle River Memorandum of Understanding, 1998
- Denver Water Gross Reservoir Expansion Project Updates - **https://www.denverwater.org/project-updates/gross-reservoir-expansion-project**
- Denver Water Gross Reservoir Expansion Project - **https://grossreservoir.org/**
- Moffat Collection System Project FEIS and ROD - **https://www.nwo.usace.army.mil/Missions/Regulatory-Program/Colorado/EIS-Moffat/**
- Chimney Hollow Reservoir Project Site - **https://www.northernwater.org/chrp**
- Colorado River Connectivity Channel Project Site - **https://www.northernwater.org/what-we-do/protect-the-environment/river-health-and-restoration/connectivity-channel**
- Reclamation Windy Gap Permitting Documents - **https://www.usbr.gov/gp/ecao/nepa/windy_gap.html**
- US Army Corps of Engineers Windy Gap Permitting Documents - **https://www.nwo.usace.army.mil/Missions/Regulatory-Program/Colorado/EIS-Windy-Gap-Firming/**
- Continental-Hoosier System Project - **https://www.csu.org/Pages/ContinentalHoosier.aspx**

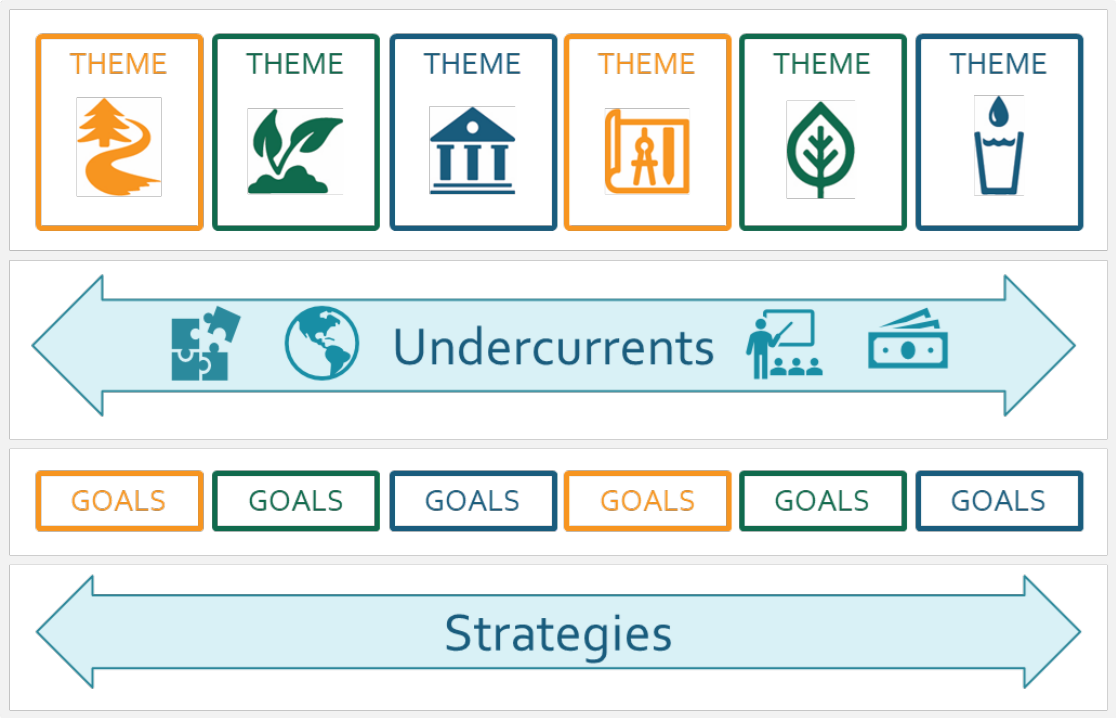
Photo source: Colorado BRT

Section 6. Strategic Vision for the Future

Strategies are general actions and pathways identified to meet and support the goals for the Colorado Basin. They include and transcend the Project Database as described in Section 7. Strategies are intended to answer the question "How can the basin make progress toward its goals and achieve its vision?"

The strategies include a set of suggested actions for any and all interested parties in the Colorado Basin to consider; the Colorado BRT's role is to support, promote, and fund these strategies.

Strategies can be applied to meet multiple goals across the six themes and are, therefore, not categorized by theme or associated with a particular goal. Undercurrents can be seen surfacing throughout the strategies. Strategies consider, condense, and consolidate the "Measurable Outcomes" and "Projects and Methods" from the 2015 BIP. Both Measurable Outcomes and Projects and Methods in the 2015 BIP were much more specific action items or metrics, but strategies are intended to be broad but concise, and not an exhaustive list.



The Colorado BRT developed a strategic vision for the future that encompasses eight strategies that cover funding, supporting policies, planning for water supply, addressing shortages, and implementation of studies, projects, and strategies. The elements of the strategic vision are described below.

Summary of Strategies

1 FUND THE BASIN IMPLEMENTATION PLAN

- Inventory existing funding mechanisms, including federal
- Develop new and/or use existing toolkits and informational resources to help project proponents find funding opportunities
- Connect with potential project partners early in project development and find matching funding sources
- Develop creative new funding solutions
- Coordinate funding efforts among multiple entities, and convene recurring funding workshops with representatives from multiple funding agencies
- Fund IWMPs and projects and actions identified by IWMPs

2 SUPPORT AND PROMOTE LEGISLATION, POLICIES, AND AGREEMENTS THAT ALIGN WITH THE GOALS

- Support existing critical Colorado River agreements, and pursue future agreements through a lens of collaboration and partnerships among stakeholders
- Increase public outreach, education, and participation regarding policies and legislation that align with the goals
- Investigate and support improvements to Colorado water law that encourage ATMs, agricultural water efficiency practices, and other creative solutions while protecting the value of the water rights for the water rights' owners

3 USE THE IWMP MECHANISM TO REDUCE RISKS AND ENHANCE BENEFITS ACROSS ALL SECTORS

- Map key data and information across planning scenarios (data and information such as diversions, water quality impairments, burn areas, insect infestations, NCNA at-risk waterbodies, recreational attributes and considerations, etc.)
- Use the maps to characterize reaches and subbasins
- Develop IWMPs that outline the approach, processes, monitoring programs, and projects that will align with basin goals
- Implement projects identified by IWMPs
- Revise the Colorado BRT IWMP Planning Framework Project information and website to include recent data, reports, and information and lessons learned from recent IWMPs
- Revise the IWMP Planning Framework to facilitate regular updates of existing IWMPs
- Use the existing IWMP Planning Framework and local partnerships to coordinate and promote local actions and projects that were identified by IWMPs or are a continuation of local work relevant to the IWMP

4 IMPLEMENT PROJECTS THAT SUPPORT THE GOALS

- Implement projects on the Project Database
- Identify and support additional projects beyond the Project Database (especially multi-use and collaborative projects), that address water shortages, infrastructure needs, and E&R needs
- Form partnerships to support multi-use reservoir projects
- Promote pilot projects that look for creative solutions and new technologies
- Address aging infrastructure needs for municipal and agricultural water users
- Use Colorado BRT funds strategically to prioritize projects that support basin goals
- Track project data for projects funded by the Colorado BRT to inform modeling

Additional information on basin projects is available in Volume 2, Section 3.

Photo source: Colorado River District

5 PLAN FOR UNCERTAINTY IN WATER SUPPLY

- Develop drought plans, source water protection plans, water efficiency plans, land use plans, and other planning efforts that address water security
- Encourage entities to incorporate climate change impacts and planning scenarios from the Technical Update into water supply planning efforts
- Reduce vulnerability of water systems to natural disasters and climate change by increasing redundancy (for example, through intakes on multiple water supply sources or permanent interconnects)
- Promote coordinated water supply planning efforts across sectors (agricultural, municipal, E&R, etc.)
- Establish regional water provider and ditch company cooperatives focused on improved regional relationships, water supply redundancy and operational flexibility, water quality mitigation, coordinated efforts for multi-beneficial projects, and addressing E&R needs

6 ADDRESS THE GAP

- Update the modeling in the Technical Update to improve accuracy at the regional level and incorporate more detailed modeling done by others (for example from stream management plans) to better understand the gaps
- Capitalize on science and data to understand gaps and risks and to inform priority setting and decision making for the basin
- Model impacts from planned future TMDs
- Protect key West Slope water rights and resources
- Protect irrigation water rights
- Promote conservation easements to preserve agricultural land and water rights
- Encourage and pursue ATMs as an alternative to permanent buy-and-dry to meet growing municipal demands while protecting agricultural water rights

7 INTEGRATE THE PUBLIC EDUCATION, PARTICIPATION & OUTREACH (PEPO) PLAN WITH THE BIP UPDATE

- Promote participation in Colorado BRT meetings from all sectors (agricultural, municipal, E&R, etc.)
- Increase education among the general population about Colorado Basin water issues and efforts

8 USE THE COLORADO BRT NEXT STEPS COMMITTEE TO SUPPORT, FOSTER, AND IMPLEMENT THESE STRATEGIES

- Dedicate set time at BRT meetings to check in on progress toward basin goals
- Dedicate set time at BRT meetings to check in on state and federal issues and the basin's water supply situation

Photo source: Colorado River District

Section 7. Future Basin Projects

The Colorado BRT, along with other stakeholders, identified projects that will further the progress toward achieving basin goals and meeting future water needs. The list of projects is managed in a database that was initially developed prior to the 2015 BIP and was updated in 2020 during the BIP update. The purpose of the Project Database is to keep a record of the projects considered by the Colorado BRT through the BIP process, both in the past and into the future. Table 7 provides a snapshot summary of the Project Database at the conclusion of the current BIP update process.

Additional information on the Project Database and its content, including regional perspectives, are provided in Volume 2, Sections 3 and 4.

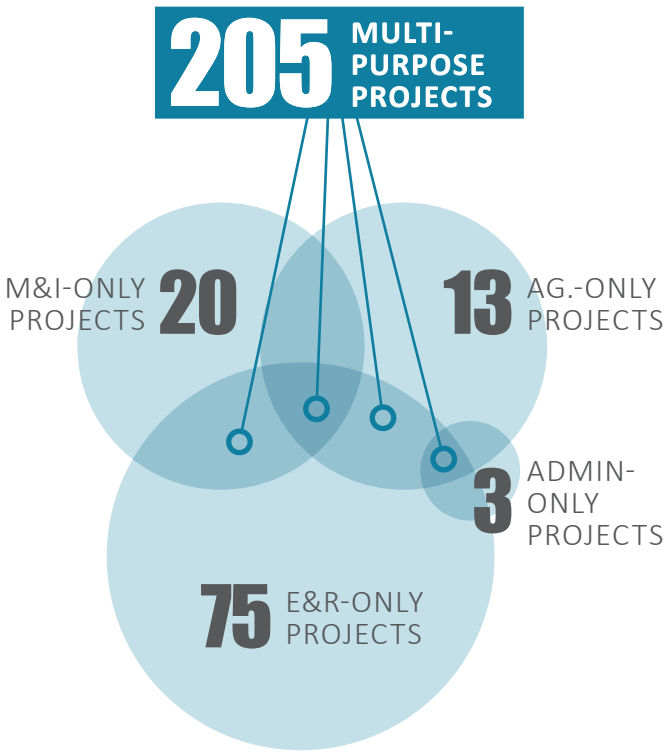


Table 7. Snapshot Summary of Colorado Basin Projects

Total Projects	321
New projects added in 2020	147
Projects completed	71
Projects being implemented	88
Projects identified as meeting M&I needs	188
Projects identified as meeting Ag needs	165
Projects identified as meeting E&R needs	262
Tier 1 projects	104
Tier 2 projects	43
Tier 3 projects	126
Tier 4 projects	48
TOTAL COST OF ALL PROJECTS	**$4,083,000,000**
PERCENTAGE OF PROJECTS WITH AN ESTIMATED COST	**68%**

Projects that are concepts, planned, or are being implemented were the basis for the above data summary (with the exception of data specifically describing projects completed or being implemented)

Project Tiering and Level of Readiness

A new feature of the Project Database for the BIP update is the assignment of "tiers" to projects (see description of tiers in the graphic). The project tiering exercise is a tool roundtables can use to do a preliminary characterization of their projects and associated project readiness. It facilitates a "first-pass" process and helps standardize data gathering to allow for project updates and movement through the tiers as they advance toward funding. Project tiering was initially developed as a tool for basin-level Water Supply Reserve Fund grant approval discussions, where the data fields describing alignment with BIPs, local planning, and criticality are likely to be considered. Note that some of these categories are subjective and were considered differently across basins. Tiering has no bearing on whether a project can be funded. Project proponents can apply for CWCB funding whether or not their project is in the database, and inclusion of a project in the database does not guarantee funding. For the CWCB in the long term, it will be useful for identifying immediate and long-term project costs and associated funding needs. Data fields describing level of readiness, alignment with the Colorado Water Plan, and the amount of available project data will also be considered.

TIER 1	**Supported and Ready** *Ready to launch and has full data set*
TIER 2	**Supported and Pursued** *Almost ready to move forward and has a significant amount of data*
TIER 3	**Supported and Developing** *Project is developing but still needs to be fleshed out*
TIER 4	**Considering** *Project not yet moving forward but should be kept on the list*

Section 8. Education and Outreach

The PEPO Workgroup is a legislatively created committee of the Interbasin Compact Committee. In 2021-22, the PEPO Workgroup will assist the Colorado BRT in strengthening their education and outreach activities through the creation of their Education Action Plan (EAP). The Colorado BRT will have the opportunity to receive up to $6,500 in state funds per year for EAP implementation activities.

PEPO goals of the Colorado BRT are to promote a well-informed and high-functioning basin roundtable and to support water awareness and broad-scale participation of diverse water-dependent communities.

All Colorado BRT members are encouraged to provide input and suggestions to the PEPO subcommittee. The subcommittee seeks to represent fully the hydrologic, agriculture, municipal, industrial, recreational, and environmental interests in the basin.

Colorado Basin Roundtable PEPO Vision/Goals:

VISION:

1. Develop and implement an EAP that facilitates awareness, educational, and diverse public engagement opportunities about Colorado and Colorado Basin water subjects.
2. Encourage awareness and development of holistic, locally driven collaborative solutions supported by best available hydrologic and watershed data.
3. Increase collaborations and partnerships with other Colorado Basin organizations that wish to promote water awareness, education, and engagement.
4. Encourage Colorado BRT members to actively participate with the PEPO subcommittee and recruit new participants.

Photo source: Colorado River District

GOALS:

1. Raise public awareness of Colorado BRT activities:
   a. Work with regional news outlets on notification of BRT meeting dates, time, location, and how to participate, and of BRT vacancies.
   b. Update BRT website with current educational information for the public while serving as an effective resource for BRT members.
   c. Plan and facilitate a Colorado Basin-specific short film illustrating environments and water stakeholders from headwaters to the state line. Film to be used by BRT and partners for water outreach events.
   d. Use social media to promote BRT communications and education on water issues in the basin.

2. Elevate awareness of the Colorado BIP and Colorado Water Plan knowledge and engagement opportunities.
   a. Engage media outlets with timely opportunities to promote public engagement on Colorado BIP and Colorado Water Plan updates.
   b. Promote BRT membership understanding of strategies and actions contained within the updated Colorado BI

3. Align efforts with Water Education Colorado's Statewide Water Education Action Plan (SWEAP).
   a. Align with the concrete actions identified in the SWEAP such as:
      i. Provide trainings, leadership development, and mentorships tailored to underrepresented groups and geographies.
      ii. Provide equity and inclusivity training for coordinators, chairs, and appointing agencies of decision-making bodies.
      iii. Track metrics to ensure all demographics and geographies demonstrate progress in educational outcomes and identify program changes to close gaps.
   b. The guiding principles of the SWEAP are that water education be:
      i. Balanced and reflective of tradeoffs
      ii. Supportive of the Colorado Water Plan vision
      iii. Achieved with strong partnerships and collaboration
      iv. Objective and fact-based
      v. Using a watershed approach
      iv. Accessible, engaging, and striving for equity
      vii. Implemented across Colorado
      viii. Adaptive and iterative in response to changing conditions

4. Support BRT watershed data/knowledge gap assessment and information-gathering efforts in the basin.
   a. Provide educational opportunities on river condition/freshwater assessments and SMPs/IWMPs.

5. PEPO subcommittee will collaborate in a timely and relevant manner to identify writers and BRT topics to be submitted to regional and state news outlets at least twice per year.

6. Other identified water education opportunities and events as identified by BRT members and partners.

7. BRT PEPO liaison will participate in CWCB education and related meetings.

Critical Education/Outreach Issues:

The Colorado BRT EAP will focus on in-basin constituents, i.e., both water stakeholders and the general public. This includes Colorado Basin stakeholders interested in State and other funding and grant opportunities.

1. Colorado Basin Issues
   a. Hydrology – local, state, and Big River
   b. Compact compliance/2007 Interim Guidelines renegotiation
   c. Colorado River Drought Contingency Plan processes – e.g., demand management
   d. TMDs
   e. Agricultural issues
   f. Recreational Issues
   g. Environmental Issues
   h. Water conservation

2. Colorado BIP Update

3. Colorado Water Plan Update

Appendix A. Colorado Basin Current and 2050 Planning Scenario Water Supply and Gap Revised Results

Analysis for Basin Implementation Plans

Technical Memorandum

Prepared for:

Colorado Water Conservation Board

Project Title:

Colorado Basin
Current and 2050 Planning Scenario
Water Supply and Gap Revised Results

Date: June 14, 2021

Prepared by: Wilson Water Group
Reviewed by: Brown & Caldwell

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Section 1: Introduction

This technical memorandum summarizes changes to modeling inputs and results from the 2019 Technical Update that were conducted during the Basin Implementation Plan update process. The original model approach and results as well as other water supply related analyses were documented in Volume 2 of the Technical Update in a memo entitled "Current and 2050 Planning Scenario Water Supply and Gap Results".

The approach and results were presented to stakeholders throughout the State and to the Basin Roundtables and feedback was obtained regarding areas where the approaches to developing the agricultural, municipal, and industrial demands or the modeling could be improved or refined. This technical document summarizes these revisions and the impact to the overall water supply and gap results that affect the Colorado Basin.

The following should be noted regarding this effort:

- The revisions were based on stakeholder input and may not include every aspect of the Technical Update. For example, one basin may only have revised M&I demands whereas another basin may only have revisions to modeling operations.
- Revisions to West Slope basins also impact the transbasin import supply gap estimated for basins that receive imports; revised import supply gaps are also included in the sections below if applicable.
- This document provides only a summary of the revisions; review specific spreadsheets and modeling datasets available on the Colorado Water Plan website for further information on revisions.
- The revised information herein supersedes any previously developed information. Documentation and reports relying on the information from September 2019 will reflect a note to this effect, but the documentation will not be updated.
- The revised information will be used in the Basin Implementation Plan Volume 1 and 2 reports and the Update to the Colorado Water Plan.

1.1 DELIVERABLES

The revised model results are provided both within this document and in separate Excel spreadsheets for each basin. The General Contractor Team for the Technical Update has developed several spreadsheets of more localized results at the Water District level for basins that have requested this detail. These spreadsheets have also been updated and provided to the Local Experts in each of those basins. Additionally, revised streamflow results were loaded into the Flow Tool and made available to the Local Experts. Lastly, the model input and output files were delivered to the General Contractor and made available to the public via the Colorado Water Plan website. These spreadsheets, modeling datasets, the revised Flow Tool, and this documentation serve as the deliverables for this effort.

1.2 DISCLAIMER

The technical data and information generated are intended to help inform decision making and planning regarding water resources at a Statewide or Basin-wide planning level. The information made available is not intended to replace projections or analyses prepared by local entities for specific project or planning purposes. The information or datasets provided are from a snapshot in time and cannot reflect actual or

exact conditions in any given basin or the State at any given time. While this Technical Update strives to reflect the Colorado Water Conservation Board's (CWCB) best estimates of future water supply and demands under various scenarios, the reliability of these estimates is affected by the availability and reliability of data and the current capabilities of data evaluation. Moreover, the Technical Update cannot incorporate the varied and complex legal and policy considerations that may be relevant and applicable to any particular basin or project; therefore, nothing in the Technical Update or the associated Flow Tool or Costing Tool is intended for use in any administrative, judicial or other proceeding to evince or otherwise reflect the State of Colorado's or the CWCB's legal interpretations of state or federal law.

Furthermore, nothing in the Technical Update or any subsequent reports generated from these datasets is intended to, nor should be construed so as to, interpret, diminish, or modify the rights, authorities, or obligations of the State of Colorado or the CWCB under state law, federal law, administrative rule, regulation, guideline or other administrative provision.

Section 2: Colorado Basin Revised Results

The following sections reflect the revisions implemented in the Colorado Basin and the resulting agricultural and M&I demands, water supply, and gaps modeled results. As discussed above, refer to the original 2019 Technical Update documentation for more information on the demands and gaps in each basin.

2.1 COLORADO BASIN

Several revisions were implemented in the Colorado Basin, including revisions to agricultural demands, industrial demands, and model operations. A portion of these revisions were identified by stakeholders in the basin after review of the approach and initial results. Other revisions, however, were identified through on-going modeling efforts that also rely on the Colorado water allocation models. These identified revisions were implemented in the Technical Update at the same time as the stakeholder-driven revisions to improve the representation of the modeled demands and operations.

2.2 COLORADO BASIN AGRICULTURAL REVISIONS

Due to the varied use of irrigation supplies in the Grand Valley Area, such as ranchettes interspersed with larger ranches, it is difficult to estimate the current irrigated acreage served by the Grand Valley Project, Grand Valley Canal, and Orchard Mesa Irrigation District. After reviewing the acreage estimates used in the 2019 Technical Update, it was identified that the acreage values over-estimated the actual acreage irrigated in the area. As such, the acreage estimates were decreased to a total of approximately 54,000 acres (from the previous estimate of approximately 68,900 acres) based on information provided by stakeholders in the basin with local knowledge.

2.3 COLORADO BASIN M&I REVISIONS

At the request of the Colorado Basin Roundtable, in January 2021, ELEMENT updated the industrial baseline and projected water demands that were initially prepared for the Colorado Water Plan Technical Update analyses completed in 2019 (Technical Update; 2019 Analysis). The updated analysis incorporates new information related to Snowmaking demands provided by the Roundtable in January 2021. No

changes were made to Thermoelectric, Large Industry, nor Energy Development demands. The updates affected the following baseline and projected demands:

2.3.1 SNOWMAKING DEMANDS

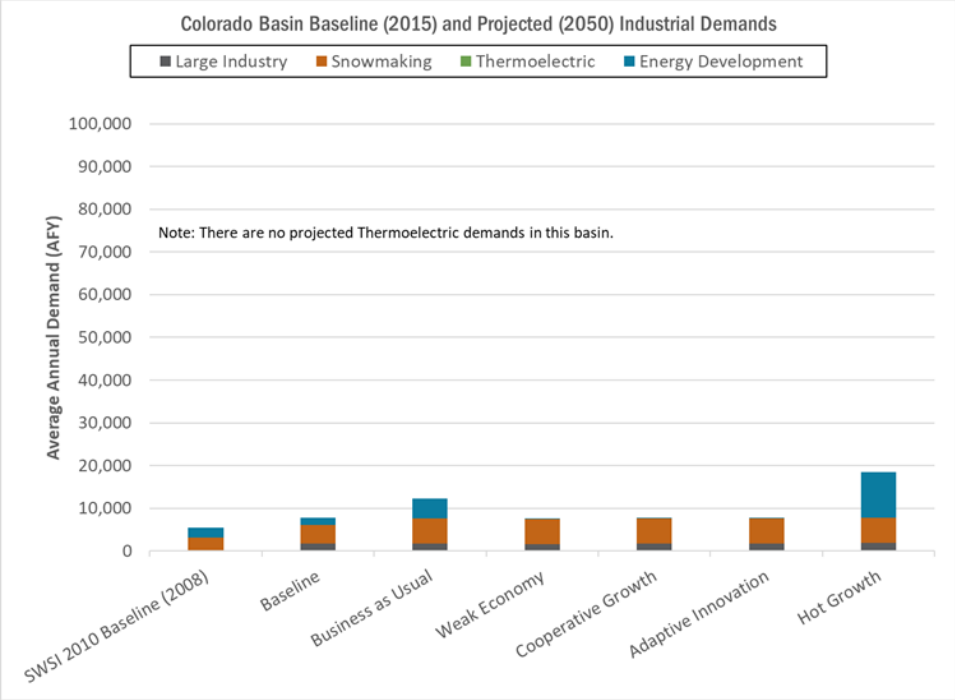
The snowmaking demands in Mesa County were refined based on new data provided by the Basin Roundtable regarding snowmaking at Powderhorn Mountain Resort. Conversely, future demands are higher than presented in the 2019 analysis due to a new water supply contract with the City of Grand Junction. A summary of Snowmaking demand data from the 2019 analysis and the updated analysis is presented in Table. Snowmaking demands increased by approximately 90 acre-feet annually in the Planning Scenarios. Refer to documentation provided by Element Water Consulting for more information on this revision.

Table 1: Snowmaking Baseline and Future Demand Comparison for Mesa County (AFY)

County	Analysis	Baseline (2015)	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Mesa	2019 Analysis	40	50	50	50	50	50
	Jan 2021 Update	30	140	140	140	140	140
	Difference	(10)	90	90	90	90	90

2.3.2 TOTAL INDUSTRIAL DEMANDS

Below is a comparison of Figure 4.4.8 from the Colorado Water Plan Technical Update Volume 1, Section 4.4: Colorado Basin Results of the Colorado Water Plan Technical Update final documentation. The comparison shows the changes in industrial water demands for each projection scenario based on the January 2021 updates. For each future scenario, the basin-scale industrial demands have increased slightly.



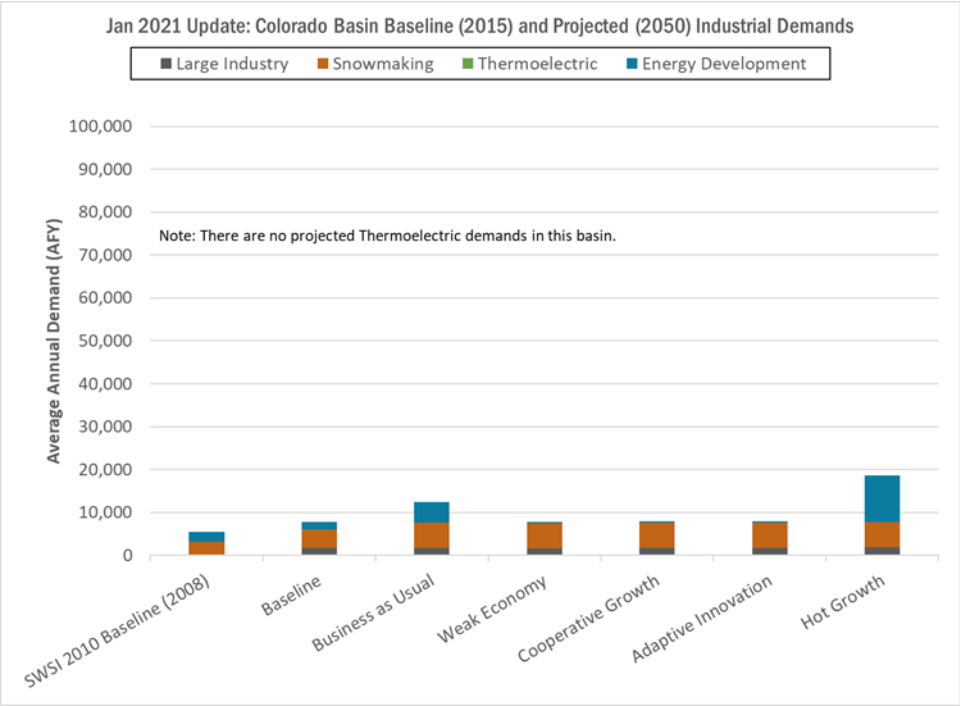


Figure 1: 2019 Analysis vs. 2021 Update, Total Colorado Basin SSI Baseline and Projected Demand

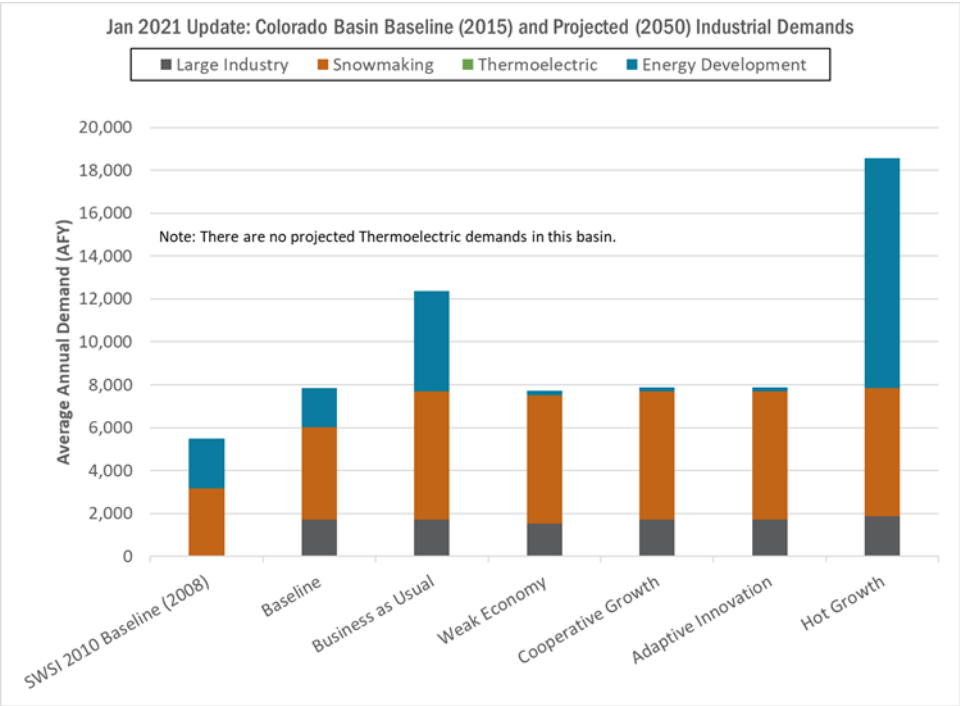


Figure 2: 2021 Update, Total Colorado Basin SSI Baseline and Projected Demand, Revised Scale

2.4 COLORADO BASIN OPERATIONAL REVISIONS

The following summarizes major operational revisions to the model implemented based on stakeholder comments and identified through other modeling efforts in the basin.

2.4.1 RED TOP VALLEY DITCH

The representation of the Redtop Valley Ditch was revised to reflect Northern Water's storage of their purchased ditch shares in Lake Granby. The agricultural demand for the ditch was reduced by approximately 50 percent and water that would have been consumed by irrigation is left in the ditch and accrues to Lake Granby via Stillwater Creek and/or Willow Creek. The water is then stored in Lake Granby under the reservoir storage right. This water is subsequently released from the reservoir to meet obligations within the 15-mile Reach (i.e. 10,825 water).

2.4.2 REDLANDS CANAL

The Redlands Canal diverts water from the Gunnison Basin with non-consumed water from the power plant and irrigation returning to the Colorado Basin. Diversions for power and irrigation were updated based on information from stakeholders for both the Gunnison River and Colorado Basin models. Refer to the Gunnison Basin revised modeling memo for more information on the changes to the Redlands Canal demand.

2.4.3 GREEN MOUNTAIN RESERVOIR

Representation of Green Mountain Reservoir operations in Colorado water allocation model were revised to more accurately reflect the order each account is filled in the reservoir; flood control draw-down operations during the winter; and releases to the 15-Mile reach during the late irrigation season. Additionally, operations were adjusted to make Historic Users Pool (HUP) water available to meet municipal demands during the winter months. The revised operations were based on input from CWCB and Division 5 staff, and more accurately reflect current operations in the reservoir. Figure 3 reflects the change in reservoir contents under Current conditions as a result of these revisions, and Figure 4 reflects the change in streamflow downstream of the reservoir under Current conditions.

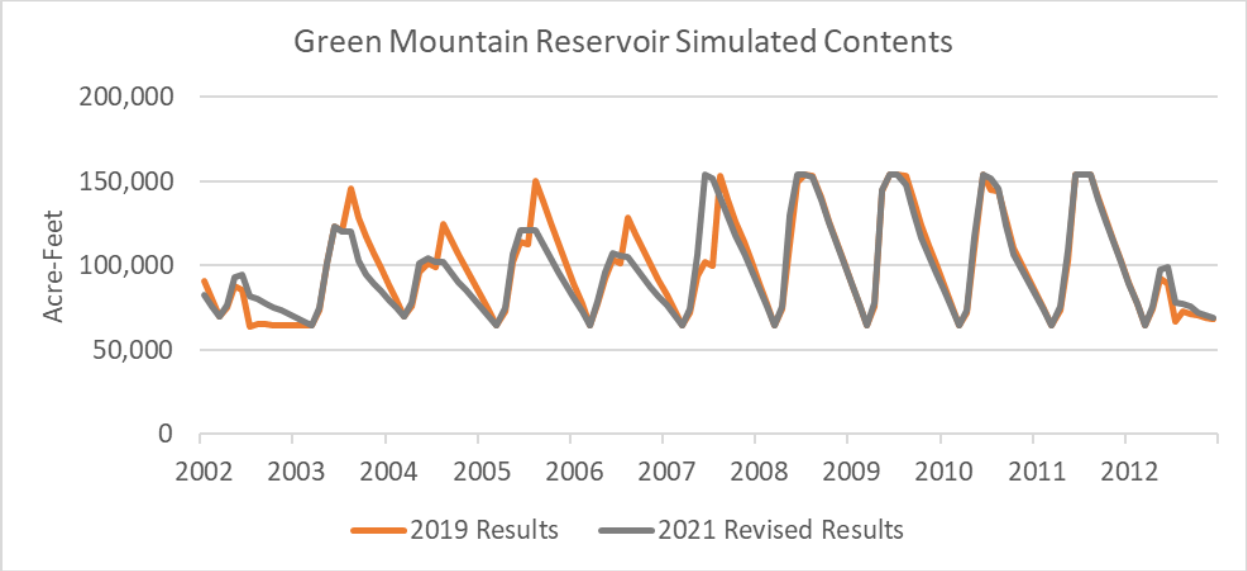


Figure 3: Green Mountain Reservoir Simulated Contents - Current Conditions

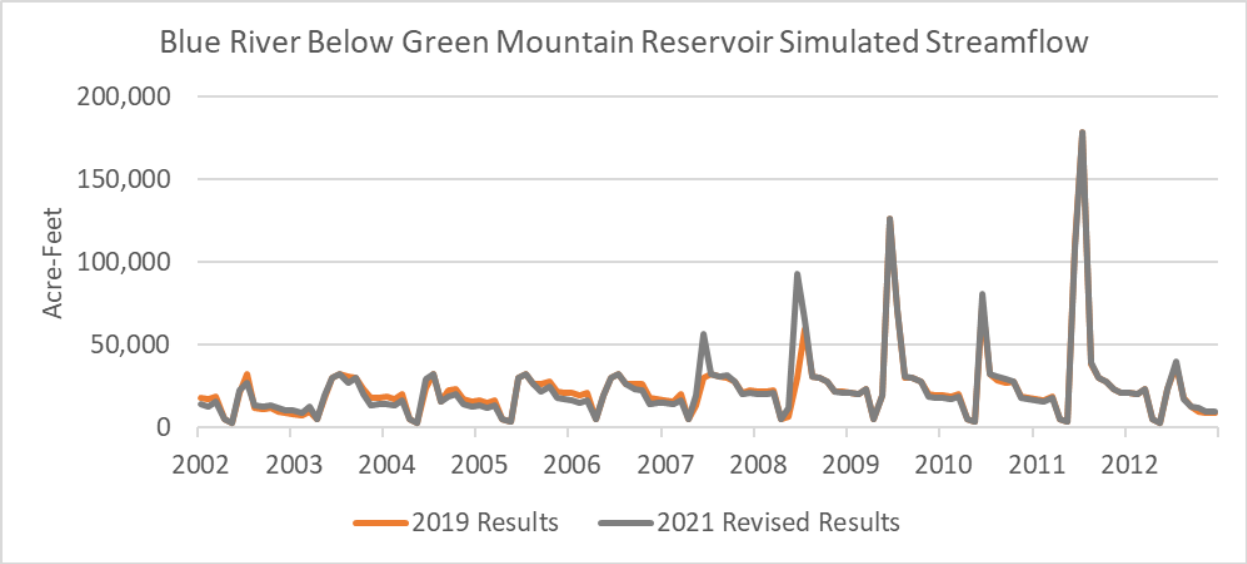


Figure 4: Blue River Below Green Mountain Reservoir Simulated Streamflow - Current Conditions

2.4.4 INSTREAM FLOW WATER RIGHTS

For several instream flow reaches, the instream flow water rights reflected in the model were not sufficient to meet the full instream flow demand. This issue was identified for one instream flow location on the Eagle River, and subsequently all instream flow reaches in the Colorado water allocation model were checked. A total of 13 instream flow water rights throughout the Colorado Basin were corrected through this effort. As instream flow water rights are typically the most junior rights on a tributary, there will be little impact to model results due to this revision.

2.4.5 EAGLE RIVER TRANSBASIN DIVERSION CAPACITY/WATER RIGHTS

Representation of the Columbine Ditch water rights in the water allocation model were revised to reflect the current water rights for the ditch. This allowed the ditch to divert its full demand when the water

rights are in priority. Representation of the Wurtz Ditch did not reflect the current capacity of the ditch. The capacity was revised to allow the ditch to divert its full demand when its water rights are in priority. The revision has limited impact to the streamflow and water availability in the headwaters of the Eagle Basin.

Several minor revisions to the Colorado water allocation model were also made, primarily to correct model input file formatting, which have little impact to the overall results. Collectively, the revisions had a limited impact to the overall water supply and gap results in the basin, however it is important that the representation of the model has been improved through the process of these revisions.

2.5 COLORADO BASIN REVISED WATER SUPPLY AND GAP RESULTS

The following tables reflect the revised demand, water supply, and gap results based on the revised demands and operations in the Colorado Basin. Overall, the revisions had less than a one percent impact on the average agricultural water supply and gap results for the basin. The maximum agricultural demand also remained very similar to previous results, however the maximum agricultural gap slightly increased in all scenarios.

There was a general reduction in the M&I demand and gap in the basin that can be partially attributable to the change in the snowmaking demands in Mesa County. The reduction is also attributable to the revised Routt County industrial demand, as discussed in the Yampa Basin results. A portion of Routt County is located in the Colorado Basin, therefore the reduction in the county-wide demand led to a reduction in the demand in the Colorado Basin as well. The reduction in demand and changes to water availability as a result of the model revisions led to approximately 100 to 5,000 acre-feet reduction in the maximum M&I gap during critically dry years across the Planning Scenarios.

As discussed in the 2019 Technical Update, the Colorado Basin benefits from the delivery of a small amount of imported transbasin supplies from the Gunnison Basin for M&I purposes in and around the Grand Junction area. Revisions to the Gunnison Basin did not impact the transbasin import supply gap associated with these deliveries; the information presented in the 2019 Technical Update for this gap remains unchanged.

Table 2: Colorado Basin Agricultural Water Supply and Gap Summary

	Agricultural Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand (ac-ft)	1,593,264	1,471,182	1,471,182	1,656,680	1,289,551	1,743,727
	Average Annual Demand Increase from Baseline (ac-ft)	-	-	-	63,416	-	150,464
	Average Annual Gap (ac-ft)	45,232	43,986	43,978	76,741	61,892	104,432
	Average Annual Gap Increase from Baseline (ac-ft)	-	-	-	31,509	16,661	59,200
	Average Annual Percent Gap	3%	3%	3%	5%	5%	6%
	Average Annual CU Gap (ac-ft)	25,069	24,395	24,392	42,672	40,623	58,128
Critically Dry	Demand In Maximum Gap Year (ac-ft)	1,592,584	1,471,284	1,471,284	1,579,864	1,252,596	1,660,417
	Increase from Baseline Demand (ac-ft)	-	-	-	-	-	67,833

	Agricultural Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
	Gap In Maximum Gap Year (ac-ft)	146,844	142,676	142,517	173,165	135,553	214,728
	Increase from Baseline Gap (ac-ft)	-	-	-	26,322	-	67,884
	Percent Gap In Maximum Gap Year	9%	10%	10%	11%	11%	13%

Table 3: Colorado River M&I Water Supply and Gap Summary

	M&I Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand (ac-ft)	68,189	98,008	85,434	94,975	94,083	120,967
	Average Annual Demand Increase from Baseline (ac-ft)	-	29,819	17,245	26,786	25,894	52,778
	Average Annual Gap (ac-ft)	507	1,145	770	1,883	2,090	3,931
	Average Annual Gap Increase from Baseline (ac-ft)	-	637	262	1,375	1,583	3,424
	Average Annual Percent Gap	1%	1%	1%	2%	2%	3%
Critically Dry Maximum	Demand In Maximum Gap Year (ac-ft)	68,189	98,008	85,434	94,975	94,083	120,967
	Increase from Baseline Demand (ac-ft)	-	29,819	17,245	26,786	25,894	52,778
	Gap In Maximum Gap Year (ac-ft)	2,435	4,454	3,523	5,222	5,573	10,849
	Increase from Baseline Gap (ac-ft)	-	2,020	1,088	2,788	3,138	8,415
	Percent Gap In Maximum Gap Year	4%	5%	4%	5%	6%	9%

Table 4: Colorado River Water Supply and Gap Summary

	Agricultural and M&I Results	Baseline	Business as Usual	Weak Economy	Coop. Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand (ac-ft)	1,661,453	1,569,190	1,556,616	1,751,655	1,383,634	1,864,694
	Average Annual Gap (ac-ft)	45,739	45,131	44,748	78,623	63,983	108,363
	Average Annual Percent Gap	3%	3%	3%	4%	5%	6%
Critically Dry Max	Demand In Maximum Gap Year (ac-ft)	1,660,773	1,569,292	1,556,718	1,674,839	1,346,679	1,781,384
	Gap In Maximum Gap Year (ac-ft)	149,278	147,130	146,040	178,388	141,126	225,577
	Percent Gap In Maximum Gap Year	9%	9%	9%	11%	10%	13%